Intrusion effects in the processing of negative polarity items

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1 Abstract

In two experiments, we investigated the influence of the accessibility of negation in negative polarity constructions in German using speeded judgment tasks and event-related brain potentials (ERPs). In particular, we examined the influence of constituency and linear order of the negator in this type of constructions. Our findings suggest that a non-c-commanding but linear preceding constituent negation can improve the acceptability of a negative polarity item like *jemals* (ever).

2 Introduction

Various lexical elements, such as the German negative polarity item *jemals* (ever) exhibit an interesting property in that they can only occur in certain kinds of sentence contexts. Negative polarity items must occur in the context of a negation. Otherwise, the construction becomes unacceptable, see (a) versus (b) and (a) versus (c).

> (a)   **Kein** Mann, der einen Bart hatte, war **jemals** glücklich.
>
>   no man who a beard had was ever happy
>
> (b)   ***Ein** Mann, der einen Bart hatte, war **jemals** glücklich.
>
>   a man who a beard had was ever happy
>
> (c)   ***Ein** Mann, der **keinen** Bart hatte, war **jemals** glücklich.
>
>   *a man who no beard had was ever happy*

Linguistic descriptions agree in that the occurrence of polarity items is licensed by semantic (e.g. Horn, 1997; Ladusaw, 1979) or pragmatic (e.g. Fouconnier, 1980; Krifka, 1995) properties, or by a combination of both (Baker, 1970; Linebarger,

1987). These properties, in addition, must be accessible to the polarity item, where accessibility is determined hierarchically rather than linearly (Progovac, 2000). Specifically, a negative polarity item is only licensed if it occurs in the scope of a negator, as in (a). By contrast, a negative polarity construction is not acceptable if a negator linearly precedes the polarity item but does not c-command it, see (c).

3 Psycholinguistic investigation

From a psycholinguistic point of view, the properties of polarity items raise questions with respect to syntactic and semantic processing. More specifically, we want to know how the human language processor responds to the different types of demands initiated by a polarity item. This is supposed to shed light not only on the specific nature of polarity items, but more important on how the specific properties of the polarity item interact with the restrictions provided by the context.

Our experiments focused on the acceptability of negative polarity in three types of constructions: In (a) negation is there and it is accessible, in (b) there is no negation at all, and in (c) the negator (constituent negation) precedes the negative polarity item but is not structurally accessible. If the linguistic description is correct that negative polarity items need a structurally accessible negator in order to be licensed, we expect that structures (b) and (c) (where this condition is not met) are significantly more often rejected as ungrammatical compared to structures such as (a). However, linguistic theory does not give reason to assume that acceptability should differ depending on whether the negation is there but not accessible such as in (c) or not present at all such as in (b).

3.1 Experiment 1: Speeded acceptability judgment-study

24 monolingual German students participated in a speeded acceptability judgment task in which structures such as (a) to (c) were tested. 24 experimental sentences (8 per condition) were intermixed with 24 related and 80 unrelated filler sentences. The statistical analysis of accuracy percentages showed that subjects rejected the structures (b) and (c) more often compared to the condition (a). Interestingly, we also found a significant difference between condition (b) and (c). Structures such as (c) with a negator in the relative clause (69 % accuracy) were more often erroneously accepted as grammatical than structures such as (b) without negation (77 % accuracy). This suggests that the negator is wrongly used to license the polarity item even it is not in a c-commanding position.

3.2 Some brief remarks on the ERP components: N400 and P600

Event-related potentials (ERP) are an ideal tool in investigating language processing because it is continuous and has a very high temporal (millisecond-by-millisecond) resolution (Kutas & van Petten, 1994). Compared to quantitative measures (e.g. reaction times), ERP effects (so-called *components*) are characterized by a set of quantitative (amplitude, latency) and qualitative parameters (polarity, topography, experimental sensitivity).

In response to linguistically distinct experimental manipulations distinct ERP patterns have been found. The *N400 component* is a negativity with a latency peaking typically around 400 ms after onset of a critical element. It reflects the processing costs of semantic and thematic integration, since it has been found in response to semantic as well as thematic violations either of verb argument structure or of thematic hierarchies between case-marked arguments (see Frisch 2000 for an overview). The *P600 component* is a positivity peaking between 600 and 900 ms and is been associated with syntactic reanalysis and repair (e.g. Friederici, 1995). It has also been found in response to enhanced syntactic complexity including ambiguity (Frisch, Schlesewsky, Saddy & Alpermann, 2002).

3.3   Experiment 2: ERP-study

In an experiment using event-related brain potentials (ERPs), we addressed the question how structures such as (a)-(c) are processed on-line. Seeing that ERPs provide qualitatively different types of responses (components) being associated with different types of linguistic information (see above), they can be used to answer the following questions: First, how do ERP patterns between acceptable (such as (a)) and unacceptable structures (such as (b) and (c)) differ? Second, what is the nature of the intrusion effect found in Experiment 1, i. e. the difference between (b) and (c)?

16 monolingual German students participated in this ERP-study which tested negative polarity structures such as (a) to (c) above. 120 experimental sentences (40 per condition) were intermixed with 120 related and 320 unrelated filler sentences.

The ERP patterns from the onset of the critical word (*jemals* (ever), onset 0 ms) up to 1000 ms thereafter are displayed in Figure 1. As can be seen from the figure, ERPs in the incorrect conditions (b) and (c) show a negativity around 400 ms (N400 component) followed by a positivity around 600 ms (P600 component) compared to the correct condition (a). As described above, the N400 is seen to reflect the cost of semantic integration, whereas the P600 can be seen as a marker of syntactic repair. By comparing ERPs in the incorrect conditions ((b) versus (c)) a significant difference between both N400s was attested at anterior sites, in that condition (c) showed a weaker effect than condition (b).

In sum, unlicensed negative polarity items elicited an ERP pattern signaling both semantic as well as syntactic processing problems compared to their licensed counterparts. In addition, we see an intrusion effect from the inaccessible negator on

the polarity item in the form of a reduced N400. This suggests that linear precedence can overwrite structural accessibility and can erroneously improve semantic integration.

4 Conclusion

Both the results of the speeded acceptability judgement as well as the ERP experiment revealed that unlicensed negative polarity items are unacceptable on both semantic and syntactic grounds. Furthermore, a linearly preceding but structurally inaccessible negator can, on the one hand, erroneously enhance the acceptability of the structure in the judgement data, and, on the other hand, weaken the N400 effect (cost of semantic integration) in the ERPs data. These results can be interpreted as follows: The costs to integrate a negative polarity item semantically (pragmatically) are lower in structures with a non-commanding negation compared to structures without a negator at all. A theoretical approach that relies only on structural relations would not predict this distribution. Taken together, the results of the two experiments suggest a combination of semantic (pragmatic) properties and hierarchical constituency during the processing of negative polarity items.

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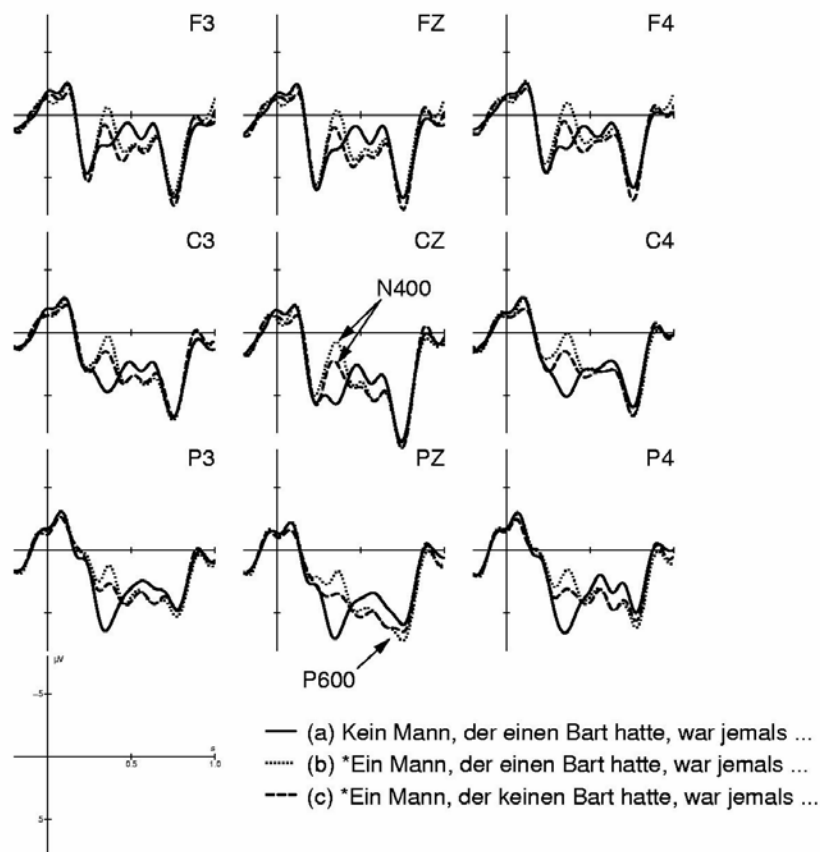
Figure 1. ERP effects on the negative polarity item "jemals" (ever) from the onset up to 1000ms there after at a subset of nine electrodes. Negativity is plotted upwards. The solid line displays the grammatical condition (a), the dotted line displays the incorrect condition without any negation (b) and the broken line displays the incorrect condition where the relative clause contains negation (c).

45