



Verb aspect, event structure, and coreferential processing

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ABSTRACT

We used an off-line story continuation task and an online ERP reading task to investigate coreferential processing following sentences that portrayed transfer-of-possession events as either ongoing or completed, using imperfective and perfective verb aspect (e.g., Amanda was shifting/shifted some poker chips to Scott). The story continuation task demonstrated that people were more likely to begin continuations with references to the Goal than to the Source, but that perfective aspect strengthened this bias. In the ERP task we probed expectations for Source and Goal referents by employing pronouns that matched one of the referents in gender. The ERP results were consistent with the biases revealed in the story continuation task and demonstrate that the difference in Goal bias for the two forms of aspect was manifested differently in the brain. These results provide novel behavioral and neurocognitive evidence that verb aspect influences the construction of situation models during language comprehension.

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Introduction

It is well known that the process of understanding language involves the construction of a mental model of the situations being described (Johnson-Laird, 1983; Kintsch, 1988; Morrow, Greenspan, & Bower, 1987; Sanford & Garrod, 1981; Van Dijk & Kintsch, 1983; Zwaan, Langston, & Graesser, 1995; for a review see Zwaan & Radvansky, 1998). This mental model is a reflection of dynamic processes that underlie the combination of different types of linguistic (e.g., phonetic, morphosyntactic, semantic), and non-linguistic (world knowledge, situational environment) representations. One of the crucial facts about successful mental model construction, and thus successful language understanding, is that comprehenders must identify which situations, people, objects, and locations are being referred to in their models from the linguistic cues provided by language. In this regard, the lexical and semantic properties of

verbs play a key role in constraining people's expectations regarding who and what the continuing discourse is likely to be about (e.g., Altmann & Kamide, 1999, 2007; Arnold, 2001; Ferretti, Kutas, & McRae, 2007; Hare, McRae, & Elman, 2003; Kamide, Altmann, & Haywood, 2003; Stevenson, Crawley, & Kleinman, 1994; Van Berkum, Koorneef, Otten, & Nieuwland, 2007). In the present research we examine how describing situations as ongoing versus completed, achieved by varying verb aspect, influences people's expectations about who will be mentioned next as the discourse continues and, importantly, how these expectations influence the degree of difficulty people exhibit during coreferential processing. Relatively little is known about how temporally describing situations as ongoing or as completed influences referential processing, despite the fact that psycholinguistic studies of verb aspect have demonstrated that this linguistic cue profiles participants, objects, and locations differently in the temporal and causal structure of situations (Ferretti, Kutas, & McRae, 2007; Madden & Zwaan, 2003; Morrow, 1985; Truitt & Zwaan, 1997).

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Verb aspect and language processing

The grammatical category of verb aspect functions as a morphosyntactic cue that signals to comprehenders how to view the temporal unfolding of situations mentioned in linguistic environments. In the present research, we examine two different forms of aspect, specifically the imperfective (*was giving*) and perfective (*gave*). Imperfective aspect encodes a temporal focus on the ongoing development of situations, whereas the perfective aspect describes the entire situation as completed (Comrie, 1976; Moens & Steedman, 1988).

Previous psycholinguistic investigations have shown that verb aspect constrains situation model construction in different ways (for a review see Madden and Ferretti (2009)). First, aspect contributes to the determination of how information in a text is partitioned with respect to foreground and background (Carreiras, Carriedo, Alonso, & Fernández, 1997; Madden & Zwaan, 2003; Magliano & Schleich, 2000; Morrow, 1985). For example, Magliano and Schleich had participants read narratives in which a critical situation was described either as ongoing with imperfective aspect (*was delivering*) or as completed with perfective aspect (*delivered*). These sentences were always followed by three additional sentences describing events that were consistent with being concurrent or subsequent to the critical situation. Activation of the critical situation in participants' mental models of the text was probed by measuring the time it took them to verify whether or not a situation denoted by a verb phrase had appeared earlier in the text (e.g., *deliver baby*). The verb phrases were presented either immediately after the critical sentence or after the three subsequent sentences. Their results demonstrated that at the end of the critical sentence and after three subsequent sentences, people were faster to identify the verb phrases that had appeared earlier in the text when they originally appeared in imperfective versus perfective form. Magliano and Schleich interpreted this as evidence that imperfective aspect serves to foreground an action more strongly than perfective aspect.

A second way that verb aspect influences the construction of situation models is by modulating the activation of participants, instruments, and locations of situations (Carreiras et al., 1997; Ferretti et al., 2007; Morrow, 1985; Truitt & Zwaan, 1997). For example, Morrow (1985) had people first memorize a layout of a house and then read sentences describing the movement of a person from one room (Source room) to another room in the house (Goal room). These sentences always involved verbs of motion and were inflected with either imperfective or perfective aspect (e.g., John was walking/walked from the kitchen to the bedroom). Morrow found that following imperfective sentences, people located the figure (i.e., John) somewhere on the path between the Source room and Goal locations, whereas following perfective aspect participants consistently located the figure in the Goal room. More recently, Ferretti et al. (2007) have extended these findings by showing that verb aspect also plays a role in the activation of world knowledge about the common locations of situations. Specifically, they demonstrated in a semantic priming task and in on-line sentence comprehension that

knowledge about common locations of situations is more activated following verbs marked with imperfective than perfective aspect.

These results suggest that the ongoing versus completed status of situations signaled by different verb aspects has important implications for the way in which salient people, objects, and locations are situated in the mental models that people construct during language processing. However, to date there has been relatively little research examining how modulation of the activation of the different properties of situations by verb aspect influences coreferential processing, despite the fact that such consequences would be expected to exist. For example, identifying the referent for a pronoun may be less difficult when the referent has been made more accessible as a result of the temporal focusing properties of verb aspect.

A recent off-line study by Rohde, Kehler, and Elman (2006) provides evidence for how verb aspect influences participant's coreferential processing. Participants in this study read context sentences that included verbs of transfer presented in either perfective or imperfective form, followed by an ambiguous pronoun that could be used to refer to either the Source or Goal referent (see Example 1). Participants were asked to generate natural sentence continuations using the pronoun prompt provided.

- (1) John_{SOURCE} handed/was handing a book to Bob_{GOAL}.
He _____.

Judges annotated the elicited continuations, assessing whether the continuation was consistent with a Goal interpretation of the pronoun (Goal continuation) or a Source interpretation (Source continuation). The results demonstrated that people were significantly more likely to generate a Goal continuation following a context sentence with perfective aspect than one with imperfective aspect.

The effect of verb aspect on coreference was confirmed in a second study by Rohde and Kehler (2008) that manipulated both verb aspect and prompt type (see Examples 2 and 3) in order to show that patterns of coreferential processing fit within a more general model of people's expectations regarding who will be mentioned next as a discourse continues. The second study replicated the original coreferential processing results in a pronoun-prompt condition, and it also showed that verb aspect influences people's choice of next mention in a bare-prompt condition.

- (2) [pronoun prompt] John_{SOURCE} handed/was handing a book to Bob_{GOAL}. He _____.
- (3) [bare prompt] John_{SOURCE} handed/was handing a book to Bob_{GOAL}. _____.

Verb aspect had the same effect in both prompt conditions (more Goal continuations following perfective context sentences than following imperfective context sentences), though there were more Goal continuations overall in the bare-prompt condition than in the pronoun-prompt condition. This difference was due to the prevalence of bare-prompt continuations that contained proper name references to the Goal. Following previous researchers (Arnold, 2001; Stevenson et al., 1994) Rohde

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