

Background: The complexity of a verb's argument structure influences accuracy of sentence production in aphasia (Thompson, Lange, Schneider, & Shapiro, 1997). For instance, transitive sentences, such as "The dog bit the frog", are more difficult to produce than intransitives, such as "The dog left". The reason for this disparity is not entirely clear, however. Other things being held equal, transitive sentences are longer than intransitive sentences, and it would be easy to jump to the conclusion that this is the essence of the matter. However, they are also more complex in syntactic phrase structure, and probably require greater memory and/or processing capacity in order to calculate the semantic relationships amongst the parts of their argument structure. For instance, in the examples cited above, the transitive sentence requires a decision about which animal has administered the bite and which has received it, whereas the intransitive sentence does not require this degree of matching between the syntactic and semantic argument structure. Here we report preliminary evidence that semantic argument structure and/or syntactic phrase structure contribute to processing difficulty in participants with aphasia in ways that cannot be accounted for as length effects.

Kohen, Milsark & Martin, (2008), reported a treatment program that used syntactic priming to improve production of transitive sentences. The participant, DD demonstrated severe aphasia with agrammatism. Over a period of two months (12 treatment sessions), DD was trained to describe photographs by producing transitive sentences of the form "The X is Ying the Z", where X and Z are nouns and Y is a verb. Each utterance was scored for accuracy of major-category lexical items and for the correctness of the order in which these items were produced. Post-hoc analysis of the stimuli showed that while all the target structures were syntactically transitive, the semantic argument structure varied in a subtle way. Some, such as (1) and (2) below were unremarkable.

- (1) The woman is opening the door.
- (2) The man is dropping the book.

However, others such as (3) and (4) contained verb phrases (VP) whose lexical content was sufficiently conventionalized that the object did not seem to be fully independent semantically.

- (3) The woman is driving the car.
- (4) The boy is brushing his teeth.

In such examples, the VPs "brush X's teeth" and "drive the car" certainly contain syntactic object arguments; however, their semantic argument structure is more similar to that of a sentence such as (5), where the use of the so-called "light" verb *take* produces a monadic predication such as that expressed more transparently in example (6).

- (5) The inspector took a look.
- (6) The inspector looked.

We call sentences (3) and (4) "half-transitives" to express the notion that their semantic argument structure is intermediate between full transitives such as (1) and (2) and intransitives such as (6).

Our study of DD's sentence production indicated that his performance reflected the 3-way distinction in semantic argument structure described above: he was most successful with intransitives, least successful with true transitives, and experienced an intermediate degree of success with half-transitives. The contrast between full and half transitives in DD's performance argues that there is a contribution to processing difficulty that is due to the greater demands that more complex semantic argument structure places on linguistic memory or encoding, rather than to sentence length or syntactic structure, since these were identical in the sentences under study.

Present Study: Currently, we are investigating a structural contrast which illuminates a different possible effect of syntactic and semantic complexity, concentrating on sentence pairs such as the following:

- (7) The woman is walking out the door.
- (8) The woman is throwing out the trash.

Superficially, these sentences seem much alike, but examination reveals that they are quite different. First, the string *throwing out* in (8) has an obvious single-word synonym (*discarding*), while *walking out* in (7) does not. Second, there are a number of ways the two structures are treated differently by syntactic processes. For instance, reordering the words of (8) as shown in (10) results in a well-formed sentence, whereas reordering (7) as (9) does not.

- (9) *The woman is walking the door out.
- (10) The woman is throwing the trash out.

The distinction between (7) and (8) is parallel in some respects to that between full and half-transitives. Just as the close semantic bonding between the verb and the object in a half-transitive reduces the number of distinct semantic elements in the sentence compared to that in a full transitive, examples such as (8) seem to contain fewer semantic elements than those such as (7). Item (7) consists of the elements "woman", "walk", "door", and the directional expression "out", whereas item (8) contains only the three elements "woman", "throw-out", and "trash". In addition, however, sentences like these differ from one another in a way that full and half-transitives do not: they have different syntactic phrase structures. The string *out the door* in example (7) is a prepositional phrase containing the noun phrase *the door*. In sentence (8), however, the string *out the trash* has no phrasal status whatsoever; essentially, the verb of the sentence is *throw-out* and *the trash* is a simple noun phrase object. Given this distinction, so-called "prepositional transitives" such as (7) have a more complex syntactic phrase structure than so-called "verb-particle" sentences such as (8).

Thus, we had two reasons to suspect that persons with aphasia would show greater difficulty in processing prepositional transitive sentences such as (7) than they would in processing verb-particle sentences such as (8), one based in the semantics and logically parallel to our analysis of the half-transitive data, and one based in the syntax.

Methods and Procedure: Five persons with aphasia were asked to repeat a total of 60 sentences: 30 "verb-particle" constructions and 30 "prepositional transitives" (see Appendix). The paired sentences were balanced for length, and lexical content was held constant between them as best as possible.

Results: Results (see Table 1) indicated that the verb particles were used correctly significantly more often than the prepositions, $t(4) = 2.815, p < .05$ during the sentence repetition task. This finding, that there was greater difficulty processing prepositions than particles, was true even though in some instances the identical word was used in both sentences of the pair. For example, the word “off” was used correctly in the verb particle construction, “The driver is turning off the lights” but not in the prepositional transitive sentence, “The driver is turning off the road”.

Conclusions: These results support the idea that semantic argument structure and/or syntactic phrase structure contribute to processing difficulty in persons with aphasia. This notion is supported further by results of a treatment study with DD that showed significantly greater success producing verb particles compared to prepositional transitives during sentence repetition (Kohen, Milsark, Martin, Concha & Wheeler, in preparation).

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Table 1

**Verb particle and preposition production
during sentence repetition**

	<u>Particles correct</u>	<u>Prepositions correct</u>
EC25	18	7
DD6	6	0
MI 10	25	11
FS 1	16	17
VA3KC	15	9
<i>Avg</i>	16	8.8