

# Production of inverse negative scope sentences

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**Background:** While the comprehension of negation has been widely studied, much less is known about how negated sentences are produced. This is surprising considering that negation is often associated with word-order alternations, a central topic in production research. In German, for instance, there are two ways to express an existential quantifier within the scope of negation: The indefinite article *ein* ('a') can either follow the negation particle *nicht* ('not') and contract to *kein* ('no'), resulting in surface scope, or it can precede the negation, yielding inverse scope. Studies on sentence comprehension have shown a preference for surface scope over inverse scope. The former is semantically transparent, whereas the latter is considered more processing intensive [1]. Nevertheless, several recent studies (e.g. [2], [3]) have shown that inverse scope is accessible in German.

**Hypotheses:** We investigate whether the syntactic function of the existential NP influences the choice between *ein-nicht* and *kein*. Based on evidence that subjects are planned early and sentence production is incremental [4], we derive the following predictions: (1) Subjects should precede negation more often than objects. (ii) Subjects with an agent role (unergative verb) are subjects at the surface and underlyingly, whereas subjects with a patient/theme role (unaccusative and passive verbs) have properties of underlying objects [4]. Consequently, we expect sentences with unergative verbs to elicit more recalls with *ein* preceding negation compared to unaccusative and passive verbs. (iii) For sentences with an indefinite object, we expect less inverse scope (*ein-nicht*) for PP than for accusative objects because PP objects can appear after the negation without contraction.

**Method:** This experiment employs a variant of the production-from-memory paradigm. It follows a 1x5 factorial design, with syntactic function of the indefinite NP as the independent variable at 5 levels (see example Table 1): subject of unergative verb, subject of unaccusative verb, subject of passive verb, accusative object, prepositional object. Participants ( $n = 27$  so far) read out a context sentence and a negated main clause with a sentence initial indefinite. Participants then read the context again, followed by a prompt like "Es heißt, dass..." ("It is said that..."), and transformed the main clause to an embedded clause. This procedure allows us to determine under which conditions they produce sentences with either *kein* or *ein-nicht*.

**Results:** We tested the hypotheses derived above in a preliminary analysis of the data from 27 participants with the `lme4` package [5] (see Table 2). (i) *ein-nicht* is produced significantly more often when the indefinite is the subject of the sentence rather than the object. (ii) There were no significant differences between the three types of subjects. (iii) *ein-nicht* is produced significantly more often for accusative objects than for PP objects. PP objects were often produced after the negation without contraction (see Figure 1a).

**Discussion:** The results show that the syntactic function of the indefinite influences the production of negation in German. During sentence planning, negation appears to be processed after the subject, leading to more inverse scope (*ein-nicht*) for subjects than for objects. The lack of differences between the three types of subjects indicates that the surface status of the subject is crucial in this regard. The results for PP objects suggest that *kein* contraction is avoided if possible. This in turn may be one of the reasons why *ein-nicht* is produced despite inverse scope.

## Example item

Table 1: A stimulus item in all five versions

<b>Context</b>	In der Galerie um die Ecke wurde vergangene Woche eine neue Ausstellung eröffnet. 'In the gallery around the corner, a new exhibition opened last week.'
<b>Target sentence</b>	
<b>S-V-ungenerative</b>	Ein lokaler Künstler hat zur Überraschung aller nicht mitgewirkt. A local artist has to surprise of-all not participated 'To everyone's surprise, a local artist has not participated.'
<b>S-V-unaccusative</b>	Ein lokaler Künstler ist zur Überraschung aller nicht erschienen. A local artist is to surprise of-all not appeared 'To everyone's surprise, a local artist has not appeared.'
<b>S-V-passive</b>	Ein lokaler Künstler wurde zur Überraschung aller nicht eingeladen. A local artist was to surprise of-all not invited 'To everyone's surprise, a local artist was not invited.'
<b>O-accusative</b>	Einen lokalen Künstler hat man zur Überraschung aller nicht eingeladen. A local artist has one to surprise of-all not invited 'To everyone's surprise, one didn't invite a local artist.'
<b>O-PP</b>	Nach einem lokalen Künstler hat man zur Überraschung aller nicht gefragt. After a local artist has one to surprise of-all not asked 'To everyone's surprise, one didn't ask for a local artist.'
<b>Prompt</b>	Es heißt, dass (man) zur Überraschung aller... 'It is said that to everyone's surprise...'

## Results

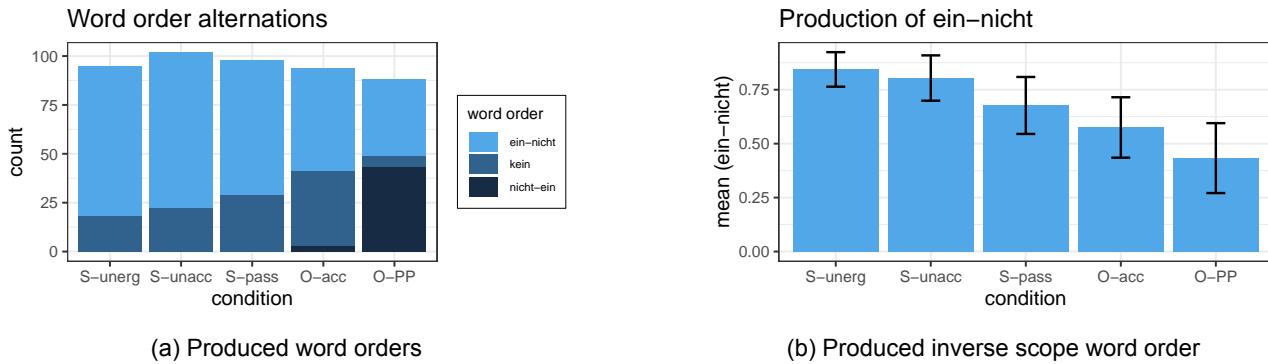


Figure 1: Preliminary results of word order and inverse scope

Table 2: Mixed-effects model for production of inverse scope (see Figure 1b).

Formula: $inverseScope \sim Condition + (1 Participant) + (1 SentenceNr)$				
Contrast	Estimate	SE	z value	p value
Subjects versus objects	1.7497	0.2828	6.186	6.17e-10 ***
S-ungenerative vs S-unaccusative	0.3770	0.4472	0.843	0.39920
S-unaccusative vs S-passive	0.6498	0.4156	1.564	0.11793
O-accusative vs O-PP	0.9326	0.3985	2.341	0.01926 *

## References

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- [3] Fanselow, G., Zimmermann, M., & Philipp, M. (2022). Accessing the availability of inverse scope in german in the covered box paradigm. *Glossa: a journal of general linguistics*, 7(1).
- [4] Momma, S., & Ferreira, V. S. (2019). Beyond linear order: The role of argument structure in speaking. *Cognitive Psychology*, 114, 101228. <https://doi.org/https://doi.org/10.1016/j.cogpsych.2019.101228>
- [5] Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1–48. <https://doi.org/10.18637/jss.v067.i01>