

Relative clause extraposition and information structure

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1 Introduction

As in many other languages, relative clauses in German can appear adjacent to the head noun they modify or separated from their head noun in clause-final position. This is illustrated in (1) (here and in the following, relative clauses are highlighted by printing them in italics).

- (1) a. Peter hat ein Buch, *das ihm Maria empfohlen hat*,
Peter has a book which him Maria recommended has
gelesen.
read
'Peter read a book that Maria had recommended to him.'
- b. Peter hat ein Buch gelesen, *das ihm Maria empfohlen hat*.
Peter has a book read which him Maria recommended has
'Peter read a book that Maria had recommended to him.'

In (1-a), the relative clause appears in its canonical position adjacent to the head noun that it modifies. (1-b), in contrast, is an instance of relative clause extraposition (RCE): the relative clause has been extraposed behind the clause-final verb, with the consequence that head noun and relative clause are no longer adjacent to each other but separated by the clause-final verb.

Whereas RCE in German typically involves putting a relative clause behind the clause-final verb (the so-called *afterfield* 'Nachfeld'), RCE in English typically affects relative clauses modifying the subject, putting them after the verb into a clause-final position, as illustrated by example (2) from Francis and Michaelis (2016).

- (2) a. Some research *that refutes the existing theories with very clear and convincing new evidence* was conducted.
- b. Some research was conducted *that refutes the existing theories with very clear and convincing new evidence*.

RCE raises two major questions. The first one concerns the syntactic representation of sentences containing adjacent and extraposed relative clauses. Since this question is beyond the scope of the present article (see Baltin 2006 for an overview of various theoretical positions), I will simply follow Büring and Hartmann (1997) and assume that relative clauses are base-generated adjacent to their head noun and RCE is derived by moving the relative clause into clause-final position. The second major question is raised by the optionality of RCE: how do speakers decide whether to produce a relative clause in adjacent or extraposed position when producing a sentence containing a relative clause. This is the question that is in the focus of the present paper.

Corpus studies as well as experimental investigations show that the choice of realizing a relative clause in adjacent or extraposed position is subject to a multitude of factors (see Francis and Michaelis 2014 and Strunk 2014 for large lists of factors). Two kind of factors are of special importance: factors rooted in the ease of sentence processing and factors related to information structure. With regard to ease of sentence processing, research on both English, German, and other languages has shown that both extraposition distance and relative clause length affect the likelihood of RCE.

One way to understand such effects is in terms of dependency length. Several accounts of syntactic complexity during language production and comprehension have proposed that shorter dependencies are easier to process than longer dependencies (Gibson 2000, Hawkins 2004, Temperley 2007, Futrell et al. 2020), which can be captured in the slogan “Minimize dependencies!”.

Two different dependencies are crucially involved in RCE, as illustrated in (3): the dependency between the head noun and the relative pronoun and the dependency between the head noun and the clause-final verb.

- (3) a. Peter hat ein Buch das ihm Maria empfohlen hat gelesen
- b. Peter hat ein Buch gelesen das ihm Maria empfohlen hat
-

The dependency between head noun and relative pronoun is optimally short when head noun and relative clause are adjacent to each other, as shown in (3-a). This dependency gets longer when the relative clause is extraposed, as shown in (3-b). In (3-b), only a single word, namely the clause-final verb, intervenes between head noun and relative clause, and the dependency between head noun and relative pronoun is therefore still rather short. In other cases, however, relative clauses are extraposed over a much longer distance, as illus-

trated by the example in (4).

- (4) a. Peter hat ein Buch, *das ihm Maria empfohlen hat*, **mit großer Begeisterung gelesen**.
 Peter has a book which him Maria recommended has with great enthusiasm read
 ‘Peter read a book that Maria had recommended to him.’
- b. Peter hat ein Buch **mit großer Begeisterung gelesen**, *das ihm Maria empfohlen hat*.
 Peter has a book with great enthusiasm read which him Maria recommended has
 ‘Peter read a book that Maria had recommended to him.’

The second dependency crucially involved in RCE is the dependency between head noun and clause final verb. As shown in (3), this dependency is optimally short when the relative clause is extraposed whereas it is lengthened by a relative clause in adjacent position. How much it is lengthened depends on the length of the relative clause – the longer it is, the longer gets the distance between head noun and clause-final verb.

In sum, RCE exhibits a trade-off between two dependencies – minimizing the dependency between head-noun and relative pronoun favors relative clauses in adjacent position whereas minimizing the dependency between head-noun and clause-final verb favors relative clauses in extraposed position. Corpus studies as well as experimental investigations have shown that both dependencies affect the rate of extraposition, although not with equal weight. In both German and English, the major determinant of RCE is the dependency between head noun and relative clause (for German, see Hawkins 1994, Uszkoreit et al. 1998, Strunk 2014, Bader 2014; for English, see Francis 2010, Francis and Michaelis 2014, 2016). RCE is preferred if this dependency, and thus the extraposition distance, is short. With longer distances, relative clauses are preferred in adjacent position. The dependency between head and verb, and thus relative clause length, also affects the rate of RCE, but to a lesser degree.

The evidence concerning dependency length is rather similar for English and German; with regard to information structure, by and large the same seems to hold. At least in typical cases, RCE in English is acceptable with passive or presentative verbs but not with agentive verbs (see (5) from Culicover and Rochemont 1990) and with indefinite but not definite subjects (see (6) from Huck and Na 1990) (see Walker 2013, Weirick and Francis 2020 for experimental evidence).

- (5) a. A man arrived *who wasn't wearing any clothes*.
 b. ??A man screamed *who wasn't wearing any clothes*.

- (6) a. A guy just came in *that I met at Treno's yesterday*.
 b. ??The guy just came in *that I met at Treno's yesterday*.

As discussed in Francis and Michaelis (2016), the effects of focus and definiteness follow from an information-structural constraint on English RCE which requires that the subject is focal and/or the VP backgrounded for RCE to be fully acceptable.

For German, definiteness has been shown to have a strong effect on the rate of extraposition during language production – in the corpus study of Strunk (2014), the rate of extraposition was 66% for indefinite antecedent NPs but only 35% for definite antecedent NPs. However, in contrast to English, German does not seem to exhibit an acceptability difference depending on definiteness, so the translations of both sentences in (6) are fully grammatical in German, as shown in (7).

- (7) a. Soeben kam ein Kerl herein, *den ich gestern bei Treno's*
 just came a guy in who I yesterday at Treno's
kennengelernt habe.
 met have.
 b. Soeben kam der Kerl herein, *den ich gestern bei Treno's*
 just came a guy in who I yesterday at Treno's
kennengelernt habe.
 met have.

Not only definiteness affects extraposition rate in both English and German in parallel ways, but the same has been claimed for focus. Based on the results of a corpus study, Shannon (1992: 273) derives the following constraint on RCE in German: “With an extraposed relative clause, the antecedent (and/or the relative clause itself) contains the sentence focus”. In contrast to the later corpus study of Strunk (2014), the corpus study of Shannon (1992) is not a multivariate analysis, controlling for the effects of other variables that may be responsible for the purported focus constraint. For example, definiteness and focus effects are likely correlated to some degree because indefinite NPs are more often discourse-new and focal than definite NPs. On the other hand, the corpus study of Strunk (2014) does not include focus as a variable, so we don't know whether focus has an separate effect in addition to the large number of variables included in Strunk's multivariate analysis. Because neither the corpus data of Shannon (1992) nor those of Strunk (2014) provide the relevant data, I ran an experiment investigating whether the discourse status of a relative clause affects the speaker's decision of producing the relative clause in adjacent or extraposition position.

2 Experiment

In order to test whether the discourse status of a relative clause affects the decision to extrapose, an experiment using the procedure of constrained production (e.g., Ferreira 1994, Stallings and MacDonald 2011, Verhoeven 2014) was run. This procedure requires from participants to produce sentences using prespecified sets of words or phrases, as illustrated in (8) by an item from the current experiment. To make a well-formed sentence out of the five fragments in (8), at least some reordering is necessary because stringing the fragments together from left to right would not give a grammatical result. The two most probable linearizations of the fragments in (8) are the ones shown in (9-a) and (9-b).

(8) **Fragments for target sentence**

kann | helfen | Peter | dem Lehrer | der in Not geraten ist
 can | help | Peter | the teacher | who is in need

(9) **Target sentences for the fragments in (8)**

a. Adjacent RC:

Peter kann dem Lehrer, *der in Not geraten ist*, helfen.
 Peter can the teacher who in need run is help
 ‘Peter can help the teacher who is in need.’

b. Extraposed RC:

Peter kann dem Lehrer helfen, *der in Not geraten ist*.
 Peter can the teacher help who in need run is
 ‘Peter can help the teacher who is in need.’

In (9-a) and (9-b), subject and object as well as modal verb and main verb are ordered in the most common way for a German main clause: The subject precedes the object, the finite modal verb occupies the verb-second position, and the main verb occurs clause-finally. What differs between (9-a) and (9-b) is the position of the relative clause, which appears adjacent to its head noun in (9-a) and extraposed to the afterfield in (9-b).

The discourse status of the relative clause was manipulated by having a context preceding the sentence fragments. Two kinds of contexts were used, establishing the relative clause that was part of the fragments either as part of the topic or as part of the focus, as illustrated in (10).

(10) **Contexts**

a. *Topic context*

Peter hat einen Lehrer, *der in Not geraten ist*. Dieser Lehrer hatte stets ein offenes Ohr für seine Schüler.
 ‘Peter has a teacher who is in need. This teacher always had an open ear for his students’

b. *Focus context*

Peter hat schon vielen Leuten an seiner Schule helfen können.
 Ich habe auch schon eine Idee, wem Peter als nächstes helfen könnte.

‘Peter has been able to help many people at his school. I already have an idea who Peter could help next.’

As shown in (10), each context consisted of two sentences. In the *topic context* (10-a), the first sentence introduced one protagonist using a proper name (*Peter*) and a second protagonist using an indefinite NP (*einen Lehrer* ‘a teacher’) modified by a relative clause. In the second context sentence, a statement was made about the second protagonist, thereby establishing this protagonist as topic of this sentence. The target sentence mentioned both protagonists introduced before – the protagonist referred to by a proper name in the first sentence and the other protagonist that was referred to in both context sentences. Because only the latter was mentioned in the second context sentence, it is the topic in the target sentence according to prominent definitions of sentence topic (e.g., Reinhart 1981, Beaver 2004). The relative clause, which was always presented as a fragment of its own, was therefore a part of the topic phrase.

In the *focus context* (10-b), the first sentence contained the same proper name as the topic context as well as a plural NP referring to a set of human referents. The second sentence in the focus context consisted of a main clause followed by an embedded wh-question. The main clause always contained the first person pronoun *ich* ‘I’ as subject and a predicate selecting an indirect question as complement. The indirect question was a wh-question with the proper name introduced in the first sentence as subject. The verb of the wh-question was identical to the main verb in the target sentence and the wh-phrase was the object of this verb. The following target sentence that had to be produced from the five sentence fragments answered the wh-question, with the definite NP fragment and the relative clause fragment together corresponding to the wh-phrase. In this way, the relative clause of the target sentence was always part of the focus, as established by the wh-question of the second context sentence.

The NP whose discourse status was manipulated by presenting either a topic or focus context was always a definite NP, as in the example target sentence in (8). While being definite is typical for a discourse-given topic NP, a focus NP could as well be indefinite, especially when its referent is discourse new. The reason for including a definite NP fragment following both types of contexts was that extraposition from an indefinite NP has been found to be more likely than extraposition from a definite NP, as discussed above (see Strunk 2014, for German and Francis and Michaelis 2016, for English). Since this was found even without a preceding context, using definite NPs following topic contexts and indefinite NPs following focus contexts would create a confound making

it impossible to interpret a potential context effect in an unambiguous way.

2.1 Method

2.1.1 Participants

32 students from the Goethe University Frankfurt participated in the experiment for course credit. All participants were native speakers of German and naive with respect to the purpose of the experiment.

2.1.2 Materials

Focus context	Thomas schwärmt für den Sänger, der hier ein Konzert gibt. Dieser Sänger hat tatsächlich ein unglaubliches Talent. 'Thomas raves about the singer who is giving a concert here. This singer actually has incredible talent.'				
Topic context	Thomas hat leider bis jetzt noch keinem seiner Stars begegnen können. Ich ahne allerdings, wem er möglicherweise begegnen könnte. 'Unfortunately, Thomas hasn't been able to meet any of his stars yet. However, I have an idea who he might possibly meet.'				
Target fragments	kann can	begegnen meet	Thomas Thomas	dem Sänger the singer	der hier ein Konzert gibt who here a concert gives

Table 1: Example stimulus

Sixteen experimental items were constructed, with each item consisting of a context and a set of five fragments representing the target sentence to be produced (see (10)/(8) and Table 1). For each item, the context came in two versions according to the factor Context with the two levels "Topic" and "Focus". All contexts consisted of two sentences and were constructed as shown in (10). Topic contexts always introduced a referent modified by a relative clause. This referent as well as the modifying relative clause were taken up again in the target sentence. In focus contexts, the second sentence always ended with a wh-question. The referent modified by a relative clause in the target sentence corresponded to the wh-phrase in the second context sentence and was thus a focus.

In contrast to the context, the five fragments used to specify the target sentence did not vary within an item, that is, topic and focus context were always followed by the same fragments. For each experimental item, the target sentence was divided into five fragments, as illustrated in (8): modal verb, main

verb, proper name, definite NP, relative clause. The proper name contained in the fragments was already introduced in both the topic and the focus context. The definite NP and the relative clause were already introduced in the topic context but not in the focus context. All relative clauses consisted of five words.

The 16 experimental items were distributed across two lists according to a Latin square design. Each list contained exactly one version of each item and an equal number of items in each condition. Each experimental list was combined with 64 filler items for a total of 80 items. The filler items were from unrelated experiments investigating the order of subject and object. Like the experimental items, the filler items consisted of a context followed by a set of sentence fragments.

2.1.3 Procedure

The experiment used the method of constrained production that has been used before by, e.g., Ferreira (1994), Stallings and MacDonald (2011), and Verhoeven (2014). The five sentence fragments appeared on a computer screen in front of the participant, one below the other. The modal verb always appeared in the highest position, followed by the main verb. Next came the proper name intended as subject, followed by a definite masculine NP unambiguously marked for dative case. The relative clause always came last in the lowest position on the screen. Participants were asked to mentally form a sentence using all words seen on the screen. They were told that function words could be added in order to arrive at a complete sentence, but that no additional content words should be used. As soon as they had formed a complete sentence, they pressed a key on the computer keyboard and uttered the sentence they had formulated.

2.2 Scoring

All 512 sentences produced by the participants were digitally recorded for later scoring. In order to be included in the analysis, a sentence had to include a relative clause that could be unambiguously classified as being extraposed or not. This excluded sentences in which participants did not include the modal verb and used the main verb as finite verb instead, as for example in *Peter hilft dem Lehrer, der in Not geraten ist*. ('Peter is helping the teacher who is in need.') Superficially, this sentence contains a relative clause adjacent to its head noun. However, because the sentence lacks an overt verb in clause-final position, the position of the relative clause in the underlying syntactic structure cannot be determined – the relative sentence could be attached to the preceding NP or it could have been moved behind the empty verb position. Sentences of this

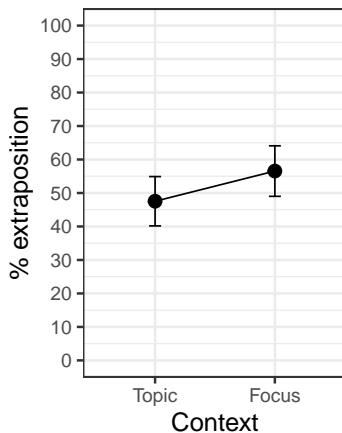


Figure 1: Percentages of extraposition depending on whether the relative clause was topic or focus given the preceding context

type were therefore excluded. In some cases, participants converted the relative clauses to another type of embedded clause (for example, an infinitive introduced by *um* ‘in order to’). Sentences where this had happened were also excluded from the analysis. Smaller deviations from the fragments presented for production, for example lexical substitutions, did not lead to exclusion because such deviations are of no relevance for the question under consideration. Overall, 40 sentences were excluded from the analysis, 19 with a preceding topic context and 21 with a preceding focus context. Thus, the factor Context did not have an effect on whether participants produced a sentence without a relative clause unambiguously in adjacent or extraposed position.

2.3 Results

All statistical analyses were conducted using the statistics software R (R Core Team 2022). For the inferential statistics, generalized mixed models were computed using the R package lme4 (Bates et al. 2015). The main factor was entered as a fixed effect into the models, using effect coding (0.5 vs. -0.5). In addition, random effects were included for items and subjects with maximal random slopes supported by the data, following the strategy proposed in Bates et al. (2015).

Figure 1 shows the percentages of sentences produced with extraposed relative clause depending on the preceding context. In a topic context, relative

clauses appeared extraposed in 47% of all cases. In a focus context, the rate of extraposition increased to a value of 56%. This resulted in a significant main effect of Context in a generalized mixed effect model with random intercepts for participants and items ($\hat{\beta} = 0.8062$, standard error = 0.2825, $z = 2.854$, $p < 0.01$).

3 Discussion

This paper has presented an experiment that investigated the role of information structure on relative clause extraposition in German. The experiment revealed mixed results. On the one hand, the results showed the expected effect of discourse status – the rate of extraposition was higher when the relative clause modified the focus than when it was the topic. Since the host NP was definite in both cases, it can be excluded that this just another instance of the often found definiteness effect on extraposition. On the other hand, with about 10% difference between extraposition from a topic and extraposition from a focus, the effect of discourse status was relatively small. In sum, while the results of the experiment confirm that the decision to extrapose is affected by information structure, it also shows that information structure has only a weak effect on this decision.

One reason for the weak effect of information structure may have to do with the short extraposition distance, which was just a single word, namely the clause-final infinite verb. Shannon (1992) explains the focus constraint on extraposition by noting that NPs in the focus are often discourse new whereas NPs in the background and topical NPs in particular are typically discourse given. For non-focal NPs, whose referent is already given in the context, the relative clause has an identificational function. To fulfill this function in an optimal way, the distance between antecedent NP and relative clause should be as short as possible. A relative clause modifying a focal NP, in contrast, presents additional information about the NP's referent but is not needed to identify the referent in the preceding context. Presenting the relative clause with some delay therefore does no harm in the case of discourse-new focal NPs. With an extraposition distance of just a single word, the delay was not severe, which may explain why the rate of extraposition was only moderately lower in the case of topical relative clauses than in the case of focal relative clauses.

Overall, relative clauses were produced about equally often in adjacent and extraposed position, that is, the overall rate of extraposition was about 50%. For extraposition, this is a relatively low value in comparison to extraposition rates in corpus data, which show about 90% extraposition when only the clause-final verb must be crossed (Bader 2014, Strunk 2014). The relatively low value of extraposition given the very short extraposition distance is

also surprising because sentences in which only the verb follows an adjacent relative clause have been claimed to be prosodically sub-optimal (so-called ‘prosodic monsters’, see Féry 2015). On the other hand, other experimental studies requiring the spoken production of relative clauses have found extraposition rates similar to the one found here (Bader 2014, Francis and Michaelis 2016). The reason for this discrepancy is an open question. It could be an artifact of how sentences are elicited in the laboratory. Alternatively, or in addition, it could indicate a difference between spoken and written language production. Assuming with Büring and Hartmann (1997) that relative clauses are base-generated adjacent to their antecedent NP in the middlefield, from where they can optionally be moved to a clause-final position, sentences with adjacent relative clauses are syntactically less complex than sentences with extraposed relative clauses. Because spoken language production is under tighter time constraints than written language production, speakers may more often stick to the underlying structure with the relative clause adjacent to its antecedent NP instead of performing the more costly movement operation that brings the sentence into a clause-final position. Further research is necessary to resolve these questions.

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