



Verbal cluster order and processing complexity



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ABSTRACT

We examine a case of word order variation where speakers choose between two near-synonymous constructions partly on the basis of the processing complexity of the construction and its context. When producing two-verb clusters in Dutch, a speaker can choose between two word orders. Previous corpus studies have shown that a wide range of factors are associated with this word order variation. We conducted a large-scale corpus study in order to discover what these factors have in common. The underlying generalization appears to be processing complexity: we show that a variety of factors that are related to verbal cluster word order, can also be related to the processing complexity of the cluster's context. This implies that one of the word orders might be easier to process — when processing load is high, speakers will go for the easier option. Therefore, we also investigate which of the two word orders might be easier to process. By testing for associations with factors indicating a higher or lower processing complexity of the verb and its context, we find evidence for the hypothesis that the word order where the main verb comes last is easier to process.

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1. Introduction

Verbal clusters in Dutch present an interesting example of grammatical variation. In clusters of two verbs, both possible orders are grammatical, leading to optionality:

- (1) *Ik denk dat ik het begrepen heb*
I think that I it understood have
'I think that I have understood it.'
- (2) *Ik denk dat ik het heb begrepen*
I think that I it have understood
'I think that I have understood it.'

Speakers may produce either order in similar contexts, and the choice between different variants does not appear to be determined by grammatical factors. A notable aspect of this optionality is that the difference in word order is generally

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assumed not to correspond to a meaning difference. However, when speakers choose between constructions in these situations, they do not do so randomly.

This variation cannot be explained on the basis of syntax alone. In the most widespread account of the syntactic mechanism behind verbal clusters, both constructions are of equal derivational complexity, making an explanation in terms of syntactic complexity unlikely. This account, first proposed by Evers (1975), states that verbal clusters are formed through the mechanism of verb raising. In verb raising, the main verb is generated as the complement of the head verb of the cluster, and then moves up to join the head verb. Fig. 1 illustrates this process. The main verb *begrepen* is raised to attach to the governing verb *heb*, forming a complex head. It can attach on either side of the head verb, resulting in either a 2–1 (Fig. 1b) or 1–2 (Fig. 1c) ordered verbal cluster (1 is the head, 2 is the participle). The claim that verbal clusters are formed using this special mechanism is illustrated by the fact that these clusters are very rarely interrupted by non-verbal material. Furthermore, in multiple verb constructions with more than two verbs the *Infinitivus Pro Participio* (IPP) effect shows up, meaning that modal verbs that would normally be participles are infinitives instead (Wurmbrand, 2006).

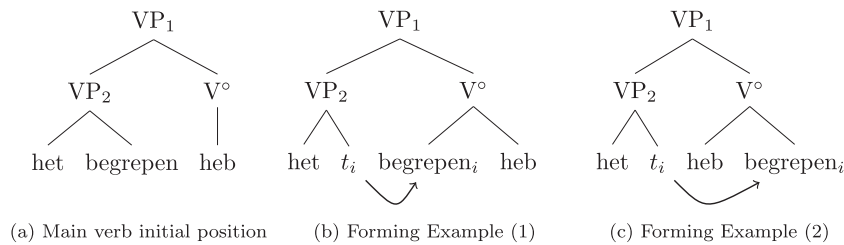


Fig. 1. Verb raising to generate the verbal clusters of examples 1 and 2, following the analysis of Evers (1975).

Corpus studies of similar variation phenomena have shown that a large portion of the variation between near-synonymous constructions in an alternation can be statistically accounted for using multifactorial statistical models that incorporate a variety of linguistic factors beyond syntax. De Sutter (2005) and Bloem et al. (2014) found that this is also the case for Dutch verbal clusters, quantifying the impact of morphosyntactic as well as semantic factors, and properties such as sentence length and word frequency. The multifactorial models employed in these studies reveal interesting patterns in the variation and associations with linguistic factors, but to explain why all of these different factors are involved when people choose to use one word order or the other, one needs to generalize over the factors that can be found by measuring things in a corpus. Various generalizations have been suggested. Several of the observed effects regarding factors such as sentence length can be interpreted as effects of adhering to the rhythm of the Dutch language (De Schutter, 1996), evenly distributing information weight throughout a sentence (De Sutter et al., 2007), or minimizing processing complexity (De Sutter, 2005; Bloem et al., 2014).

Processing complexity refers to the amount of cognitive resources or effort required to produce or comprehend an utterance. Speakers prefer to minimize their use of cognitive resources, formulating sentences in a way that minimizes processing complexity when they have multiple grammatical ways to communicate something (see Jaeger and Tily [2011] for an overview, Levy and Jaeger [2007] and Fedzechkina et al. [2012] for experimental work).

In this work, we will explore the suggestion that minimizing processing complexity is a general factor that can explain the effects observed in multifactorial studies so far. De Sutter (2005) originally formulated this idea for Dutch verb cluster order variation on the basis of two factors that were found to correlate with verb cluster order in his study — main verb frequency, and differences between verb clusters with arguments that are complements or adjuncts. He argues that the 1–2 word order is stylistically preferred, and is therefore more likely to be used when speakers have the spare cognitive capacity to do so, while the 2–1 order is otherwise more likely to be used. De Sutter ends his dissertation with the suggestion that in future work, other factors from his multifactorial study should be interpreted from the same perspective of processing complexity. Bloem et al. (2014) take this idea and suggest that it can be tested by studying whether factors indicating ease of processing correlate with one particular verb cluster word order, which would be the ‘default’ order. They also state that this default order is not necessarily the 2–1 order, and that there are arguments for considering the 1–2 order to be the default as well. That makes the processing complexity generalization empirically testable – is there a word order that correlates with processing complexity, and if so, which one? The present study aims to answer this question.

We address the issue by gathering empirical evidence for factors that affect verbal cluster order using a large amount of corpus data. Considering the wide range of factors that have been found to be associated with verbal cluster order variation in earlier studies, we expect that semantics, information structure and processing complexity all play a role in the choice between orders. However, in this study we focus on factors related to processing complexity, while controlling for other influences as much as possible. We hypothesize that any factor that cannot be attributed to semantics (i.e. it does not affect the meaning of the utterance), should be attributed to processing. We largely follow the methodology of Bloem et al. (2014), but with more factors relating to processing complexity. Furthermore, we analyze the previously studied factors in terms of processing complexity. This approach can be viewed as analogous to that of De Sutter et al. (2007). They use a multifactorial model to study rhythm as a possible generalization over factors relating to verb cluster word order, but conclude that

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