

# Scopal ambiguity preferences in German negated clauses

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## Abstract

When following a negated matrix clause, adverbial clauses (ACs) like “because it was paid very well” in (1) can be interpreted as residing within the scope of the negation (1b), or outside of it (1).

- (1) a. Peter did not quit his job because it was paid very well  
b. Peter did not quit his job because it was paid very badly.

Depending on the scope of the negative, the interpretation differs dramatically: Whereas Peter did in fact not quit his job in (1a), he did so in (1b), but for yet unknown reasons. It has been shown for English (see Frazier & Clifton, 1996), that there is a preference to interpret the adverbial clause outside of the scope of the negation so that (1b) appears fairly odd. This observation challenges recency based processing principles, such as late closure, since the high attachment (to IP) appears to be preferred over low attachment (to VP) (see figure 1). In this paper, we will present evidence on German equivalents of (1a,b), varying the order of the negative and the verb (Experiment I), the context in which the ambiguity appears (Experiment II), and the position of the adverbial in relation to the clause boundary where the negation of the main verb is restricted or even retracted (Experiment III). None of these variations reduced the preference substantially. Only an explicit alternative cause reduced it but even this variation did not eliminate the difficulty of the inside scope interpretation. We will argue that incremental interpretation as well as immediate attribution of prosodic structure determine the interpretation of the adverbial clause.

## Introduction

Whereas the scope of quantifiers has been the subject of substantial research (e.g., Ioup, 1975, Johnson-Laird, 1969; Kurtzman & MacDonald, 1996; for an extensive discussion see Frazier, 1999) this is much less the case for the scope of negations. In this paper, we will look at sentences like (1) where an adverbial clause can be interpreted as either being within the scope of the negation in the matrix clause or outside of it. Structurally, the adverbial clause has to be attached to the VP if it is interpreted as residing within the scope of the negation whereas it has to be attached to IP if it is interpreted outside the scope of the negation.

Locality based principles of syntactic attachment as they are assumed in most theories of human sentence processing (e.g., Frazier, 1978; Gibson, 1991) predict a preference to attach the adverbial clause to VP, and thus a preference to interpret it inside of the scope of the negation.

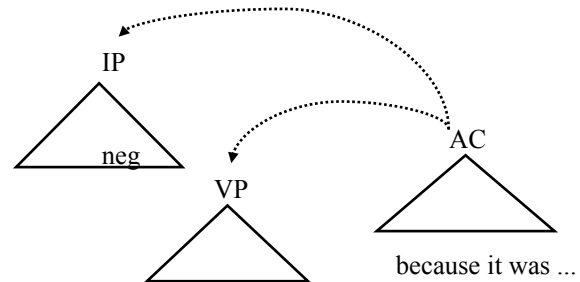


Figure 1

However, Frazier and Clifton (1996) found a clear preference for an interpretation of the AC outside of the negation scope. In their experiments, this preference does not show up in early stages of processing, but only in later off-line measures. In the framework of Construal Theory, the authors argue that only argument like or primary relations are attached to the phrase marker of the sentence immediately. Only primary relations are subject to syntactic attachment principles like Minimal Attachment or Recency. As a non-primary relation, the adverbial clause is only construed as part of the maximal projection of the preceding thematic domain (i.e. the IP). All kinds of factors (syntactic, semantic, pragmatic, or prosodic) jointly determine the final interpretation of the clause.

In this paper, we do not want to dispute the immediacy of the attachment or the interpretation of adverbial clauses. We are much more interested in the question of which factors are driving this final preference, and how general or universal it is. This means testing this preference in different constructions, in different environments, and across languages. Therefore, we have been looking at German versions of Frazier and Clifton’s materials. In four experiments, we tried to find a way to override the interpretational preference, by putting the negation in focus position (Exp I), varying contextually given presuppositions (Exp II), and restricting the negation (Exp III). Since our main interest does not lie in the question of when these factors come into play, but only whether they do have an effect at all, in all of our experiments, we applied an off-line acceptability judgment task.

## Experiment I

In Experiment I, we wanted to test whether the preference for high attachment of the adverbial clause which has

already been established for English can also be found in German. Additionally, we varied the position of the negation “nicht” (not). Since the clause final position in German is prosodically more dominant than clause internal positions, we assumed that an interpretation of the adverbial clause inside the scope of the negation might be more viable if it is clause final. As a control for lexical effects we included controls without negations.

## Methods

**Materials.** Eighteen sentences were constructed, closely related to the materials from Frazier and Clifton (1996). Each sentence contained a main clause followed by a subclause beginning with “weil” (because). The comma preceding “weil” is obligatory in German for all possible interpretations. It cannot serve as a cue for the interpretation of the adverbial clause. In the main clause, a character was introduced as the subject in the default topic position. The pronoun in the because-clause was meant to refer to the subject of the main clause. This was the most plausible reading according to the intuitions of the experimenters and qualitative interviews after the experiment showed that subjects interpreted the pronouns exactly this way. Six versions of each sentence were constructed. In two, the negation preceded the clause-final participle (condition VP-internal, 2a,b). Two versions had the negation as the last word of the main clause (VP-final, 2c,d). Crossed with the position of the negation, the because-clause could either be plausibly interpreted as being inside of the scope of the negation or not. In order to control for potential plausibility differences in the adverbial clauses, we included two controls (2e,f) which only differed with respect to the adverbial clause, but did not have a negation in the matrix clause.

- (2) a. neg. VP-internal, AC outside negation scope  
Die Sekretärin hat nicht gekündigt, weil sie ein hohes Gehalt erhielt.  
The secretary has not quit her job, because she got a high salary.
- b. neg. VP-internal, AC in negation scope  
Die Sekretärin hat nicht gekündigt, weil sie ein geringes Gehalt erhielt.  
The secretary has not quit her job, because she got a low salary.
- c. neg. VP-final, AC outside negation scope  
Die Sekretärin kündigte nicht, weil sie ein hohes Gehalt erhielt.  
The secretary did not quit her job, because she received a high salary.
- d. neg. VP-final, AC in negation scope  
Die Sekretärin kündigte nicht, weil sie ein geringes Gehalt erhielt.  
The secretary did not quit her job, because she received a low salary.
- e. no negation (control-a)

Die Sekretärin war unbeliebt, weil sie ein hohes Gehalt erhielt

The secretary wasn't liked very much, because she received a high salary.

f. no negation (control-b)

Die Sekretärin war unbeliebt, weil sie ein geringes Gehalt erhielt.

The secretary wasn't liked very much, because she received a low salary.

Six counterbalanced forms of the questionnaire were constructed. One sixth of the 18 experimental sentences appeared in each version in each form of the questionnaire, and across the six forms, each experimental sentence appeared once in each version. Each sentence was followed by a question concerning its acceptability. These 18 sentences were combined with 36 sentences of various forms varying in complexity (simple main clauses, simple embeddings and doubly nested embeddings) and plausibility (from fully plausible to fairly implausible according to the intuitions of the experimenters). One randomization was made of each form.

**Participants.** Eighteen participants, mostly undergraduate students from the University of Freiburg, judged the acceptability of sentences presented in a printed questionnaire. They either received course credits or they were paid for their participation. All subjects' native language was German, none of them was bilingual.

**Procedure.** The rating technique used was magnitude estimation (ME, see Bard et al., 1996). Participants were instructed to provide a numeric score that indicates how much better (or worse) the current sentence was compared to a given reference sentence (Example: If the reference sentence was given the reference score of 100, judging a target sentence five times better would result in 500, judging it five times worse in 20). Judging the acceptability ratio of a sentence in this way results in a scale which is open-ended on both sides. It has been demonstrated that ME is therefore more sensitive than fixed rating-scales, especially for scores that would approach the ends of such rating scales (Bard, et al., 1996).

Each questionnaire began with a written instruction where the subject was made familiar with the task based on two examples. After that subjects were presented with a reference sentence for which they had to provide a reference score. All following sentences had to be judged in relation to the reference sentence.

## Results

Individual judgments were individually standardized and logarithmized. Table 1 contains mean judgments in the six conditions.

Table 1: Acceptability judgments Experiment I

	neg. internal	VP- neg. final	VP- no negation
AC within scope of negation	-.64	-.79	.24
AC outside of scope of negation	.28	.31	.34

Judgments were submitted to a two-factorial MANOVA including the factors “negation” (VP-internal, VP-final, no negation) and “attachment” (IP, VP). There was a main effect of “negation” ( $F(2, 34) = 11.25, p < 0.001$ ;  $F(2,34) = 10.89, p < 0.001$ ), resulting from the fact that on average, sentences without negations were judged more acceptable than those containing negations (VP-internal: -0,178, VP-final: -0,240; no negation: 0,287). The main effect of “attachment” as well as the interaction “negation”\*“attachment” reached significance as well (“attachment”:  $F(1,17) = 51.29, p < 0.001$ ;  $F(1,17) = 26.00, p < 0.001$ ; “negation”\*“attachment”:  $F(2,34) = 7.26, p < 0.01$ ;  $F(2,34) = 8.64, p < 0.01$ ). Planned comparisons show that low attachment was judged less acceptable in sentences containing a VP-internal negation ( $F(1,17) = 26.47, p < 0.001, F(1,17) = 16.20, p < 0.01$ ) as well as in sentences containing a VP-final negation ( $F(1,17) = 38.31; p < 0.001; F(1,17) = 29.29, p < 0.001$ ), whereas there was no difference in acceptability between the control sentences ( $F(1,17) < 1, ns; F(2,17) < 1, ns$ ).

## Discussion

In Experiment I, we clearly replicated the findings Frazier & Clifton (1996) report for English. In German as in English it is harder to interpret the adverbial clause as residing within the scope of the negation. Varying the position of the negation, however, did not exert an influence on the acceptability of this interpretation. The clause-final focus on the negation is obviously not sufficient to render it more viable. In the second experiment we tried to put the negated sentences in contexts that were supposed to bias for either of the two interpretations.

## Experiment II

For Experiment II, we constructed four different contexts for each sentence: A neutral context, leaving open whether or not the proposition stated in the following matrix clause holds or not (3), a context biasing an external scope reading (4), and two contexts biasing an internal scope reading, with one context explicitly stating that the proposition stated in the matrix clause should not be negated (5) and another one presupposing that e.g. the secretary actually quit her job (6).

(3) Neutral context

Jeder hat die Neuigkeiten über die Sekretärin gehört.

Die Sekretärin hat nicht gekündigt, weil sie ein (a) hohes / (b) geringes Gehalt erhielt.

Everybody heard the news about the secretary.

The secretary did not quit her job, because she got a (a) high / (b) low salary.

(4) Contextual bias: AC outside neg. scope

Jeder hat sich gefragt, ob die Sekretärin gekündigt hat.

Die Sekretärin hat nicht gekündigt, weil sie ein (a) hohes / (b) geringes Gehalt erhielt.

Everybody wondered, whether the secretary had quit her job.

The secretary did not quit her job, because she got a (a) high / (b) low salary.

(5) Contextual bias: AC within neg. scope (I)

Jeder hat gehört, dass die Sekretärin gekündigt hat.

Die Sekretärin hat nicht gekündigt, weil sie ein (a) hohes / (b) geringes Gehalt erhielt.

Everybody heard that the secretary had quit her job.

The secretary did not quit her job, because she got a (a) high / (b) low salary.

(6) Contextual bias: AC within neg. scope (II)

Jeder hat sich gefragt, warum die Sekretärin gekündigt hat.

Die Sekretärin hat nicht gekündigt, weil sie ein (a) hohes / (b) geringes Gehalt erhielt.

Everybody wondered, why the secretary had quit her job.

The secretary did not quit her job, because she got a (a) high / (b) low salary.

## Methods

We applied the same technique as in the previous experiment. 24 subjects, all native German speakers and all students from the University of Freiburg participated in the experiment. Fillers varied along the full range from fully grammatical to ungrammatical, as well as from fully plausible to highly implausible.

## Results

There was a reliable main effect of Scope: sentences for which the adverbial clause had to be interpreted inside the scope of the negation were judged less acceptable than their counterparts ( $F(1,23) = 26.25, p < 0.001$ ;  $F(1,15) = 53.4, p < 0.001$ ).

Table II: Acceptability judgments Experiment II

	Neutral Context	Scope external	Scope internal I	Scope internal II
AC inside scope of negation	-.54	-.38	-.16	-.44
AC outside scope of negation	.36	.26	.39	.52

No main effect of context was found ( $F(3, 69) < 1, ns$ ;  $F(3,45) = 1.23, ns$ ). Although explicitly stating the fact that

the proposition described in the matrix clause should not be negated rendered the sentences slightly more acceptable numerically, this did not result in an interaction between Context and Scope ( $F(1,3,69) = 1,12$ , ns;  $F(2,3,45) = 1.61$ , ns).

## Discussion

In all contexts, even in those biasing the inside scope reading, interpreting the adverbial clause outside of the scope of the negation was judged more acceptable. Before we will discuss why this may be the case, we will extend the phenomenon by including a temporal adverb as a possible domain for the negation.

## Experiment III

In Experiment III we presented the same ambiguous constructions as in the earlier experiments. However, we added two conditions with a temporal adverb between the negation and the adverbial clause. This has the effect that now, the adverbial clause in (7d) can easily be interpreted outside of the scope of the negation which is restricted by the temporal adverb (The secretary quit the job before yesterday because of the low salary.). The only viable interpretation for (7c), however is an interpretation of the adverbial clause inside the scope of the negation (The secretary actually quit the job yesterday, but not because she got a high salary, but e.g., because she didn't have another job offer before.). The prediction is that we should find the same preference for the outside scope reading in these constructions.

- (7) a. AC outside of neg. scope, no restriction before clause boundary  
 Die Sekretärin kündigte nicht, weil sie ein hohes Gehalt erhielt.  
 The secretary did not quit her job, because she got a high salary.
- b. AC within neg. scope, no restriction before clause boundary  
 Die Sekretärin kündigte nicht, weil sie ein geringes Gehalt erhielt.  
 The secretary did not quit her job, because she got a low salary.
- c. AC inside of neg. scope, restriction before clause boundary  
 Die Sekretärin kündigte nicht erst gestern, weil sie ein hohes Gehalt erhielt.  
 The secretary did not quit her job only yesterday, because she got a high salary.
- d. AC outside of neg. scope, restriction before clause boundary  
 Die Sekretärin kündigte nicht erst gestern, weil sie ein geringes Gehalt erhielt.  
 The secretary did not quit her job only yesterday, because she got a low salary.

## Methods

As in the other experiments, subjects judged the acceptability of the sentences in relation to a reference sentence (Magnitude Estimations). The sixteen experimental sentences were randomly mixed with 48 filler sentences of varying acceptability (some ungrammatical, some highly implausible). Sixteen native German subjects, all students of the University of Freiburg, participated in the experiment.

## Results

The sentences where we included a temporal modifier as a possible domain for the negation were generally more complex and judged less acceptable than the shorter versions  $5F(1,15) = 17.69$ ,  $p < 0.001$ ;  $F(2,1,15) = 10.07$ ;  $p < 0.01$ ). More importantly though, the interpretation of the adverbial clause outside of the scope of the negation was clearly preferred in both, the shorter and the longer version ( $F(1,15) = 45.10$ ,  $p < 0.001$ ;  $F(2,1,15) = 156.00$ ,  $p < 0.001$ ). The difference between the inside and the outside scope reading was, however, somewhat stronger for sentences without a temporal adverb as indicated by a reliable interaction between the two experimental factors ( $F(1,15) = 5.71$ ,  $p < 0.05$ ;  $F(2,1,15) = 7.51$ ;  $p < 0.05$ ).

Table 3: Acceptability judgments Experiment II

	Restriction before clause boundary	No restriction before clause b.
AC within scope of negation	-.54	-.24
AC outside of scope of negation	-.05	.85

## Discussion

Although the sentences including a temporal modifier were somewhat less acceptable than the shorter versions, they showed the same preference pattern. Interpretation of the adverbial clause inside the scope of the negation is always far less acceptable than its outside scope interpretation. The interaction between the domain of the scope of the negation and the presence of a temporal modifier can be explained by the fact that the sentences including a temporal adverb were generally semantically more complex. Assuming a preference for incremental interpretation (Konieczny, Hemforth, Scheepers, & Strube, 1997; Crocker, 1995), the negation in these conditions has to be revised (First the secretary did not quit her job, then she did, but not only yesterday.). This local revision is obviously less costly than a revision between clause boundaries as in (7b), but it may have reduced the difference between the final interpretation of (7c) and (7d).

## Experiment IV

In our fourth experiment, we presented a continuation of the sentence, explicitly providing the alternative cause (8a).

- (8) a. Die Sekretarin hat nicht gekündigt, weil sie ein geringes Gehalt erhielt, sondern weil sie ihre Arbeit langweilig fand.  
The secretary did not quit her job because she got a low salary but because she found her work boring.  
b. Die Sekretarin hat nicht gekündigt, weil sie ein hohes Gehalt erhielt, obwohl sie ihre Arbeit langweilig fand.  
The secretary did not quit her job because she got a high salary although she found her job boring.

In this Experiment we found, that although the difference is actually strongly reduced, interpreting the “because”-clause inside the scope of the negation still causes some difficulties (mean ME score: 0.09 for 8a, +0.45 for 8b,  $F(1,15) = 5.83$ ,  $p < 0.05$ ;  $F(1,15) = 6.51$ ;  $p < 0.05$ ).

## General Discussion

A strong preference to interpret the adverbial outside of the negative was established, which turned out to be very stable across experiments. It is independent of the ordering of the verb and the negative (Experiment I).

It shows up even in very strong contexts biasing the inside scope reading where the secretary actually quit her job (Experiment II), and the same pattern can be established in constructions, where the negation can be interpreted as restricted by a temporal adverb (Experiment III). Finally, Experiment IV shows that the preference for interpreting the adverbial clause outside the scope of the negation is reduced but not eliminated by a continuation that provides an explicit alternative to the negated because clause.

Obviously, the interpretation of the adverbial clause inside of the scope of the negation is very hard even in a context biasing for this reading. The question is why this is the case. One possibility is that the short texts in (5) and (6) are still semantically incomplete, since we now know what is not the reason for the secretary quitting her job but not what the reason for doing so actually is. Since it may be assumed that negative information is not as well presented as positive information (Legrenz, Girotto, & Johnson-Laird, 2003), mental models for texts like these may be insufficiently specified and thus less acceptable. The data presented for Experiment IV, on the other hand, suggest that this aspect actually plays a major role. However, it does not seem to tell the whole story, since even an explicitly given alternative does not render the inside scope reading as acceptable as the outside scope reading.

An further possibility lies in the interaction of semantic and prosodic information. Ronat (1984) presents the Prosodic Binding hypothesis for French, roughly stating that a prosodic boundary delimits the scope of a quantifier or a wh-phrase (see also the Scope Correspondence Principle (SPC) suggested by Hirotani, 2003, for Japanese). Note,

that this is actually a principle of grammar, meant to constrain the interpretational domain of quantifiers.

Assuming that even during silent reading, a prosodic structure of a sentence is constructed (Implicit Prosody Hypothesis; Fodor, 1998), this may play a role in reading as well. Since there is a high probability for a prosodic boundary between the matrix clause and the adverbial clause, the AC cannot be interpreted inside the scope of the negation. The inside scope reading of the adverbial clause is actually only viable with a very marked prosodic contour. At least intuitively (as stated by several native German and English informants), the break before the adverbial clause in this marked prosodic contour is strongly reduced. Interestingly, this seems to be true even though there still has to be a comma in the German clauses. So the comma by itself cannot be the major factor. The remaining difficulty in interpreting “complete” models may thus result from the interaction of semantic and prosodic constraints. This will, however, be a question to be answered in future research (Bradley, Fodor, Fernandez, Hemforth, & Pynte, in prep).

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