

Linguistic theory and on-line processing: The case of aspectual coercion

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1 Aspectual Coercion

The field of lexical semantics views the effects of verb class, arguments and/or other aspectually sensitive elements as integrative features of non-linguistic (conceptual) sentence level representations. A prime example is the phenomena of aspectual coercion. Take the following sentences:

- (1) a. The tourist *photographed* the sunset until nightfall.
- b. The athlete *won* the competition for two years.
- c. The author *began* the book about tribalism in Africa.

The ultimate interpretation of each sentence implies an inferential process not explicitly stated in surface form structure. Sentence (a) invokes a sense of repetition, namely iteration, within the same time span. The interactive effects of verb class (*point action*), singular object (*the sunset*) and a durational adverbial (*until nightfall*) result in a repetitive effect absent from other class combinations (e.g. the same object and adverbial with an activity class such as *The tourist watched the sunset until nightfall*). It has also been argued that iteration is implied in sentence (b) which combines an achievement verb (*won*) and a singular object (*the competition*) across different time spans (*for two years*). In sentence (c) the semantic combinatorial effects of the verb (*begin*), subject (*author*) and object noun phrase (*book*) yield an implicit complement reading that is *The author began (writing/to write) the book*.

2 Iteration

Iteration refers to the repetition of a situation in a given time frame. It is particularly enhanced by the inherent quantity of the point action verb in question, which may reflect either a single (*dive*) or iterative (*knock*) act (Frawley, 1992). This is an impor-

tant distinction given the conceptual expectations triggered between singular and iterative scenarios for both verbs when combined with durational adverbials. Importantly for the present discussion, single acts represent repeated actions across different time spans (*The girl dived in the pool for some time*). In contrast, iterative situations demonstrate an action repeated on a single occasion (*The man knocked on the door for a minute*). The sense of repetition triggered by these combinatorial effects involves extra processing capabilities needed to integrate such features in the course of comprehension. The resulting sentence is not ungrammatical but often gives the comprehender pause.

3 Linguistic Models of Coercion and Sentence Processing

Linguistic and computational approaches to aspectual coercion have assumed either a compositional approach, in which semantic mismatches between the verb and adverbial modifiers are interpreted as the interpolation of conceptual structure (Krifka, 1998; Jackendoff, 2002; Pustejovsky, 1998) or a type shifting operation (Moens and Steedman, 1988; De Swart, 1998) in which a repair strategy realigns overall sentential meaning. To date, it has been difficult to distinguish between the two models. Linguistic evidence for coercion has traditionally relied on data from truth conditionals, namely paraphrasing, and adverbial tests (Dowty, 1979). However, a recent trend has moved towards on-line experimental settings to further investigate the possible processing costs of aspectual coercion. A small but important number of studies have examined iteration (Piñango, Zurif & Jackendoff, 1999; Todorova, Straub, Badecker & Frank, 2000) and complement selection (McElree, Traxler, Pickering, Seely & Jackendoff, 2001) at the syntax/semantics interface. Experimental evidence from the cross modal lexical decision (CMLD) interference and reading time tasks used in these studies has demonstrated *where* (within the sentence) the coercive process emerges at the sentential level. However, *how* this process is computed on-line is still an open empirical question, and one complicated by the variation in sentence stimuli design features across studies in the domain of iteration. The following discusses sentence stimuli design issues from two recent studies.

4 On-Line Processing Evidence for Iteration

Piñango, Zurif & Jackendoff (1999) employed a CMLD interference task to test for processing differences between paired sentences that varied only on verb type, (activity vs. point action). They compared sentences like *The little girl snoozed for a*

*long time*¹ after the grown-ups left the room/ *The little girl curtseyed for a long time* after the grown-ups left the room. The results showed an increased processing load, demonstrated by longer reaction times, for those sentences that incorporated point action verbs. The authors interpreted such a result as evidence for a combinatorial process triggered by the aspectual shift between the verb and adverbial modifier. This finding was further supported by an off-line plausibility questionnaire presented to a separate group of participants (N=20) who were asked to judge the overall plausibility of sentence combinations. Those results revealed no significant differences between the two conditions. This presumably eliminated the possibility that point action/adverbial modifier combinations were overall less plausible when compared to their activity sentence pairs, and thus more difficult to process. However, plausibility remains a concern, given the semantic oddity of sentences like *The little girl curtseyed for a long time after the grown-ups left the room*. In order to assess this, a replication of Piñango et al.'s (1999) plausibility questionnaire was presented to 20 undergraduate students studying a first year linguistics course at The University of Queensland. An items analysis revealed a significant difference between activity ($M = 3.58$) and point action ($M = 3.21$) sentence pairs, $t(48) = 2.18, p < .05$, with activity sentences interpreted as more plausible than their point action counterparts. This suggests that the on-line processing differences may have been an artifact of the singular versus iterative readings of point action verbs used in the stimuli (DeVelle, 2003).

Piñango et al. (1999) varied verb type to measure possible processing effects of iteration. In contrast, Todorova et al. (2000) alternated singular/plural direct objects and type of adverbial modifier, as shown in Table 1.

	Durative Modifier	Non-durative Modifier
Singular object	Even though Howard sent <i>a large check</i> to his daughter <u>for many years</u> , she refused to accept his money. A	Even though Howard sent <i>a large check</i> to his daughter <u>last year</u> , she refused to accept his money. C
Plural object	Even though Howard sent <i>large checks</i> to his daughter <u>for many years</u> , she refused to accept his money. B	Even though Howard sent <i>large checks</i> to his daughter <u>last year</u> she refused to accept his money. D

Table 1. Todorova et al. (2000) sentence stimuli design crossing factors of Cardinality and Modifier Type.

¹ Sentences were presented auditorally over headphones. At a certain position within the sentence (250 msec. after the adverbial modifier) a probe appeared on the screen. Participants were instructed to respond to the probe by pressing yes (a real word) or no (a non word) via the mouse.

It was hypothesized that singular objects (representing a single instance reading) would disrupt sentence comprehension to a greater extent than those sentences that incorporated a plural object and / or non-durative modifier. The authors employed a self-paced reading time/make sense judgment task. The results showed significantly longer reading times for Condition A (singular plus durative), compared to Condition B (plural plus durative) at, and immediately following, the temporal adverb. In comparison, no differences emerged between singular and plural objects when combined with non-durative adverbials. This finding was cited as evidence for type-shifting models of aspectual coercion that involve a re-analysis of overall sentential meaning due to semantic mismatches as a function of verb type, object cardinality and type of adverbial modifier alone. However, it is not clear such an interpretation is warranted, as a closer look at the stimuli demonstrates more complex processing constraints at the sentential level. For example, even though the authors kept the verb constant within items (*sent*), there was a variation of verb type (*point action, achievement*) and time span (*singular and different*) across items. Furthermore, the incorporation of indefinite rather than definite articles allowed for an iterative reading deemed ungrammatical with other verb classes (*Although the dragon devoured a girl from the village for years vs. *Although the dragon devoured the girl from the village for years...*).² Such variations suggest constant updating and integration of sentential meaning over and above the insertion of repetition at (or following) the adverbial modifier.

5 General Discussion

The present discussion highlights the different sentential elements that play a role in the coercive process, and demonstrate a number of processing constraints that may contribute to the significant differences in reaction time and reading time data. The studies presented here argue for different linguistic models that describe the iterative process (a compositional approach taken by Piñango et al. 1999, versus a type-shifting model advocated by Todorova et al. 2000). However, little has been said on how to align such findings with performance models of language processing. The question yet to be answered is to what extent semantic anomalies reflected in plausibility ratings affect processing load associated with iteration. One approach (among others) takes into account presuppositional complexity and the role of context during real-time processing (Crain & Steedman, 1985). It would be informative to systematically manipulate prior context and observe its effect on coercion. On-line paradigms such as eye tracking, that allows for both first, second and overall regression reading times, and CMLD interference tasks that vary the probe position, may also shed light on the semantic processing constraints discussed here. It is only then that

² Sentence items also started with expressions such as *because, even though* and *although*, further suggesting that the on-line parsing system leaves open all alternative processing strategies until after the adverbial modifier and final clause are processed.

abstract differences between compositional and type-shifting approaches can be further refined.

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