



Animacy in processing relative clauses: The hikers that rocks crush

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Abstract

For several languages, a preference for subject relative clauses over object relative clauses has been reported. However, Mak, Vonk, and Schriefers (2002) showed that there is no such preference for relative clauses with an animate subject and an inanimate object. A Dutch object relative clause as ...de rots, die de wandelaars beklommen hebben... ('the rock, that the hikers climbed') did not show longer reading times than its subject relative clause counterpart ...de wandelaars, die de rots beklommen hebben... ('the hikers, who climbed the rock'). In the present paper, we explore the factors that might contribute to this modulation of the usual preference for subject relative clauses. Experiment 1 shows that the animacy of the antecedent per se is not the decisive factor. On the contrary, in relative clauses with an inanimate antecedent and an inanimate relative-clause-internal noun phrase, the usual preference for subject relative clauses is found. In Experiments 2 and 3, subject and object relative clauses were contrasted in which either the subject or the object was inanimate. The results are interpreted in a framework in which the choice for an analysis of the relative clause is based on the interplay of animacy with topichood and verb semantics. This framework accounts for the commonly reported preference for subject relative clauses over object relative clauses as well as for the pattern of data found in the present experiments.

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Processing relative clauses in Dutch: When rocks crush hikers

When readers process a sentence, there are different types of information available to arrive at the correct interpretation of the sentence. These types of informa-

tion include the syntactic structure of the sentence, the semantic content of the words in the sentence, and pragmatic influences from the discourse in which the sentence is embedded. At any point in the sentence, the different sources of information may either work together to guide the reader towards the correct interpretation of the sentence or provide contradictory cues about the interpretation of the sentence.

This paper investigates how some of these sources of information interact in the processing of Dutch subject and object relative clauses. Examples of a subject

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relative clause and an object relative clause are given in (1) and (2), respectively.

- (1) Morgen zal de professor, die de studenten ontmoet heeft, de diploma's uitreiken.
Tomorrow will the professor, that the students met has, the diplomas present.
 (Tomorrow the professor, that has met the students, will present the diplomas.)
- (2) Morgen zal de professor, die de studenten ontmoet hebben, de diploma's uitreiken.
Tomorrow will the professor, that the students met have, the diplomas present.
 (Tomorrow the professor, that the students have met, will present the diplomas.)

The Dutch relative clauses in (1) and (2) are not disambiguated by word order, in contrast to English, but only by the number marking on the auxiliary. When the subject and the object have the same number, Dutch relative clauses with full noun phrases remain syntactically ambiguous between a subject relative clause reading and an object relative clause reading.

In studies on English and French relative clauses (e.g., Ford, 1983; Frauenfelder, Segui, & Mehler, 1980; Holmes & O'Regan, 1981; King & Just, 1991; King & Kutas, 1995; Traxler, Morris, & Seely, 2002) it was found that object relative clauses were more difficult to process than subject relative clauses. Processing difficulty was also found at the auxiliary of verb-final relative clauses in Dutch (e.g., Frazier, 1987; Mak et al., 2002) and in German, which also has a verb-final structure in relative clauses (e.g., Mecklinger, Schriefers, Steinhauer, & Friederici, 1995; Schriefers, Friederici, & Kühn, 1995).

This processing difficulty at the auxiliary is still present when the thematic fit of the noun phrases with the verb (hereafter referred to as the semantic content of the verb) in the relative clause renders a subject relative clause reading very implausible, as in (3) and (4).

- (3) Morgen zal de professor, die de studenten opgeleid heeft, de diploma's uitreiken.
Tomorrow will the professor, that the students educated has, the diplomas present.
 (Tomorrow the professor, that has educated the students, will present the diplomas.)
- (4) Morgen zullen de studenten, die de professor opgeleid heeft, de diploma's ontvangen.
Tomorrow will the students, that the professor educated has, the diplomas receive.
 (Tomorrow the students, that the professor has educated, will receive the diplomas.)

In (3) and (4) the semantic content of the verb *opleiden* (to educate) makes it highly implausible that the noun phrase *de studenten* (the students) is the subject

of the relative clause, and the noun phrase *de professor* (the professor) the object. However, experiments in German and Dutch have shown that this information did not result in the disappearance of the difference at the auxiliary: Object relative clauses, as in (4), still lead to processing difficulty on the auxiliary compared to subject relative clauses, as in (3) (Mak et al., 2002; Mecklinger et al., 1995; Schriefers et al., 1995).

Most studies mentioned above used relative clauses in which both the antecedent and the relative-clause-internal noun phrase (henceforth RC-internal noun phrase) were animate. A notable exception is a study by Traxler et al. (2002), which we will return to shortly. That the preference for subject relative clauses is modulated by the animacy of the noun phrases, has already been shown by Mak (2001; Mak et al., 2002) in self-paced reading and eye-tracking experiments: Object relative clauses had longer reading times than subject relative clauses when both the subject and the object were animate, in line with the above-mentioned studies; the difference between subject and object relative clauses disappeared, however, when the subject of the relative clause was animate and the object inanimate, as in the subject relative clause in (5) and the object relative clause in (6).

- (5) Vanwege het onderzoek moeten de inbrekers, die de computer gestolen hebben, een tijdje op het politiebureau blijven.
Because of the investigation must the burglars, that the computer stolen have, some time at the police office stay.
 (Because of the investigation, the burglars, that have stolen the computer, must stay at the police office for some time.)
- (6) Vanwege het onderzoek moet de computer, die de inbrekers gestolen hebben, een tijdje op het politiebureau blijven.
Because of the investigation must the computer, that the burglars stolen have, some time at the police office stay.
 (Because of the investigation, the computer, that the burglars have stolen, must remain at the police office for some time.)

These data show that animacy influences relative clause processing. The data however, are open to more than one interpretation. Theories differ in the way the factor of animacy can influence parsing decisions. Syntax-first theories posit that readers begin understanding a sentence by constructing a syntactic structure based on grammatical principles. In a later stage readers use non-grammatical information to evaluate this syntactic structure. Syntax-first theories thus predict that the initial parsing decision in the processing of relative clauses is made on the basis of syntactic principles only.

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