

Utilizing case and agreement information in structural ambiguity resolution: An eye-tracking study on German

Nariman Utegaliyev¹, Gunnar Jacob^{1,2}, and Shanley Allen¹

¹University of Kaiserslautern, ²University of Mannheim

Contract e-mail: utegaliyevnariman@gmail.com

While the processing of temporarily ambiguous sentences has been investigated extensively in Psycholinguistics, only a relatively small number of studies have directly compared the size of the garden-path effect in sentences disambiguated by different types of structural cues.

Meng and Bader (2000), in a self-paced reading study on German, found stronger garden-path effects for sentences disambiguated by subject-verb agreement (such as (1)) than for sentences disambiguated by the case-marking (such as (3)). The authors argued that case-marking can also guide reanalysis, as it is potentially helpful to identify the correct subject. Subject-verb agreement, in contrast, just signals that the initial analysis is incorrect. Gerth, Otto, Felser, and Nam (2015), in a self-paced reading study using similar items as Meng and Bader (2000), instead found garden-path effects of a similar magnitude for both types of disambiguation.

In the present study, we compare the relative strength of garden-path effects in the processing of temporarily ambiguous sentences disambiguated by either case or agreement using eye-tracking instead of self-paced reading. Unlike self-paced reading, eye-tracking allows the reader to re-visit previous areas of the sentence. This is crucial given that reanalysis requires the parser to go back to the previously encountered ambiguous noun phrases and re-assign syntactic roles.

Thirty-two (female = 17, mean age \pm SD = 23.1 \pm 3.34 years) native speakers of German were recruited. The experimental sentences were composed of twenty-four sentence quadruplets as shown in the examples below. The sentences the participants read contained a subject-object ambiguity, which were disambiguated by either subject-verb agreement (1) or case marking (3). These were compared with otherwise identical unambiguous control conditions ((2) and (4)) in which the subject interpretation is ruled out from the very start, through accusative marking on the noun phrase.

Generalized Linear Mixed Effects Models were used for the analysis of post sentence comprehension questions. The results showed significant garden-path effects for both agreement and case ($p < .01$). In addition, in line with Bader and Meng (2000), these effects were significantly stronger in sentences disambiguated by agreement than in sentences disambiguated by case ($p < .01$ for an interaction).

Participants' eye-movements were analyzed using Linear Mixed Effect Models. The reading measures analyzed were the total reading time, rereading duration, and the regression path duration in the disambiguation segments. These measures also showed significant effects of ambiguity (all $ps < .01$). However, unlike for the comprehension questions, the effects were of a similar magnitude for case and agreement ($p > .15$ for all interactions).

We conclude that, during on-line reanalysis, case and agreement constitute equally strong cues, as illustrated by the eye-tracking measures. However, when readers reach the post-sentence comprehension questions, the disambiguation type also provides additional information for the reconstruction of the previous sentence, causing stronger garden-path effects for agreement than for case.

Item sample

agreement, ambiguous

(1) Die Beraterin der Arbeitsagentur haben gerade die Gärtner wirklich liebevoll begrüßt.

the consultant_[FEM, NOM or ACC] of the employment agency have_[PL] just the gardeners really lovingly greeted.

‘The gardeners have just greeted the consultant of the employment agency really lovingly.’

agreement, unambiguous

(2) Den Berater der Arbeitsagentur haben gerade die Gärtner wirklich liebevoll begrüßt.

the consultant_[MASC, ACC] of the employment agency have_[PL] just the gardeners really lovingly greeted.

‘The gardeners have just greeted the consultant of the employment agency really lovingly.’

case-marking, ambiguous

(3) Die Beraterin der Arbeitsagentur hat gerade der Gartner wirklich liebevoll begrüßt.

the consultant_[FEM, NOM or ACC] of the employment agency has_[SING] just the gardener really lovingly greeted.

‘The gardener has just greeted the consultant of the employment agency really lovingly.’

case-marking, unambiguous

(4) Den Berater der Arbeitsagentur hat gerade der Gartner wirklich liebevoll begrüßt.

the consultant_[MASC, ACC] of the employment agency has_[SING] just the gardener really lovingly greeted.

‘The gardener has just greeted the consultant of the employment agency really lovingly.’