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The Acceptability of Extraposition of PPs out of NP in German

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1 Introduction

This paper presents two acceptability judgement experiments investigating PP extraposition in language production in German. The aim is to shed some light on two aspects of PP extraposition: the first question addressed is whether a PP that includes a relative clause (RC) is more acceptable in extraposed position than a PP that does not include an RC. This question does not only concern weight effects in (PP) extraposition, but also investigates the validity of different measures of weight. Secondly, this paper tests if there is a (soft) constraint for definiteness in PP extraposition in German, similar to the one previously found in English RC extraposition.

A constituent is extraposed when it appears to the right of the position in which it is expected (given its syntactic and semantic properties). The following example from Baltin (2006) shows a PP in adjacent position (1a) and in extraposed position (1b).

- (1) a. A review of Chomsky's book appeared. (Adjacent)
b. A review appeared of Chomsky's book. (Extraposed)

One of the factors that is considered to influence the motivation to extrapose is the heaviness of the constituent. Heavier constituents are assumed to be preferred at the end of utterances (Arnold et al., 2000; Behagel, 1930; Quirk et al., 1972). A number of corpus studies on RC extraposition (Bader, 2014; Francis, 2010; Strunk, 2014; Uszkoreit et al., 1998) have found that extraposition occurs more often when the RCs are longer than the intervening material. Studies that conducted production experiments on Heavy NP Shift (HNPS) (Stallings et al., 1998; Stallings & MacDonald, 2011) found that NPs were shifted more often when they were longer.

How to define 'heaviness' is still a matter of debate. Sometimes it means 'longer' as in the number of words in a constituent. Hawkins (1990, 1994) applies this definition of weight in his local complexity metric. In other definitions, 'heaviness' refers to 'complexity' of a constituent. Rickford et al. (1995), for example, define the weight of a constituent by the number of phrasal nodes. Wasow (1997) tested the predictive power of three different measurements of weight found in the literature (number of words, number of nodes, and number of phrasal nodes) in his corpus study on HNPS. He concluded that "counting words, nodes, or phrasal nodes all work well" (Wasow, 1997: 102).

2 Theoretical background

Since the number of phrasal nodes is higher in a PP that includes an RC, it is also supposed to be 'heavier' according to the definition of weight by Rickford et al. (1995). As heavier constituents

are preferably realized at the end of an utterance, sentences with PPs that include an RC should be rated higher than sentences with a ‘simple’ PP. The sentences in the experimental material in Experiment 1 are matched for length, measured in words. If number of words defines weight, the PP only and PP+RC conditions should receive the same ratings. If number of phrasal nodes defines weight, the heavier PP+RC sentences should be rated higher in sentences with extraposed PPs.

Furthermore, the predictions made by the *Early Immediate Constituents* proposal (Hawkins, 1990, 1994) and the *Dependency Locality Theory* (DLT) (Gibson, 2000) are tested. In the following, the predictions of both theories with regard to the test sentences are discussed.

2.1 Predictions made by Hawkins’ *Early Immediate Constituents* proposal

The basic assumption behind the *Early Immediate Constituents* (EIC) proposal originally proposed by Hawkins (1990, 1994) is that there is a preference for words and constituents within a sentence to appear in a sequence that will guarantee the fastest possible parsing of phrases and their immediate constituents (IC). The crucial point here is how fast the parser can recognize the last immediate constituent. Hawkins (1994: 57) illustrates this idea with an example of a sentence with Heavy NP Shift in English, shown in (2)

- (2) a. I [_{vp} gave [_{np} the valuable book that was extremely difficult to find] [_{pp} to
1 2 3 4 5 6 7 8 9 10 11
Mary]]
- b. I [_{vp} gave [_{pp} to Mary] [_{np} the valuable book that was extremely difficult to
1 2 3 4
find]]

Contrary to Rickford et al. (1995), Hawkins’ EIC measures the weight of a constituent in number of words rather than in number of phrasal nodes. While we should see a difference in acceptability of the experimental material if number of phrasal nodes is the deciding factor, the EIC makes no difference between PPs that include an RC and PPs that do not.

Hawkins (1990, 1994) developed a local complexity metric which was influenced by the original metric of syntactic complexity by Miller & Chomsky (1963), as well as further extensions of it by Frazier (1985). The theory employs a ratio of non-terminal to terminal nodes. The original idea was that “complexity is a function of the amount of structure that is associated with the terminal elements, or words, of a sentence” (Hawkins, 2004: 8). Thus, it is preferable to have a low ratio of structure to words, in order to minimize the processing complexity.

As illustrated in Table 1, the IC-to-word ratios for a sentence with an adjacent ‘PP only’ are the same as for a sentence with an adjacent PP including an RC. Likewise, the IC-to-word ratios for an extraposed ‘PP only’ are the same as for an extraposed PP that includes an RC.¹

Following the local complexity metric of the EIC, the number of ICs are divided by the number of words it takes until the last IC can be recognized. In the example sentence taken from Experiment 1, the VP consists of two ICs, namely the direct object NP (*eine Trauerfeier für einen jungen und sehr beliebten Politiker* / *eine Trauerfeier für einen Politiker, der sehr*

¹The IC-to-word ratios calculated and shown in Table 1 are for PPs of length 7 words. The full sentences in their adjacent versions are: ‘Gestern hat eine Trauerfeier für einen jungen und sehr beliebten Politiker stattgefunden.’ and ‘Gestern hat eine Trauerfeier für einen Politiker, der sehr beliebt war, stattgefunden.’

Table 1. IC-to-word ratios for a sample sentence from Experiment 1

Adjacent PP only / PP+RC											
...	eine	Tr.f.	für	einen	jungen	und	sehr	beliebten	P.	stattg.	IC/word
...	eine	Tr.f.	für	einen	P.	der	sehr	beliebt	war	stattg.	
VP	1	2	3	4	5	6	7	8	9	10	2/10 = 20 %
NP	1	2	3								3/3 = 100 %
Total IC-to-word ratio											5/13
Mean percentage											60 %
Extrapolated PP only / PP+RC											
...	eine	Tr.f.	stattg.	für	einen	jungen	und	sehr	beliebten	P.	
...	eine	Tr.f.	stattg.	für	einen	P.	der	sehr	beliebt	war	
VP	1	2	3								2/3 = 66.7 %
NP	1	2	3	4							3/4 = 75 %
Total IC-to-word ratio											5/7
Mean percentage											70.8 %

beliebt war ‘a funeral for a young and very popular politician / a funeral for a politician who was very popular’), and the verb *stattgefunden* ‘taken place’. The NP consists of three ICs, the indefinite determiner *eine* ‘a’, the noun *Trauerfeier* ‘funeral’, and the PP *für einen jungen und sehr beliebten Politiker / für einen Politiker, der sehr beliebt war* ‘for a young and very popular politician/ for a politician who was very popular’. The PP can be recognized at the point of parsing the preposition *für* ‘for’.

In the adjacent version, ten words have to be processed until both ICs of the VP can be recognized, resulting in a ratio of 2/10 (= 20 %) for the VP. The three ICs of the NP can be recognized after three words, making the ratio 3/3 (= 100 %). In the version with the extraposed PP, the two ICs of the VP can be processed after only three words, resulting in a ratio of 2/3 (= 66.7 %) for the VP. In order to process the three ICs of the NP, four words have to be processed since there is now one word intervening between the noun and the preposition. Compared to the adjacent sentence version, the ratio thus goes down to 3/4 (= 75 %). The structure to be preferred is the one with the maximal overall minimization of phrasal combination domains (PCDs). The mean PCDs of the sentence are 60 % in the adjacent version and 70.8 % in the extraposed version. Thus, the EIC predicts a preference of almost 11 % for the extraposed version.

For convenience, Table 2 shows the mean percentages of the efficiency of the test sentences in Experiment 1 as predicted by the EIC. The percentages differ slightly from those in the table above, as the different lengths of the PPs have been incorporated. In the experimental material, 1/3 of test items were of lengths six, seven and eight words each. The EIC predicts a difference of efficiency with regard to PP position. Extraposed PPs are predicted to be preferred by a rough 10 %. According to the EIC, it will not make any difference whether the PP includes an RC (an additional phrasal node) or not.

Table 2. Mean percentages of the IC-to-word ratios for Experiment 1

Constituent	Adjacent	Extrapolated
PP only	60.07 %	70.83 %
PP incl. RC	60.07 %	70.83 %

While Hawkins (1990) measured weight in number of words, Rickford et al. (1995) measured weight in number of phrasal nodes. In their study, they investigated the construction *as far as NP* and, amongst other factors, the influence of the weight of the NP on the possible omission

of the verbal coda of the construction, *goes/is concerned*. Their data came from a variety of sources, including natural language corpora, sociolinguistic interviews, TV and radio broadcasts, newspapers, students' exams and final papers. They identified three types of NPs within their data: 1. a simple NP, consisting of a noun with or without modifier, and with one phrasal node, 2. an NP with a phrasal conjunct or a PP, with three phrasal nodes, and 3. a sentential NP, with five phrasal nodes. The results showed that when the NP is relatively light (with one phrasal node), the absence of the verbal coda occurs rarely, while a heavy sentential NP occurs very often without the verb. The number of occurrences of medium-weight NPs (conjoined NPs and NPs with a PP, with three phrasal nodes) and a verb is somewhere between the other two. Rickford et al. (1995: 128) conclude that "syntactic complexity, measured in terms of the number of maximal projections, turned out to provide the single best approximation to the notion of grammatical weight."

In his corpus study on HNPS, dative alternation, and particle movement in English, Wasow (1997: 91) found that number of words, nodes, and phrasal nodes "are all extremely good predictors of constituent ordering in the three constructions examined." He also notes that it was impossible to determine which of the three makes the most accurate predictions as they are all interconnected. Long sentences tend to be more complex, with both a higher number of nodes and phrasal nodes.

Further support for the advantages of measuring weight in number of phrasal nodes, however, comes from a corpus study on weight effects in Russian by Kizach (2012).² He investigated the influence of weight on the ordering of postverbal PPs in Russian.³ His expectation was that the least complex PP will be placed first. He found this expectation confirmed in 88 % of the cases when he defined complexity by the number of phrasal nodes. When measuring complexity by the number of words, the expectation that the least complex PP comes first was confirmed in 82 % of the cases. Kizach (2012: 255) concludes that measuring complexity in number of phrasal nodes is "more precise."

2.2 Predictions made by Gibson's *Dependency Locality Theory*

The *Dependency Locality Theory* (DLT) by Gibson (2000) is a theory of linguistic complexity based on the notion of locality, in which complexity is measured by the distance between the dependent elements and the resulting use of resources that involve limitations of working memory.

Gibson identifies two important aspects of sentence comprehension for which computational resources are required. The first aspect concerns *storage cost* (SC), since the sentence structure built thus far has to be kept in memory. The second aspect takes into account the *structural integration*, in which the current word has to be integrated into the sentence structure thus far. One of the key ideas here is that *structural integration cost* (SIC) depends on the distance between two items in a dependency (e.g., a head noun and a PP).

Table 3 shows the total processing costs at each word of an example sentence of Experiment 1 with a PP that is seven words long. The energy units (EUs) associated with establishing a new discourse referent (DR) and structural integration (SIC) are given as well. The process-

²The corpus used was the Russian National Corpus (RNC).

³Apart from postverbal PPs, Kizach (2012) also examined the double object construction, adversity impersonals and the order of S, V and O in Russian. However, only for postverbal PPs did he compare measuring weight in number of phrasal nodes and number of words. Since number of phrasal words seemed to be more accurate for postverbal PPs, the other three constructions were examined with regard to number of phrasal nodes only.

ing costs at the verb *stattgefunden* ‘taken place’ are 2 EUs in the adjacent version and 1 EU in the extraposed version. At the preposition *für* ‘for’ the processing cost is 0 EU in the adjacent version and 1 EU in the extraposed version. Thus, there is hardly any difference between the two sentence versions. If anything, sentences in which the PP (only) is extraposed are slightly preferred over the version in which the PP (only) is in adjacent position.

Table 3. Discourse processing (DR) and structural integration (SIC) costs for an example sentence from Experiment 1, constituent type: PP only

Adjacent PP										
...	eine	Tr.f.	für	einen	jungen	und	sehr	beliebten	P.	stattg.
DR	0	1	0	0	0	0	0	0	1	1
SIC	0	0	0	0	0	0	0	0	0	1
Total	0	1	0	0	0	0	0	0	1	2
Extraposed PP										
...	eine	Tr.f.	stattg.	für	einen	jungen	und	sehr	beliebten	P.
DR	0	1	1	0	0	0	0	0	0	1
SIC	0	0	0	1	0	0	0	0	0	0
Total	0	1	1	1	0	0	0	0	0	1

The total processing costs for a test sentence of Experiment 1 which features a PP including an RC are shown in Table 4. In this version, the processing costs at the verb are 3 EUs in the adjacent version and 1 EU in the extraposed version. This is due to the fact that in addition to the noun *Politiker* ‘politician’ within the PP, the verb of the RC *war* ‘was’ is now also intervening. The processing cost at the preposition *für* is 0 EU in the adjacent version and 1 EU in the extraposed version. Thus, sentences in which the PP+RC is extraposed are slightly preferred over sentences in which the PP+RC is in adjacent position.

Table 4. Discourse processing (DR) and structural integration (SIC) costs for an example sentence from Experiment 1, constituent type: PP including an RC

Adjacent PP+RC										
...	eine	Tr.f.	für	einen	P.	der	sehr	beliebt	war	stattg.
DR	0	1	0	0	1	0	0	0	1	1
SIC	0	0	0	0	0	0	0	0	0	2
Total	0	1	0	0	1	0	0	0	1	3
Extraposed PP+RC										
...	eine	Tr.f.	stattg.	für	einen	P.	der	sehr	beliebt	war
DR	0	1	1	0	0	1	0	0	0	1
SIC	0	0	0	1	0	0	0	0	0	0
Total	0	1	1	1	0	1	0	0	0	1

The storage costs (SC) for an example set of sentences from Experiment 1 are given in Table 5. Storage cost is measured in memory units (MUs). The storage costs for the PP both with and without an RC are 1 MU higher in the adjacent version than in the extraposed version.

In summary, the EIC predicts a slightly better efficiency for sentences with extraposed PPs than for sentences with adjacent PPs, independently of the number of phrasal nodes within the PP. Crucially, the EIC does not make any difference between the ‘PP only’ and ‘PP+RC’ conditions. Likewise, the DLT predicts a slight preference for extraposed sentence versions, both for ‘PP only’ and ‘PP+RC’ conditions.

Table 5. Storage costs (SC) for an example set of sentences from Experiment 1

Adjacent PP										
...	eine	Tr.f.	für	einen	jungen	und	sehr	beliebten	P.	stattg.
SC	2	1	2	2	2	3	3	2	1	0
Extraposied PP										
...	eine	Tr.f.	stattg.	für	einen	jungen	und	sehr	beliebten	P.
SC	2	1	0	1	1	1	2	2	1	0
Adjacent PP+RC										
...	eine	Tr.f.	für	einen	P.	der	sehr	beliebt	war	stattg.
SC	2	1	2	2	1	3	3	2	1	0
Extraposied PP+RC										
...	eine	Tr.f.	stattg.	für	einen	P.	der	sehr	beliebt	war
SC	2	1	0	1	1	0	2	2	1	0

3 Empirical evidence on RC extraposition in German and English

While extraposition of PPs in German has not previously been investigated from a psycholinguistic perspective, there are a number of studies on the extraposition of RCs in German. In a corpus study on RC extraposition in German, Uszkoreit et al. (1998) found that the preferred distance of extraposition is 1-2 words, and that extraposition was more likely over purely verbal material than over any non-verbal material. Extraposition occurred more often when the relative clause was long (10-15 words), but extraposition distance had more influence than the length of the relative clause.

Bader (2014) conducted a corpus study on German RC extraposition. 2000 sentences with RCs in either adjacent or extraposed position were analysed. Similar to the findings of Uszkoreit et al. (1998), extraposition rates decreased when the extraposition distance increased. Extraposition was especially common over verbal material. With only verbal material intervening, extraposition took place in about 90 % of the cases.

Konieczny (2000) conducted an acceptability experiment as well as a self-paced reading task. He investigated the effect of end-weight in the processing of German relative clause extraposition. The results showed that ratings for extraposed RCs increased with the length of the RC, while they decreased in conditions in which the RC was in adjacent position. The interaction of *Length X Position* was statistically significant. There was also evidence for the influence of extraposition distance, with the highest ratings for extraposition over a short distance (one word). Overall, sentences in which the RC is in adjacent position are rated higher than those with extraposed RCs. Contrary to the expectations of the EIC, RCs that were extraposed over only one verb were not rated higher than their adjacent counterparts.

In the self-paced reading experiment, Konieczny (2000) found that reading times for the relative pronoun were slower for extraposed RCs, indicating higher processing costs for the integration of an extraposed RC with its head noun. Varying the extraposition distance, however, had no influence on reading times. According to the EIC, the prediction would be that integration becomes more difficult with growing extraposition distance, so the expectation would have been that reading times become slower the longer the distance. In the conditions with the RC in adjacent position, longer RCs did not result in longer reading times for the verb of the matrix clause. This finding was contrary to the expectations of locality-based accounts, such as the EIC or the DLT. Reading times for the matrix verb in sentences with adjacent RCs even tended to be shorter than in sentences with extraposed RCs. From a locality-based perspective, this finding is surprising, because in the extraposed condition, the matrix verb is closer to its complements, and

should therefore be integrated more easily and faster. Konieczny (2000) explains this finding by suggesting that readers can anticipate the phrase-final verb on the basis of the additional information provided by the adjacent RC. Furthermore, readers also have more time to narrow down possible candidates for the verb, therefore needing less time for accessing and processing the verb once it is eventually parsed.

Strunk (2014) conducted a corpus study on RC extraposition in German, using the Tübingen Treebank of Written German (TüBa-D/Z) (Telljohann et al., 2006). He fit a binary logistic regression model to the corpus data. In order to acquire a more complete overview of “which factors are required to account for the corpus data and which of them are most important” (Strunk, 2014: 97), he included 33 factors in the model. In a log-likelihood ratio test, 15 factors yielded at least a marginally significant result, among them *definiteness of the antecedent, length and complexity of the RC, and distance between antecedent and RC*.

While Strunk (2014) found a number of other factors that are important with respect to RC extraposition, the distance of extraposition and the length of the RC are “indeed the most important factors influencing the likelihood of extraposition” (Strunk, 2014: 105).

Another factor that is investigated in the current study is the influence of the definiteness of the NP out of which is extraposed. In English, it has been observed that extraposition out of NPs with a definite article is often less acceptable than extraposition out of NPs with an indefinite article, while both definite and indefinite NPs are fine as antecedents as long as their dependent constituents (PPs as well as RCs) are in adjacent position (Guéron, 1980).

In her study on RC extraposition in English, Walker (2013) conducted an acceptability judgement experiment using the method of magnitude estimation. She found that indefinite NPs are more acceptable as antecedents for extraposed RCs than definite NPs. She concludes that “this can be taken as an indication that extraposition from NPs with definite determiners [...] violates a soft constraint” (Walker, 2013: 164).

Experiment 1 tests if weight defined in number of phrasal nodes has an influence on the acceptability of extraposition. As mentioned above, ‘heavier’ constituents are preferred at the end of utterances. If the number of phrasal nodes is indeed an indicator of weight, a PP that includes an RC should be ‘heavier’ than a PP without an RC. Therefore, the ‘heavier’ PP+RC should be preferred at the end of the utterance. Experiment 1 thus tests sentences in which the inner structure of the PP differs between PP only vs. PP+RC, with both conditions matched in number of words.

Experiment 2 investigates if a (soft) constraint for definiteness can be found for PP extraposition in German.

4 The influence of the inner structure of the PP on acceptability

In the literature, different measures of weight of a constituent are proposed. Hawkins (1990) measures weight in terms of number of words, while Rickford et al. (1995) measure weight by the number of phrasal nodes.

A preliminary corpus survey found that about half of the extraposed PPs were followed by an RC.⁴ Following the definitions of weight mentioned above, an extraposed PP that includes an RC should be ‘heavier’ than a PP without an RC, since the number of phrasal nodes is higher.

⁴The corpus used was the deWac corpus (Baroni et al., 2009) with over 1 billion tokens, built by web crawling. Search queries were for main clauses as well as complement clauses that included a noun, verb, and preposition in exactly this sequence. In a sample of 1000 hits, 150 sentences with extraposed PPs out of NP were found.

If indeed heavier constituents are realized at the end of an utterance (Arnold et al., 2000; Quirk et al., 1972), the acceptability of an extraposed PP that includes an RC should be higher than that of an extraposed PP without one. Experiment 1 thus asks if the inner structure of the extraposed constituent (PP only vs. PP+RC) influences its acceptability. Since all of the corpus studies on RC extraposition mentioned above agree that extraposition is most likely over purely verbal material, and preferably over only one word, the intervening material in the test sentences of Experiment 1 consisted of one verb.

4.1 Method

4.1.1 Participants

Twenty-four students of the University of Frankfurt participated in the experiment. All were native speakers of German and naive with respect to the aims of the experiment. They received either course credits or were paid for participating in the experiment.

4.1.2 Materials

Twenty-four sentences were created, each in four conditions according to the factors *Position* (extraposed vs. adjacent) and *Inner Structure* (PP only vs. PP+RC). In half of the sentences, the PP was part of a subject NP; in the other half, the PP was part of a direct object NP. In adjacent conditions, the PP was adjacent to the NP and was followed by a verb; in extraposed conditions a verb intervened between NP and PP. The PP consisted either of a PP only, or a PP that included an RC. The meaning conveyed by the PP/PP+RC was the same in both versions. The ‘PP only’ and ‘PP+RC’ constituents of each item were matched in length, measured in words. Eight sentences each had a PP length of six, seven or eight words. The prepositions used were: *mit* ‘with’ (14×), *für* ‘for’ (6×), *von* ‘of’ (3×) and *zwischen* ‘between’ (1×).⁵ In all conditions, the intervening material consisted of one verb. Table 6 presents an example sentence in all four conditions.

From the experimental sentences, four stimulus lists were generated which contained an equal number of sentences within each condition but each sentence only in one of its four versions. The experimental sentences within these lists were randomized. The 24 stimulus sentences in each list were interspersed in lists of 56 filler sentences. There were 35 grammatical and 21 ungrammatical filler sentences. 30 of the 35 grammatical filler sentences were experimental items in a study about the agreement of hybrid nouns and relative pronouns in German.

4.1.3 Procedure

Four written questionnaires were produced on the basis of the four lists of experimental and filler sentences. Participants completed the questionnaires as part of a class session. They were given a questionnaire on which they indicated their native language, age, gender and the state in which they had grown up (e.g., Hessen). The task was explained on the questionnaire. They were told that they had to rate the acceptability of sentences on a scale from 1 (‘totally unacceptable’) to 7 (‘totally acceptable’). In order to clarify these ratings, it was explained that a sentence was ‘totally acceptable’ if they could not find any fault with it and ‘totally unacceptable’ if they could not imagine a sentence ever to occur in this form. They were also told to judge the sentences only by their intuition and not by what they may have been taught in school or elsewhere about ‘good’ or ‘bad’ German.⁶ The instruction did not contain any example sentences. Participants

⁵In a previous study, prepositions were distributed equally, however no effect for *preposition* was found, thus prepositions in this study were chosen regarding the naturalness of sentences they were used in.

⁶There are no prescriptive rules for extraposition in German. This instruction only served the purpose to ensure that participants followed their own intuitions with regard to their native language.

Table 6. A complete experimental stimulus from Experiment 1

PP only										
Condition 1: PP position: adjacent										
Gestern	hat	eine	Trauerfeier	für	einen	jungen	und	sehr	beliebten	
Yesterday	has	a	funeral	for	a	young	and	very	popular	
			service							
Politiker	stattgefunden.									
politician	taken									
	place									
Condition 2: PP position: extraposed										
Gestern	hat	eine	Trauerfeier	stattgefunden	für	einen	jungen	und	sehr	beliebten
Yesterday	has	a	funeral service	taken place	for	a	young	and	very	popular
Politiker.										
politician										
'Yesterday, a funeral service took place for a deceased politician.'										
PP + RC										
Condition 3: RC position: adjacent										
Gestern	hat	eine	Trauerfeier	für	einen	Politiker,	der	sehr	beliebt	war,
Yesterday	has	a	funeral service	for	a	politician	who	very	popular	was
			stattgefunden							
			taken							
			place							
Condition 4: RC position: extraposed										
Gestern	hat	eine	Trauerfeier	stattgefunden	für	einen	Politiker,	der	sehr	beliebt
Yesterday	has	a	funeral service	taken place	for	a	politician	who	very	popular
			war.							
			was							
'Yesterday, a funeral service took place for a politician who was very popular.'										

then proceeded to mark their ratings for the 80 sentences on the questionnaire. They needed about 15-20 minutes to complete the questionnaire.

4.2 Results

All of the data were analyzed using the R statistics software, Version 3.2.1 (R Core Team, 2015). All statistics were performed on the raw ratings of the data. To test for significant effects, the data were analyzed by means of linear mixed-effect modeling using the lme4 package (Bates et al., 2015). The experimental factors and all interactions between them were entered as fixed effects into the model. In addition, random effects were included for items and participants. In a first analysis, the factor of *Grammatical Function* (Subject vs. Object NPs) was included. There was no effect of *Grammatical Function*, so further analyses only included the factors *Position* and *Clause Type*.

Figure 1 shows the mean acceptability ratings obtained in Experiment 1. The results of the corresponding statistical analysis are shown in Table 7. There was a significant main effect for *Position*. There was no effect for *Clause Type* and no interaction between *Position* and *Clause Type*. Sentences with adjacent PPs received higher mean ratings than sentences with PPs in extraposed position (in sentences with 'PP only': 6.0 vs. 5.3; Tukey's test: t -ratio = 3.72, $p = 0.0035$, in sentences with 'PP+RC': 5.7 vs. 5.1; Tukey's test: t -ratio = 2.777, $p = 0.0406$). *Clause Type* did not have any significant effect on the acceptability of sentences (for sentences with adjacent PPs: 6.0 vs. 5.7; Tukey's test: t -ratio = 2.089, $p = 0.1740$, in sentences with extraposed PPs: 5.3 vs. 5.1; Tukey's test: t -ratio = 0.876, $p = 0.8174$).

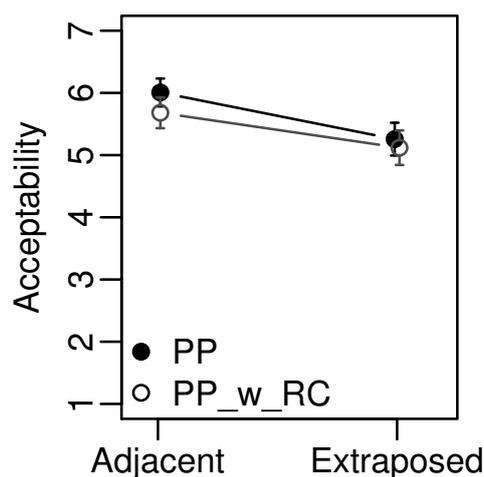


Figure 1. Mean acceptability ratings for Experiment 1. Error bars show 95 % confidence intervals

Table 7. Linear mixed model fitted by maximum likelihood estimation for Experiment 1

	Estimate	Std. Error	<i>t</i> value
(Intercept)	5.51628	0.20343	27.117
clausetype	0.11566	0.06171	1.874
position	0.32747	0.08630	3.795
clausetype:position	0.04753	0.06017	0.790

Formula:

$response \sim clausetype * position + (clausetype * position|subject) + (clausetype * position|sentence)$

4.3 Discussion

The main result of Experiment 1 is that sentences with adjacent PPs (both ‘PP only’ and ‘PP+RC’) were rated higher than sentences with extraposed PPs (both ‘PP only’ and ‘PP+RC’). This finding suggests that acceptability is not easily predicted by efficiency theories such as the EIC and DLT. The EIC had predicted a better efficiency of 10 % for extraposed sentences. The DLT had also predicted a slight preference for extraposed PP only and for extraposed PP+RC.

It has to be noted that the ratings for the extraposed versions were still rather good. The mean ratings were 5.257 for ‘PP only’ and 5.124 for ‘PP+RC’. In comparison, in an experiment on hybrid nouns in German, which supplied the filler sentences for Experiment 1, extraposed RCs were consistently rated lower than the extraposed PPs and PP+RCs of Experiment 1.

Clause Type did not have any significant effect on the acceptability of sentences. There was no difference between ratings for sentences with simple PPs and for sentences with PPs that included an RC. This is contrary to the findings of Rickford et al. (1995), which showed that it is the number of phrasal nodes contained within an NP that defines the weight of that NP. From this followed the expectation that ‘heavier’ constituents, meaning constituents with more phrasal nodes, will be preferred at the end of the utterance, and thus receive higher ratings than ‘lighter’ constituents in extraposed position. However, the findings are in line with the predictions of the EIC, which said that there would be no difference between PP only vs. PP+RC conditions. In the EIC, the number of phrasal nodes makes no difference, but the number of words that need to be parsed in order to recognize all of the immediate constituents (ICs) does.

As the PPs in the test sentences were matched for number of words, the finding that both

clause types were rated similarly suggests that number of words might be a better indicator of weight than number of phrasal nodes.

5 The influence of the definiteness of the NP on acceptability

In English it has been observed that extraposition out of NPs with a definite article is often less acceptable than extraposition out of NPs with an indefinite article. Both definite and indefinite NPs seem to be fine as antecedents as long as their dependent constituents (PPs as well as RCs) are in adjacent position (Guéron, 1980; Ziv & Cole, 1974), as illustrated in (3) and (4).

- (3) a. A man who is carrying a large package is here.
b. The man who is carrying a large package is here.

- (4) a. A man is here who is carrying a large package.
b. *The man is here who is carrying a large package.

(Rochement & Culicover, 1990)

Guéron (1980: 665) gives the example in (5) for PP extraposition. However, she notes that a ‘hard constraint’ that states that the “determiner of the NP source of PP Extraposition must be [–definite] [...] is incorrect.”

- (5) a. A book was published about linguistics.
b. *The book was published about linguistics.

She points out that there are definite NPs that allow extraposition, as in the example given in (6a) and that likewise there are indefinite NPs out of which extraposition is not acceptable, as shown in (6b).

- (6) a. The review has just appeared of Chomsky’s latest book.
b. *A certain book came out by Chomsky.

Walker (2013) points out that the acceptability of RC extraposition out of definite NPs is not clear. In some cases, extraposition out of definite NPs is judged as ungrammatical, as in the example given in (4b). In other cases, such as in the examples given by Ziv & Cole (1974: 772), shown in (7) and (8), extraposition out of definite NPs is judged as having “reduced acceptability.”

- (7) a. A guy that I met at Treno’s yesterday just came in.
b. The guy that I met at Treno’s yesterday just came in.

- (8) 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.

Sometimes, RC extraposition out of definite NPs is even judged as grammatical and fully acceptable, as in the example sentences by Kroch & Joshi (1986: 126), shown in (9). Rochement & Culicover (1990) suggest that the acceptability of extraposition out of NP depends on the discourse function of the NP. Similarly, Bolinger (1992) proposes that context and contrastivity play a role in making such sentences acceptable.

- (9) a. The people who were angry at the movie have come.
 b. The people have come who were angry at the movie.

In the past, judgements were mostly given by the researchers themselves, instead of a number of participants who are naive with regard to the subject under investigation (cf. Schütze, 1996; Wasow & Arnold, 2005). Therefore, Walker (2013) conducted an acceptability judgement experiment on RC extraposition in English using the method of thermometer judgements (Featherston, 2007). Apart from the influence of the definiteness status of the NP, she also tested the influence of the verb class that is used. According to the *predicate restriction*, the acceptability of RC extraposition decreases when the main verb of the sentence is not a verb of appearance. The last factor in her experimental design was *grammatical function* of the NP out of which was extraposed. Her findings support both the *predicate restriction* and the *definiteness restriction*. RC extraposition in English is less acceptable when the NP is definite and when the verb in the sentence is not a verb of appearance. With respect to the influence of the grammatical function, Walker shows that grammatical function of the NP out of which is extraposed only has an influence on the acceptability of RC extraposition when the verb used is not a verb of appearance. With regard to the definiteness constraint, her findings show that indefinite NPs are more acceptable as antecedents for extraposed RCs than definite NPs. She concludes that “this can be taken as an indication that extraposition from NPs with definite determiners [...] violates a soft constraint” (Walker, 2013: 164).

The term ‘soft constraint’ as it is used here was introduced by Keller (2000), who uses it to refer to constraints which lead to a mild unacceptability when violated, and which show context effects. Hard constraints, on the other hand, show no contextual variation and a violation of a hard constraint triggers serious unacceptability. Furthermore, the distinction between soft and hard constraints is supposed to be cross-linguistically stable.

Strunk (2014) found evidence for a soft constraint for definiteness in RC extraposition in German. In a corpus study, he found that extraposition from definite NPs occurred significantly less often than from indefinite NPs.

Experiment 2 investigates whether a similar (soft) constraint for definiteness can be found for PP extraposition in German. Furthermore, the influence of grammatical function of the NP is tested.

5.1 Method

5.1.1 Participants

Forty students of the University of Frankfurt participated in the experiment. All were native speakers of German and naive with respect to the aims of the experiment. They received either course credits or were paid for participating in the experiment.

5.1.2 Materials

Twenty-four sentences were created, each in four conditions according to the factors *Position* (extraposed vs. adjacent) and *Definiteness of the NP* (definite vs. indefinite). In half of the sentences, the PP was part of a subject NP; in the other half, the PP was part of a direct object NP. Three prepositions were used to construct the sentences: *mit* ‘with’ (12×), *von* ‘of’ (8×) and *für* ‘for’ (4×). In all conditions, the intervening material consisted of one verb. Table 8 presents an example sentence in all four conditions.

In conditions with an indefinite NP, not only did the NP out of which was extraposed have an indefinite article, but also the lexical NP within the PP was indefinite and had an overt indefinite

Table 8. A complete experimental stimulus from Experiment 2

Indefinite NP								
Condition 1: PP position: adjacent								
<i>Gestern</i>	<i>hat</i>	<i>ein</i>	<i>Mann</i>	<i>mit</i>	<i>einer</i>	<i>tiefen</i>	<i>Stimme</i>	<i>angerufen.</i>
Yesterday	has	a	man	with	a	deep	voice	called
Condition 2: PP position: extraposed								
<i>Gestern</i>	<i>hat</i>	<i>ein</i>	<i>Mann</i>	<i>angerufen</i>	<i>mit</i>	<i>einer</i>	<i>tiefen</i>	<i>Stimme.</i>
Yesterday	has	a	man	called	with	a	deep	voice
'Yesterday, a man with a deep voice called.'								
Definite NP								
Condition 3: PP position: adjacent								
<i>Gestern</i>	<i>hat</i>	<i>der</i>	<i>Mann</i>	<i>mit</i>	<i>der</i>	<i>tiefen</i>	<i>Stimme</i>	<i>angerufen.</i>
Yesterday	has	the	man	with	the	deep	voice	called
Condition 4: PP position: extraposed								
<i>Gestern</i>	<i>hat</i>	<i>der</i>	<i>Mann</i>	<i>angerufen</i>	<i>mit</i>	<i>der</i>	<i>tiefen</i>	<i>Stimme.</i>
Yesterday	has	the	man	called	with	the	deep	voice
'Yesterday, the man with the deep voice called.'								

article (Conditions 1 and 2). When the NP out of which was extraposed had a definite article, the lexical NP within the PP had an overt definite article as well. In adjacent conditions, the PP was adjacent to the NP and was followed by a verb; in extraposed conditions a verb intervened between NP and PP.

When the PP was part of a subject NP, either a temporal adverb, such as *gestern* 'yesterday', or a PP adverbial (i.e., *vor dem Hotel* 'in front of the hotel') was placed at the beginning of the sentence, followed by the auxiliary verb. When the PP was part of a direct object NP, the initial part of the sentences consisted of the subject and the auxiliary verb. All sentences were matrix clauses, there were no subordinate or embedded clauses.

From the experimental sentences, four stimulus lists were generated. Each experimental list contained only one version of each sentence, with an equal number of sentences occurring in each of the four experimental conditions. The experimental sentences within these lists were randomized. The 24 stimulus sentences in each list were interspersed in lists of 64 filler sentences. Of the filler sentences, 40 were grammatical and 24 were ungrammatical.

5.1.3 Procedure

The procedure was the same as in Experiment 1.

5.2 Predictions

Looking at some of the examples of RC extraposition in English, it seems clear that there are some differences between English and German. In the example sentence in (4b), repeated here as (10a) for convenience, an extraposed RC is judged as ungrammatical when extraposed out of a definite NP.

- (10) a. *The man is here who is carrying a large package.
- b. *Der Mann ist hier der ein großes Paket trägt.*
 The man is here who a large package carries
 ‘The man is here who is carrying a large package.’

The same sentence, translated to German in (10b), is commonly accepted as part of the grammar of Standard German. Definite NPs tend to represent old information, and the sentence in (10b) definitely suggests that *der Mann* ‘the man’ is known to the speaker and possibly also to the addressee, just as well as the fact that he is carrying a large package. This is true for both the extraposed as well as for the adjacent version of the sentence. It is unknown, however, if participants reading the sentence without any additional context would come up with the same interpretation.

If participants ‘create’ their own context to the test sentences, they might rate sentences with definite NPs just as high as sentences with indefinite NPs. However, the need for more context to make the definite version more felicitous might result in lower ratings for sentences with definite NPs. It might be more important for given NPs that all of the information is available at once to facilitate access to the old information. Thus definite NPs could receive higher ratings when their PPs are adjacent.

Another possibility is that definite subject NPs are analysed as the sentence topic by default, while indefinite subject NPs are analysed as being part of the focus. According to Shannon (1995: 115), extraposition only takes place when the entire NP is ‘the locus of the sentence focus.’ Even if the test sentences are analysed in this way, only half of the NPs are subjects, thus the grammatical function of the NP should show an effect in the statistical analysis.

Taking into account the findings of Walker’s (2013) acceptability study on RC extraposition in English, there might well exist a similar soft constraint for definiteness of the NP in German PP extraposition, thus the expectation is that extraposed PPs out of definite NPs should be less acceptable than extraposed PPs out of indefinite NPs or adjacent PPs out of definite NPs.

5.3 Results

The statistical analysis of Experiment 2 was the same as in Experiment 1. In a first analysis, the between-sentence factor of *Grammatical Function* (Subject vs. Object NPs) was included. There was no effect of *Grammatical Function*, so further analyses only included the factors *Position* and *Definiteness*.

Figure 2 shows the mean acceptability ratings obtained in Experiment 2. The results of the corresponding statistical analysis are shown in Table 9. The two main effects as well as the interaction between them were significant. Sentences with extraposed PPs received much lower mean ratings than sentences with PPs in adjacent position (in sentences with indefinite NPs: 4.3 vs. 6.5; Tukey’s test: t -ratio = 9.09, $p < .0001$, in sentences with definite NPs: 3.8 vs. 6.5; Tukey’s test: t -ratio = 11.18, $p < .0001$). Sentences with indefinite NPs were rated significantly higher than sentences with definite NPs when the PP was in extraposed position (4.3 vs. 3.8; Tukey’s test: t -ratio = 3.62, $p = 0.0041$). With an adjacent PP, there was no significant acceptability difference between sentences with indefinite NPs and sentences with definite NPs (6.52 vs. 6.45; Tukey’s test: t -ratio = 0.445, $p = 0.97$).

5.4 Discussion

The main result of Experiment 2 is that sentences with PPs in adjacent position were rated significantly higher than sentences with PPs in extraposed position. This finding mirrors the

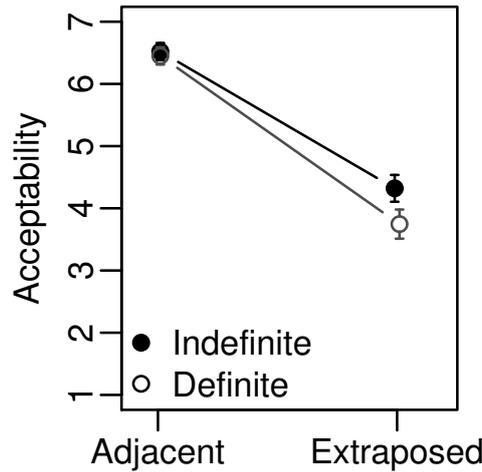


Figure 2. Mean acceptability ratings for Experiment 2. Error bars show 95 % confidence intervals

Table 9. Linear mixed model fitted by maximum likelihood estimation for Experiment 2

	Estimate	Std. Error	t value
(Intercept)	5.25938	0.14699	35.78
definiteness	0.16146	0.05958	2.71
position	1.22604	0.10876	11.27
definitness:position	-0.12604	0.05459	-2.31

Formula:

$response \sim definiteness*position+(definiteness*position|subject)+(definiteness*position|sentence)$

occurrence of adjacent and extraposed PPs in natural language corpora, and it is also in line with the findings of Uszkoreit et al. (1998) and Konieczny (2000), who both conducted acceptability judgement tasks on RC extraposition in German, and who found that adjacent RCs were generally rated higher than extraposed RCs. As in Experiment 1, the higher ratings for adjacent versions are contrary to the predictions of both the EIC and the DLT.

PP extraposition in German seems to be less acceptable when the antecedent NP is definite. Sentences with extraposed PPs out of definite NPs were rated significantly lower than sentences where the PP was extraposed out of an indefinite NP. The definiteness status of the NP played no role when the PP was adjacent to the NP. Ratings for sentences with adjacent PPs were the same for both indefinite and definite antecedent NPs.

Since sentences with extraposed PPs out of definite NPs were not rated as low as the ungrammatical sentences in the experiment (mean rating: 3.3), this finding suggests that there is indeed a soft constraint for definiteness in PP extraposition out of NP in German.

The findings are similar to those by Walker (2013), who found that RC extraposition in English is less accepted when the antecedent NP is definite than when the NP is indefinite. Likewise, sentences with RCs extraposed out of definite NPs were not rated as low as ungrammatical sentences, leading Walker to the conclusion that the definiteness restriction in RC extraposition in English is a soft constraint rather than a hard constraint.

In Experiment 2, there was no significant effect of grammatical function. Whether the PP was extraposed out of a subject NP or a direct object NP had no influence on the acceptability of the sentences. Walker (2013) found that sentences were rated significantly higher when the

RC was extraposed from an object rather than a subject NP.⁷ However, in the sentences used by Walker (2013), RCs were extraposed from different syntactic positions. Subject NPs were extraposed from SpecIP over a finite verb, while Object NPs were extraposed from VP over an infinite verb. Thus syntactic function and syntactic position were confounded and it is not clear which of the two was responsible for the difference in ratings between Subject and Object NPs. In contrast, the PPs in Experiment 2 were all extraposed from the same syntactic position (left to the infinite verb in the right bracket).

6 General discussion

The main finding of both experiments is that sentences with adjacent PPs are rated significantly higher than sentences with extraposed PPs. Even when the extraposition distance only consists of one verb, ratings for extraposition are still lower than for adjacent sentence versions. This finding is contrary to the findings of Bader (2014) and Uszkoreit et al. (1998) who both conducted corpus studies on RC extraposition in German.

The crucial difference between the findings of these corpus studies and my experiments seems to be the constituent type. In an elicited production experiment on PP and RC extraposition over intervening material consisting of only one verb, Weber (2018) found that there is a tendency for extraposed PPs to be reproduced in adjacent position. At the same time, adjacent RCs tend to be reproduced in extraposed position. Thus, the above mentioned corpus studies as well as the elicited production experiment all point in the same direction, that RC extraposition is actually preferred as long as the intervening material consists of one verb.

The extraposition of PPs seems to be fundamentally different from extraposition of RCs. The difference is most likely due to the presence of the relative pronoun, which repeats the semantic properties of the head noun, such as number- and gender-marking, and which is adjacent to the rest of the RC. Therefore, ambiguities as to the attachment site of the RC are avoided. When a PP is extraposed, the constituent is thoroughly separated from the head noun which carries all the semantic information. First of all, this information has to be kept available in working memory so that once the PP is parsed it can be integrated with its head noun. This extra load on working memory is most likely one of the reasons for the lower rating of extraposed PPs compared to extraposed RCs. Secondly, ambiguities with regard to the attachment site of the PP are much more likely to emerge and result in a higher integration cost.

Another interesting finding is that both the EIC and the DLT make wrong predictions for the acceptability of extraposed PPs. Both theories predict that extraposed PPs should be slightly preferred to the adjacent versions. The results, however, show that sentences with adjacent PPs consistently receive higher ratings than sentences with extraposed PPs.

First of all, the question arises whether theories that make predictions for online processing are a good indicator for offline measurements. It has been argued that structures that are more difficult to process are also less acceptable (cf. Gibson, 1998). This is even more the case when two different structures convey the same meaning, as is the case with adjacent and extraposed PPs. When one structure is less acceptable this should be due to the fact that processing of the structure was more difficult.

Thus, when we assume that processing affects acceptability, more or less difficult processing

⁷Walker (2013) found that grammatical function made no difference in acceptability when the verbs used were verbs of appearance. Only when other verbs were used did grammatical function show an effect. Since the verbs in Experiment 2 were not verbs of appearance, the results are compared to Walker's results about non-appearance verbs.

should be reflected in acceptability measures. So why is the predicted difference in processing not reflected in acceptability in the case of adjacent and extraposed PPs?

Konieczny (2000) suggests that alternative word-orders are considered in acceptability tasks. It is assumed that adjacent PPs are canonical, while extraposed PPs are non-canonical. This is reflected in the frequency of the structures in natural language corpora. Adjacent PPs are far more frequent than their extraposed counterparts. Thus it could be that the higher frequency of adjacent PPs in language input results in a higher acceptability.

Uszkoreit et al. (1998) and Francis (2010) found in corpus studies that RCs occur in extraposed position mostly if they are at least four times longer than the VP. This might suggest that extraposition becomes only more acceptable once the extraposed structure is much easier to process than the adjacent structure. It should be noted that extraposed RCs occur much more frequently in language corpora than extraposed PPs, so this might be even more the case for extraposed PPs. The PPs used in Experiment 2 were shorter than in Experiment 1 and thus might not have been long enough to result in a better rating. In general, PPs tend to be much shorter than RCs which might make it harder for PPs to be preferred in extraposed position.

6.1 Definition of weight: Number of words vs. number of phrasal nodes

Experiment 1 tested the acceptability of (extraposed) PPs with regard to their weight. Specifically, it was tested if weight defined as the number of phrasal nodes within a given constituent (here the PP) influences the acceptability of extraposition. The results showed that the number of phrasal nodes within the constituent had no effect on the acceptability of extraposition. Both PPs including an additional RC and PPs without an RC received the same ratings. The PPs were matched for length, measured in number of words. This suggests that number of words might be a better indicator of weight than number of phrasal nodes.

Further support for the influence of constituent weight measured in words comes from a comparison of Experiments 1 and 2. Sentences with extraposed PPs received considerably higher ratings in Experiment 1 than in Experiment 2 (mean: 5.7 vs. 4.0). The most likely explanation for this difference in acceptability is the length of the extraposed PP. While in Experiment 1 the PPs were 6-8 words in length, in Experiment 2 all PPs measured 4 words. In both experiments the intervening material consisted of one verb. Thus extraposition was more acceptable when the extraposed PP was long.

The studies by Rickford et al. (1995), Wasow (1997), and Kizach (2012) are corpus studies, and thus looked at the influence of weight from the speaker's perspective, while Experiment 1 was an acceptability judgement task. Placing longer and more complex phrases at the end of utterances has advantages for processing, as illustrated by Hawkins' EIC. Input can be parsed more efficiently when shorter/less complex constituents come first. However, as Wasow (1997) points out, weight effects play also an important role in language production. Producing longer and more complex phrases later in the sentence allows the speaker more time to plan. It is possible that, while weight plays a role in comprehension and production, the best way(s) to define weight might differ between the two.

6.2 A soft constraint for definiteness of the NP in PP extraposition in German

The results of Experiment 2 showed that there is indeed a soft constraint for definiteness in PP extraposition in German. This might have been expected, following the results of the study on RC extraposition in English by Walker (2013). However, while sentences have been judged

as ungrammatical when constituents were extraposed out of definite NPs in English (see the example in (5) given by Guéron (1980: 665)), the same cannot be said for German. There are no examples of extraposition out of definite NPs in German which have been judged as ungrammatical. There were also no previous data on the acceptability of extraposition out of definite NPs in German. Therefore, a soft constraint in PP extraposition in German was possible, but not expected due to any previous data on extraposition in German.

There were some differences between the sentences used in Experiment 2 and those used by Walker (2013). One of the obvious differences was that the experimental design of Experiment 2 did not include *verb class* as a factor and none of the verbs used were verbs of appearance. More importantly, the sentences in Experiment 2 always included another article as part of the PP, with the same definiteness status as that of the antecedent NP. In RC extraposition (both in English and in German), the antecedent NP can be definite and the RC can include an indefinite article, and the sentence will still be grammatical, as shown in (11), taken from Walker (2013: 156):

(11) The girl fainted who was hugging a doll.

In PP extraposition, sentences can easily become implausible if the definiteness status of the antecedent NP and the NP within the PP do not agree, as shown in (12). The implausibility of these sentences does not depend on the position of the PP. The sentence shown in (12a) is implausible, no matter if the PP is in adjacent or extraposed position.

- (12) a. **Gestern hat ein Mann mit der tiefen Stimme angerufen.*
 Yesterday has a man with the deep voice called
 ‘Yesterday, a man with the deep voice called.’
 b.??*Gestern hat der Mann mit einer tiefen Stimme angerufen.*
 Yesterday has the man with a deep voice called
 ‘Yesterday, the man with a deep voice called.’

The only way in which (12b) could possibly be judged as acceptable is with a reading that suggests that everyone knows ‘the man’ who is being talked about, and unlike all the other times when he called, this time he used a deep voice. In this reading, however, the PP would no longer be modifying the NP. This kind of context is not present in an acceptability task in which participants receive all of the sentences as stand-alone sentences as part of a questionnaire. Therefore, in Experiment 2, the definiteness status of the antecedent NP was always in agreement with the definiteness status of the NP within the PP.

However, the issue of plausibility and agreement in definiteness status is not as straightforward. Context and discourse status play an important role in making sentences acceptable. While the example sentence in (12a) is implausible and, therefore most likely unacceptable, the sentences in (13) are acceptable, within a certain context.

- (13) a. *Gestern hat eine Trauerfeier für den verstorbenen Politiker stattgefunden.*
 Yesterday has a funeral service for the late politician taken place
 ‘Yesterday, a funeral service for the late politician took place.’
 b. *Gestern hat die Trauerfeier für einen verstorbenen Politiker stattgefunden.*
 Yesterday has the funeral service for a late politician taken place
 ‘Yesterday, the funeral service for a late politician took place.’

The sentence in (13a) is perfectly fine, as long as *der verstorbene Politiker* ‘the late politician’ refers to an antecedent that was mentioned in the prior discourse. Without a felicitous context,

the sentence is not as good, but probably still acceptable. If we compare (13a) to the sentence *Gestern hat eine Trauerfeier für den Mann stattgefunden* ‘Yesterday, a funeral service took place for the man’, the latter seems less acceptable and definitely not plausible. In this case, it seems that semantic reasons play a role as well. A politician is a public figure, much more likely to be known, or to be expected to be known, than an unidentified man.

Definite NPs do not have to refer back to a previously mentioned discourse referent. They can also appear in isolation, or refer to entities that have not been previously introduced by another NP (Fraurud, 1990). Hawkins (1978) identifies a sub-form of definite NP, which does not refer back to an entity mentioned in prior discourse, and which does not present shared knowledge of the hearer and speaker. Hawkins calls these cases *definite NPs with explanatory modifiers*. According to this theory, definite NPs can occur as first-mention NPs, as long as they are modified by “referent-establishing relative clauses” (Hawkins, 1978: 131).⁸

(14) What’s wrong with Bill?

- a. – Oh, the woman he went out with last night was nasty to him.
- b. *– The woman who was from the South was nasty to him.

The sentence in (14a) is fine, because the relative that modifies the NP establishes the referent within the discourse. Hawkins (1978: 131f) proposes that it can be seen as a “collapsed version” of the sentence *Oh, he went out with a woman last night, and she/the woman was nasty to him*. The sentence in (14b), however, can only function anaphorically. According to Hawkins (1978: 134), referent-establishing RCs “must relate the new, definite referent either to some previously known object, or to participants in the talk-exchange, or to objects in the immediate situation.”

Following Hawkins’ definition, the PPs used in the test sentences in Experiment 2 do not qualify as ‘referent-establishing’. It is possible that some sentences, like the one in (13b), might benefit from an explanatory element in the modifying PP (such as *für einen verstorbenen Politiker* ‘for a late politician’.) But even if that was the case, it would not explain why definite NPs are just as acceptable as indefinite NPs in sentences with adjacent PPs, while definite NPs are not as acceptable as indefinite NPs in sentences with extraposed PPs.

If participants created their own felicitous context to make sentences more acceptable, why would they do this more often for adjacent PPs than extraposed PPs? If some of the PPs were similar enough to Hawkins’ referent-establishing explanatory modifiers, why did the explanatory element work better for adjacent PPs than extraposed PPs? Maybe the explanatory element of the modifier works better when the modifier is in adjacent position, because the additional information about the NP is processed without interruption. In sentences with extraposed PPs, the definite NP stands alone and without further information, at least shortly. Thus, the extraposed PP (which includes another definite NP) would serve not so much as an explanatory element, but rather as a focused constituent, which requires prior knowledge of the definite entity within it to make it sound completely natural and acceptable.

A possible reason for the soft constraint could be that readings for the test sentences were somewhat ambiguous as to which phrase is modified by the PP. As noted by an anonymous reviewer, in a sentence like *Gestern hat ein Mann angerufen mit einer tiefen Stimme* ‘Yesterday a man called with a deep voice’ the PP could also modify the VP instead of the noun. Such a reading might result in better ratings for the indefinite version. In the definite version of the

⁸Hawkins (1978) speaks of relative clauses, it is not clear if other modifying constituents, such as PPs, would work in this theory as well.

sentence, *Gestern hat der Mann angerufen mit der tiefen Stimme* ‘Yesterday the man called with the deep voice’ a reading that has the PP modify the VP is less likely. However, this kind of ambiguity seldom occurred in the test sentences. Another example of a test sentence, in which no ambiguity occurs is shown in (15):

- (15) a. *Ein Besucher hat die Vase beschädigt von dem berühmten Künstler*
 A visitor has the vase damaged of the famous artist
 ‘A visitor has damaged the vase of the famous artist.’

The finding of a soft constraint may also be due to influences of information structural effects. Shannon (1995) concludes that extraposition out of NP only takes place when the sentence focus is located on the head of the NP and its complement. However, if the NP of the definite versions of the test sentences is the topic of the sentence by default, and therefore not the sentence focus, this might explain the lower ratings.

7 Summary

Compared to RCs, PPs seem to be less acceptable in extraposed position. RCs are most likely easier to extrapose, because the relative pronoun repeats the properties of the head noun out of which is extraposed, and thus the integration of RCs over intervening material causes less memory load than the integration of PPs. The number of phrasal nodes does not play a role with regard to the weight of the constituent. There exists a soft constraint of definiteness for extraposed PPs. This constraint might be due to information structural influences.

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Appendix A: Stimuli Experiment 1

- (1) a. *Vor der Tür hat eine weiße Katze mit einem buschigen schwarz gestreiften Schwanz gelegen.*
In front of the door has a white cat with a bushy black striped tail lain
- b. *Vor der Tür hat eine weiße Katze gelegen mit einem buschigen schwarz gestreiften Schwanz.*
In front of the door has a white cat lain with a bushy black striped tail
'In front of the door lay a white cat with a bushy black-striped tail.'
- c. *Vor der Tür hat eine weiße Katze mit einem Schwanz, der gestreift war, gelegen.*
In front of the door has a white cat with a tail that striped was lain
- d. *Vor der Tür hat eine weiße Katze gelegen mit einem Schwanz, der gestreift war.*
In front of the door has a white cat lain with a tail that striped was
'In front of the door lay a white cat with a tail that was striped.'
- (2) a. *Heute Morgen hat eine Familie mit einem plötzlich krank gewordenen Kind abgesagt.*
Today morning has a family with a suddenly ill become child cancelled
- b. *Heute Morgen hat eine Familie abgesagt mit einem plötzlich krank gewordenen Kind.*
Today morning has a family cancelled with a suddenly ill become child
'This morning a family with a child that has suddenly become ill cancelled (their stay).'
- c. *Heute Morgen hat eine Familie mit einem Kind, das krank ist, abgesagt.*
Today morning has a family with a child that ill is cancelled
- d. *Heute Morgen hat eine Familie abgesagt mit einem Kind, das krank ist.*
Today morning has a family cancelled with a child that ill is
'This morning a family with a child that is ill cancelled (their stay).'
- (3) a. *Bei dem Sturm ist ein Baum mit einem innen völlig hohlen Stamm umgefallen.*
During the storm is a tree with a inside completely hollow trunk fell
- b. *Bei dem Sturm ist ein Baum umgefallen mit einem innen völlig hohlen Stamm.*
During the storm is a tree fell with a inside completely hollow trunk
'During the storm a tree with a completely hollow trunk on the inside fell.'
- c. *Bei dem Sturm ist ein Baum mit einem Stamm, der hohl war, umgefallen.*
During the storm is a tree with a trunk that hollow was fell
- d. *Bei dem Sturm ist ein Baum umgefallen mit einem Stamm, der hohl war.*
During the storm is a tree fell with a trunk that hollow was
'During the storm a tree with a trunk which was hollow fell.'
- (4) a. *Gestern hat eine Frau mit einer extrem heiser klingenden Stimme angerufen.*
Yesterday has a woman with a extreme hoarse sounding voice called
- b. *Gestern hat eine Frau angerufen mit einer extrem heiser klingenden Stimme.*
Yesterday has a woman called with a extreme hoarse sounding voice
'Yesterday a woman with an extremely hoarse sounding voice called.'
- c. *Gestern hat eine Frau mit einer Stimme, die heiser klang, angerufen.*
Yesterday has a woman with a voice that hoarse sounded called
- d. *Gestern hat eine Frau angerufen mit einer Stimme, die heiser klang.*
Yesterday has a woman called with a voice that hoarse sounded
'Yesterday a woman with a voice that sounded hoarse called.'
- (5) a. *Heute wurde eine neue Schule für besonders begabte Kinder und Jugendliche eröffnet.*
Today was a new school for especially talented children and youths opened
- b. *Heute wurde eine neue Schule eröffnet für besonders begabte Kinder und Jugendliche.*
Today was a new school opened for especially talented children and youths
'Today a new school opened for especially talented children and youths.'
- c. *Heute wurde eine neue Schule für Kinder, die besonders begabt sind, eröffnet.*
Today was a new school for children who especially talented are opened
- d. *Heute wurde eine neue Schule eröffnet für Kinder, die besonders begabt sind.*
Today was a new school opened for children who especially talented are
'Today a new school opened for children who are especially talented.'
- (6) a. *Letzte Nacht ist eine Bibliothek mit wertvollen Büchern aus der Antike abgebrannt.*
Last night is a library with valuable books from the antiquity burned down
- b. *Letzte Nacht ist eine Bibliothek abgebrannt mit wertvollen Büchern aus der Antike.*
Last night is a library burned down with valuable books from the antiquity
'Last night, a library with valuable books of ancient times burned down.'
- c. *Letzte Nacht ist eine Bibliothek mit Büchern, die unschätzbar wertvoll waren, abgebrannt.*
Last night is a library with books that inestimably valuable was burned down
- d. *Letzte Nacht ist eine Bibliothek abgebrannt mit Büchern, die unschätzbar wertvoll waren.*
Last night is a library burned down with books that inestimably valuable was
'Last night, a library with books that were inestimably valuable burned down.'

- (7) a. *Das Rote Kreuz hat eine Beratungsstelle für an chronischen Krankheiten leidende Menschen eingerichtet.*
The Red Cross has a outreach clinic for from chronic diseases suffering people set up
- b. *Das Rote Kreuz hat eine Beratungsstelle eingerichtet für an chronischen Krankheiten leidende Menschen.*
The Red Cross has a outreach clinic set up for from chronic diseases suffering people
'The Red Cross has set up an outreach clinic for people suffering from chronic diseases.'
- c. *Das Rote Kreuz hat eine Beratungsstelle für Menschen, die chronische Krankheiten haben, eingerichtet.*
The Red Cross has a outreach clinic for people who chronic diseases have set up
- d. *Das Rote Kreuz hat eine Beratungsstelle eingerichtet für Menschen, die chronische Krankheiten haben.*
The Red Cross has a outreach clinic set up for people who chronic diseases have
'The Red Cross has set up an outreach clinic for people who suffer from chronic diseases.'
- (8) a. *Ein Arzt hat einen Mann mit einer bisher völlig unbekannt Krankheit untersucht.*
A doctor has a man with a hitherto completely unknown disease examined
- b. *Ein Arzt hat einen Mann untersucht mit einer bisher völlig unbekannt Krankheit.*
A doctor has a man examined with a hitherto completely unknown disease
'A doctor has examined a man with a hitherto completely unknown disease.'
- c. *Ein Arzt hat einen Mann mit einer Krankheit, die unbekannt ist, untersucht.*
A doctor has a man with a disease that unknown is examined
- d. *Ein Arzt hat einen Mann untersucht mit einer Krankheit, die unbekannt ist.*
A doctor has a man examined with a disease that unknown is
'A doctor has examined a man with a disease that is unknown.'
- (9) a. *In der Notaufnahme hat ein Mann mit einem hoch ansteckenden und gefährlichen Tropenvirus gelegen.*
In the emergency room has a man with a highly contagious and dangerous tropical virus lain
- b. *In der Notaufnahme hat ein Mann gelegen mit einem hoch ansteckenden und gefährlichen Tropenvirus.*
In the emergency room has a man lain with a highly contagious and dangerous tropical virus
'In the emergency room, a man with a highly contagious and dangerous tropical virus lay.'
- c. *In der Notaufnahme hat ein Mann mit einem Tropenvirus, der hoch ansteckend ist, gelegen.*
In the emergency room has a man with a tropical virus that highly contagious is lain
- d. *In der Notaufnahme hat ein Mann gelegen mit einem Tropenvirus, der hoch ansteckend ist.*
In the emergency room has a man lain with a tropical virus that highly contagious is
'In the emergency room, a man with a tropical virus that is highly contagious lay.'
- (10) a. *Gestern hat ein Schwimmbad mit einem Turm von zwanzig Metern Höhe aufgemacht.*
Yesterday has a bath with a tower of twenty metres height opened
- b. *Gestern hat ein Schwimmbad aufgemacht mit einem Turm von zwanzig Metern Höhe.*
Yesterday has a bath opened with a tower of twenty metres height
'Yesterday, a bath with a tower of 20 metres height opened.'
- c. *Gestern hat ein Schwimmbad mit einem Turm, der zwanzig Meter zählt, aufgemacht.*
Yesterday has a bath with a tower that twenty metres measures opened
- d. *Gestern hat ein Schwimmbad aufgemacht mit einem Turm, der zwanzig Meter zählt.*
Yesterday has a bath opened with a tower that twenty metres measures
'Yesterday, a bath with a tower that measures twenty metres opened.'
- (11) a. *Gestern hat eine Trauerfeier für einen jungen und sehr beliebten Politiker stattgefunden.*
Yesterday has a funeral service for a young and very popular politician taken place
- b. *Gestern hat eine Trauerfeier stattgefunden für einen jungen und sehr beliebten Politiker.*
Yesterday has a funeral service taken place for a young and very popular politician
'Yesterday a funeral service took place for a young and very popular politician.'
- c. *Gestern hat eine Trauerfeier für einen Politiker, der sehr beliebt war, stattgefunden.*
Yesterday has a funeral service for a politician who very popular was taken place
- d. *Gestern hat eine Trauerfeier stattgefunden für einen Politiker, der sehr beliebt war.*
Yesterday has a funeral service taken place for a politician who very popular was
'Yesterday a funeral service took place for a politician who was very popular.'
- (12) a. *Gestern ist ein Kirchturm mit einer über drei Tonnen wiegenden Glocke eingestürzt.*
Yesterday is a church spire with a over three tonnes weighing bell collapsed
- b. *Gestern ist ein Kirchturm eingestürzt mit einer über drei Tonnen wiegenden Glocke.*
Yesterday is a church spire collapsed with a over three tonnes weighing bell
'Yesterday a church spire collapsed with a bell that was weighing over three tonnes.'
- c. *Gestern ist ein Kirchturm mit einer Glocke, die drei Tonnen wiegt, eingestürzt.*
Yesterday is a church spire with a bell that three tonnes weighs collapsed
- d. *Gestern ist ein Kirchturm eingestürzt mit einer Glocke, die drei Tonnen wiegt.*
Yesterday is a church spire collapsed with a bell that three tonnes weighs
'Yesterday a church spire collapsed with a bell that weighed three tonnes.'

- (13) a. *Auf dem Speicher hat eine Kiste mit so gut wie nie benutzten Spielsachen gestanden.*
In the attic has a box with as good as never used toys stood
- b. *Auf dem Speicher hat eine Kiste gestanden mit so gut wie nie benutzten Spielsachen.*
In the attic has a box stood with as good as never used toys
'In the attic a box stood with toys that were as good as new.'
- c. *Auf dem Speicher hat eine Kiste mit Spielsachen, die nie benutzt worden sind, gestanden.*
In the attic has a box with toys that never used been were stood
- d. *Auf dem Speicher hat eine Kiste gestanden mit Spielsachen, die nie benutzt worden sind.*
In the attic has a box stood with toys that never used been were
'In the attic a box stood with toys that had never been used.'
- (14) a. *Ein Freund hat ein Geschenk für seine in Australien lebende ältere Schwester gekauft.*
A friend has a present for his in Australia living older sister bought
- b. *Ein Freund hat ein Geschenk gekauft für seine in Australien lebende ältere Schwester.*
A friend has a present bought for his in Australia living older sister
'A friend has bought a present for his older sister who is living in Australia.'
- c. *Ein Freund hat ein Geschenk für seine Schwester, die in Australien lebt, gekauft.*
A friend has a present for his sister who in Australia lives bought
- d. *Ein Freund hat ein Geschenk gekauft für seine Schwester, die in Australien lebt.*
A friend has a present bought for his sister who in Australia lives
'A friend has bought a present for his sister who lives in Australia.'
- (15) a. *Juwelendiebe haben einen Tresor mit dem angeblich sichersten Schloss der Welt aufgebrochen.*
Jewel thieves have a safe with the allegedly safest lock of the world broken open
- b. *Juwelendiebe haben einen Tresor aufgebrochen mit dem angeblich sichersten Schloss der Welt.*
Jewel thieves have a safe broken open with the allegedly safest lock of the world
'Jewel thieves broke a safe with the allegedly safest lock in the world.'
- c. *Juwelendiebe haben einen Tresor mit einem Schloss, das angeblich einbruchsicher ist, aufgebrochen.*
Jewel thieves have a safe with a lock that allegedly burglarproof is broken open
- d. *Juwelendiebe haben einen Tresor aufgebrochen mit einem Schloss, das angeblich einbruchsicher ist.*
Jewel thieves have a safe broken open with a lock that allegedly burglarproof is
'Jewel thieves broke a safe with a lock that allegedly is burglarproof.'
- (16) a. *Ein Schauspieler hat einen Vertrag für einen im alten Ägypten spielenden Abenteuerfilm unterschrieben.*
A actor has a contract for a in the old Egypt playing adventure film signed
- b. *Ein Schauspieler hat einen Vertrag unterschrieben für einen im alten Ägypten spielenden Abenteuerfilm.*
A actor has a contract signed for a in the old Egypt playing adventure film
'An actor has signed a contract for an adventure film set in ancient Egypt.'
- c. *Ein Schauspieler hat einen Vertrag für einen Abenteuerfilm, der in Ägypten spielt, unterschrieben.*
A actor has a contract for a adventure film that in Egypt plays signed
- d. *Ein Schauspieler hat einen Vertrag unterschrieben für einen Abenteuerfilm, der in Ägypten spielt.*
A actor has a contract signed for a adventure film that in Egypt plays
'An actor has signed a contract for an adventure film that is set in ancient Egypt.'
- (17) a. *Im Museum hat eine Ausstellung mit selten zu sehenden Exponaten aus dem Orient eröffnet.*
In the museum has a exhibition with rare to see exhibits from the orient opened
- b. *Im Museum hat eine Ausstellung eröffnet mit selten zu sehenden Exponaten aus dem Orient.*
In the museum has a exhibition opened with rare to see exhibits from the orient
'At the museum an exhibition with rarely seen exhibits from the Orient has opened.'
- c. *Im Museum hat eine Ausstellung mit Exponaten, die man selten zu sehen bekommt, eröffnet.*
In the museum has a exhibition with exhibits that one rarely to see gets opened
- d. *Im Museum hat eine Ausstellung eröffnet mit Exponaten, die man selten zu sehen bekommt.*
In the museum has a exhibition opened with exhibits that one rarely to see gets
'At the museum an exhibition with exhibits that one rarely gets to see has opened.'
- (18) a. *Eine Bibliothekarin hat ein Buch von einem kürzlich verstorbenen Schriftsteller aus der Schweiz vorgelesen.*
A librarian has a book of a recently deceased author from the Switzerland read
- b. *Eine Bibliothekarin hat ein Buch vorgelesen von einem kürzlich verstorbenen Schriftsteller aus der Schweiz.*
A librarian has a book read of a recently deceased author from the Switzerland
'A librarian has read (out loud) a book of a recently deceased author from Switzerland.'
- c. *Eine Bibliothekarin hat ein Buch von einem Schriftsteller, der vor kurzem gestorben ist, vorgelesen.*
A librarian has a book of a author who recently died is read
- d. *Eine Bibliothekarin hat ein Buch vorgelesen von einem Schriftsteller, der vor kurzem gestorben ist.*
A librarian has a book read of a author who recently died is
'A librarian has read (out loud) a book of an author who passed away recently.'

- (19) a. *Die Polizei hat in einen Streit zwischen zwei stark betrunkenen und sich prügelnden Fussballfans eingegriffen.*
The police has in a quarrel between two heavily intoxicated and Pro.refl fighting football fans intervened
- b. *Die Polizei hat in einen Streit eingegriffen zwischen zwei stark betrunkenen und sich prügelnden Fussballfans.*
The police has in a quarrel intervened between two heavily intoxicated and Pro.refl fighting football fans
'The police intervened in a fight between two heavily intoxicated football fans.'
- c. *Die Polizei hat in einen Streit zwischen zwei Fussballfans, die beide stark betrunken waren, eingegriffen.*
The police has in a quarrel between two football fans who both heavily intoxicated were intervened
- d. *Die Polizei hat in einen Streit eingegriffen zwischen zwei Fussballfans, die beide stark betrunken waren.*
The police has in a quarrel intervened between two football fans who both heavily intoxicated were
'The police intervened in a fight between two football fans, who were both heavily intoxicated.'
- (20) a. *Eine Nonne hat einen Gutschein für eine Rundreise durch Norditalien und die Schweiz gewonnen.*
A nun has a gift certificate for a trip through Northern Italy and the Switzerland won
- b. *Eine Nonne hat einen Gutschein gewonnen für eine Rundreise durch Norditalien und die Schweiz.*
A nun has a gift certificate won for a trip through Northern Italy and the Switzerland
'A nun has won a gift certificate for a trip around Northern Italy and Switzerland.'
- c. *Eine Nonne hat einen Gutschein für eine Rundreise, die durch ganz Italien führt, gewonnen.*
A nun has a gift certificate for a trip that through whole Italy leads won
- d. *Eine Nonne hat einen Gutschein gewonnen für eine Rundreise, die durch ganz Italien führt.*
A nun has a gift certificate won for a trip that through whole Italy leads
'A nun has won a gift certificate for a trip that passes though the whole of Italy.'
- (21) a. *Ein Unbekannter hat ein Auto mit einem Lenkrad und Felgen aus purem Gold geklaut.*
A stranger has a car with a wheel and rims from pure gold stolen
- b. *Ein Unbekannter hat ein Auto geklaut mit einem Lenkrad und Felgen aus purem Gold.*
A stranger has a car stolen with a wheel and rims from pure gold
'A stranger has stolen a car with a wheel and rims made of pure gold.'
- c. *Ein Unbekannter hat ein Auto mit einem Lenkrad, das aus purem Gold ist, geklaut.*
A stranger has a car with a wheel that from pure gold is stolen
- d. *Ein Unbekannter hat ein Auto geklaut mit einem Lenkrad, das aus purem Gold ist.*
A stranger has a car stolen with a wheel that from pure gold is
'A stranger has stolen a car with a wheel that is made of pure gold.'
- (22) a. *Ein Mädchen hat ein Lied von einer in früheren Zeiten sehr erfolgreichen Band gesungen.*
A girl has a song of a in past times very successful band sung
- b. *Ein Mädchen hat ein Lied gesungen von einer in früheren Zeiten sehr erfolgreichen Band.*
A girl has a song sung of a in past times very successful band
'A girl has sung a song of a band that was very successful in times past.'
- c. *Ein Mädchen hat ein Lied von einer Band, die früher sehr erfolgreich war, gesungen.*
A girl has a song of a band that in the past very successful was sung
- d. *Ein Mädchen hat ein Lied gesungen von einer Band, die früher sehr erfolgreich war.*
A girl has a song sung of a band that in the past very successful was
'A girl has sung a song of a band that was very successful in times past.'
- (23) a. *Ein Archäologe hat einen Sarkophag mit einer in kostbaren goldenen Tüchern eingewickelten Mumie gefunden.*
A archaeologist has a sarcophagus with a in valuable golden clothes wrapped mummy found
- b. *Ein Archäologe hat einen Sarkophag gefunden mit einer in kostbaren goldenen Tüchern eingewickelten Mumie.*
A archaeologist has a sarcophagus found with a in valuable golden clothes wrapped mummy
'An archaeologist has found a sarcophagus with a mummy wrapped in valuable golden clothes.'
- c. *Ein Archäologe hat einen Sarkophag mit einer Mumie, die in Goldtüchern eingewickelt war, gefunden.*
A archaeologist has a sarcophagus with a mummy that in golden clothes wrapped was found
- d. *Ein Archäologe hat einen Sarkophag gefunden mit einer Mumie, die in Goldtüchern eingewickelt war.*
A archaeologist has a sarcophagus found with a mummy that in golden clothes wrapped was
'An archaeologist has found a sarcophagus with a mummy that was wrapped in golden clothes.'

- (24) a. *Eine Freundin hat ein Rezept von einem berühmten Koch mit einer eigenen Fernsehsendung nachgekocht.*
A friend has a recipe of a famous chef with a own TV show cooked-after
- b. *Eine Freundin hat ein Rezept nachgekocht von einem berühmten Koch mit einer eigenen Fernsehsendung.*
A friend has a recipe cooked-after of a famous chef with a own TV show
'A friend has prepared a dish following a recipe of a famous chef with his own TV show.'
- c. *Eine Freundin hat ein Rezept von einem Koch, der eine eigene Fernsehsendung hat, nachgekocht.*
A friend has a recipe of a chef who a own TV show has cooked-after
- d. *Eine Freundin hat ein Rezept von einem Koch nachgekocht, der eine eigene Fernsehsendung hat.*
A friend has a recipe of a chef cooked-after who a own TV show has
'A friend has prepared a dish following the recipe of a chef who has his own TV show.'

Appendix B: Stimuli Experiment 2

- (1) a. *Vor der Tür hat eine Katze mit einem gestreiften Schwanz gelegen.*
In front of the door has a cat with a striped tail lain
- b. *Vor der Tür hat eine Katze gelegen mit einem gestreiften Schwanz.*
In front of the door has a cat lain with a striped tail
'In front of the door lay a cat with a striped tail.'
- c. *Vor der Tür hat die Katze mit dem gestreiften Schwanz gelegen.*
In front of the door has the cat with the striped tail lain
- d. *Vor der Tür hat die Katze gelegen mit dem gestreiften Schwanz.*
In front of the door has the cat lain with the striped tail
'In front of the door lay the cat with the striped tail.'
- (2) a. *Heute morgen hat eine Familie mit einem kleinen Kind abgesagt.*
Today morning has a family with a small child cancelled
- b. *Heute morgen hat eine Familie abgesagt mit einem kleinen Kind.*
Today morning has a family cancelled with a small child
'This morning a family with a small child cancelled (their stay).'
- c. *Heute morgen hat die Familie mit dem kleinen Kind abgesagt.*
Today morning has the family with the small child cancelled
- d. *Heute morgen hat die Familie abgesagt mit dem kleinen Kind.*
Today morning has the family cancelled with the small child
'This morning the family with the small child cancelled (their stay).'
- (3) a. *Im Krankenwagen hat ein Mann mit einer schweren Gehirnerschütterung gelegen.*
In the ambulance has a man with a severe concussion lain
- b. *Im Krankenwagen hat ein Mann gelegen mit einer schweren Gehirnerschütterung.*
In the ambulance has a man lain with a severe concussion
'In the ambulance lay a man with a severe concussion.'
- c. *Im Krankenwagen hat der Mann mit der schweren Gehirnerschütterung gelegen.*
In the ambulance has the man with the severe concussion lain
- d. *Im Krankenwagen hat der Mann gelegen mit der schweren Gehirnerschütterung.*
In the ambulance has the man lain with the severe concussion
'In the ambulance lay the man with the severe concussion.'
- (4) a. *Gestern hat ein Schwimmbad mit einem 10-Meter-Turm aufgemacht.*
Yesterday has a swimming bath with a 10-metre-tower opened
- b. *Gestern hat ein Schwimmbad aufgemacht mit einem 10-Meter-Turm.*
Yesterday has a swimming bath opened with a 10-metre-tower
'Yesterday a bath with a 10 metre tower opened.'
- c. *Gestern hat das Schwimmbad mit dem 10-Meter-Turm aufgemacht.*
Yesterday has the swimming bath with the 10-metre-tower opened
- d. *Gestern hat das Schwimmbad aufgemacht mit dem 10-Meter-Turm.*
Yesterday has the swimming bath opened with the 10-metre-tower
'Yesterday the bath with the 10 metre tower opened.'
- (5) a. *Bei dem Sturm ist ein Baum mit einem hohlen Stamm umgefallen.*
During the storm is a tree with a hollow trunk fallen over
- b. *Bei dem Sturm ist ein Baum umgefallen mit einem hohlen Stamm.*
During the storm is a tree fallen over with a hollow trunk
'During the storm a tree with a hollow trunk fell.'
- c. *Bei dem Sturm ist der Baum mit dem hohlen Stamm umgefallen.*
During the storm is the tree with the hollow trunk fallen over
- d. *Bei dem Sturm ist der Baum umgefallen mit dem hohlen Stamm.*
During the storm is the tree fallen over with the hollow trunk
'During the storm the tree with the hollow trunk fell.'
- (6) a. *Gestern hat eine Trauerfeier für einen verstorbenen Politiker stattgefunden.*
Yesterday has a funeral service for a deceased politician taken place
- b. *Gestern hat eine Trauerfeier stattgefunden für einen verstorbenen Politiker.*
Yesterday has a funeral service taken place for a deceased politician
'Yesterday, a funeral service took place for a deceased politician.'
- c. *Gestern hat die Trauerfeier für den verstorbenen Politiker stattgefunden.*
Yesterday has the funeral service for the deceased politician taken place
- d. *Gestern hat die Trauerfeier stattgefunden für den verstorbenen Politiker.*
Yesterday has the funeral service taken place for the deceased politician
'Yesterday, the funeral service took place for the deceased politician.'

- (7) a. *Gestern hat ein Mann mit einer tiefen Stimme angerufen.*
Yesterday has a man with a deep voice called
- b. *Gestern hat ein Mann angerufen mit einer tiefen Stimme.*
Yesterday has a man called with a deep voice
'Yesterday, a man with a deep voice called.'
- c. *Gestern hat der Mann mit der tiefen Stimme angerufen.*
Yesterday has the man with the deep voice called
- d. *Gestern hat der Mann angerufen mit der tiefen Stimme.*
Yesterday has the man called with the deep voice
'Yesterday, the man with the deep voice called.'
- (8) a. *In der Oper hat eine Ballerina von einer russischen Ballettgruppe getanzt.*
In the opera has a ballerina of a russian ballet group danced
- b. *In der Oper hat eine Ballerina getanzt von einer russischen Ballettgruppe.*
In the opera has a ballerina danced of a russian ballet group
'At the opera, a ballerina of a Russian ballet company danced.'
- c. *In der Oper hat die Ballerina von der russischen Ballettgruppe getanzt.*
In the opera has the ballerina of the russian ballet group danced
- d. *In der Oper hat die Ballerina getanzt von der russischen Ballettgruppe.*
In the opera has the ballerina danced of the russian ballet group
'At the opera, the ballerina of the Russian ballet company danced.'
- (9) a. *Vor dem Hotel hat ein Journalist von einem englischen Klatschblatt gelauert.*
In front of the hotel has a journalist of a english tabloid lurked
- b. *Vor dem Hotel hat ein Journalist gelauert von einem englischen Klatschblatt.*
In front of the hotel has a journalist lurked of a english tabloid
'In front of the hotel, a journalist of a British tabloid was lurking.'
- c. *Vor dem Hotel hat der Journalist von dem englischen Klatschblatt gelauert.*
In front of the hotel has the journalist of the english tabloid lurked
- d. *Vor dem Hotel hat der Journalist gelauert von dem englischen Klatschblatt.*
In front of the hotel has the journalist lurked of the english tabloid
'In front of the hotel, the journalist of the British tabloid was lurking.'
- (10) a. *Beim Pferderennen hat ein Hengst von einem amerikanischen Millionär gewonnen.*
At the horse race has a stallion of a american millionaire won
- b. *Beim Pferderennen hat ein Hengst gewonnen von einem amerikanischen Millionär.*
At the horse race has a stallion won of a american millionaire
'A stallion of an American millionaire won at the horse race.'
- c. *Beim Pferderennen hat der Hengst von dem amerikanischen Millionär gewonnen.*
At the horse race has the stallion of the american millionaire won
- d. *Beim Pferderennen hat der Hengst gewonnen von dem amerikanischen Millionär.*
At the horse race has the stallion won of the american millionaire
'The stallion of the American millionaire won at the horse race.'
- (11) a. *Heute ist ein Schiff mit einer großen Hilfslieferung ausgelaufen.*
Today is a ship with a big aid delivery sailed
- b. *Heute ist ein Schiff ausgelaufen mit einer großen Hilfslieferung.*
Today is a ship sailed with a big aid delivery
'Today a ship sailed with a big aid delivery.'
- c. *Heute ist das Schiff mit der großen Hilfslieferung ausgelaufen.*
Today is the ship with the big aid delivery sailed
- d. *Heute ist das Schiff ausgelaufen mit der großen Hilfslieferung.*
Today is the ship sailed with the big aid delivery
'Today the ship sailed with the big aid delivery.'
- (12) a. *Auf dem Bauernhof hat eine Scheune mit einem Strohdach gebrannt.*
At the farm has a barn with a thatched roof burned
- b. *Auf dem Bauernhof hat eine Scheune gebrannt mit einem Strohdach.*
At the farm has a barn burned with a thatched roof
'At the farm, a shed with a thatched roof burned.'
- c. *Auf dem Bauernhof hat die Scheune mit dem Strohdach gebrannt.*
At the farm has the barn with the thatched roof burned
- d. *Auf dem Bauernhof hat die Scheune gebrannt mit dem Strohdach.*
At the farm has the barn burned with the thatched roof
'At the farm, the shed with the thatched roof burned.'

- (13) a. *Eine Bibliothekarin hat ein Buch von einem bekannten Schriftsteller vorgelesen.*
A librarian has a book of a known author read
- b. *Eine Bibliothekarin hat ein Buch vorgelesen von einem bekannten Schriftsteller.*
A librarian has a book read of a known author
'A librarian read (out loud) a book by a known author.'
- c. *Eine Bibliothekarin hat das Buch von dem bekannten Schriftsteller vorgelesen.*
A librarian has the book of the known author read
- d. *Eine Bibliothekarin hat das Buch vorgelesen von dem bekannten Schriftsteller.*
A librarian has the book read of the known author
'A librarian read (out loud) the book by the known author.'
- (14) a. *Ein Besucher hat eine Vase von einem berühmten Künstler beschädigt.*
A visitor has a vase of a famous artist damaged
- b. *Ein Besucher hat eine Vase beschädigt von einem berühmten Künstler.*
A visitor has a vase damaged of a famous artist
'A visitor damaged a vase of a famous artist.'
- c. *Ein Besucher hat die Vase von dem berühmten Künstler beschädigt.*
A visitor has the vase of the famous artist damaged
- d. *Ein Besucher hat die Vase beschädigt von dem berühmten Künstler.*
A visitor has the vase damaged of the famous artist
'A visitor damaged the vase of the famous artist.'
- (15) a. *Ein Freund hat einen Hund von einer kranken Nachbarin gehütet.*
A friend has a dog of a ill neighbour watched
- b. *Ein Freund hat einen Hund gehütet von einer kranken Nachbarin.*
A friend has a dog watched of a ill neighbour
'A friend has taken care of a dog of an ill neighbour.'
- c. *Ein Freund hat den Hund von der kranken Nachbarin gehütet.*
A friend has the dog of the ill neighbour watched
- d. *Ein Freund hat den Hund gehütet von der kranken Nachbarin.*
A friend has the dog watched of the ill neighbour
'A friend has taken care of the dog of the ill neighbour.'
- (16) a. *Ein Kino-Mitarbeiter hat einen Werbe-Flyer für einen neuen Film ausgeteilt.*
A cinema-employee has a promotional flyer for a new film passed out
- b. *Ein Kino-Mitarbeiter hat einen Werbe-Flyer ausgeteilt für einen neuen Film.*
A cinema-employee has a promotional flyer passed out for a new film
'One of the staff of the movie theatre passed out a promotional flyer for a new film.'
- c. *Ein Kino-Mitarbeiter hat den Werbe-Flyer für den neuen Film ausgeteilt.*
A cinema-employee has the promotional flyer for the new film passed out
- d. *Ein Kino-Mitarbeiter hat den Werbe-Flyer ausgeteilt für den neuen Film.*
A cinema-employee has the promotional flyer passed out for the new film
'One of the staff of the movie theatre passed out the promotional flyer for the new film.'
- (17) a. *Eine Nonne hat einen Gutschein für eine Rundreise durch Italien gewonnen.*
A nun has a gift certificate for a tour through Italy won
- b. *Eine Nonne hat einen Gutschein gewonnen für eine Rundreise durch Italien.*
A nun has a gift certificate won for a tour through Italy
'A nun has won a gift certificate for a tour around Italy.'
- c. *Eine Nonne hat den Gutschein für die Rundreise durch Italien gewonnen.*
A nun has the gift certificate for the tour through Italy won
- d. *Eine Nonne hat den Gutschein gewonnen für die Rundreise durch Italien.*
A nun has the gift certificate won for the tour through Italy
'A nun has won the gift certificate for the tour around Italy.'
- (18) a. *Ein Unbekannter hat ein Auto mit einem goldenen Lenkrad geklaut.*
A stranger has a car with a golden wheel stolen
- b. *Ein Unbekannter hat ein Auto geklaut mit einem goldenen Lenkrad.*
A stranger has a car stolen with a golden wheel
'A stranger has stolen a car with a golden wheel.'
- c. *Ein Unbekannter hat das Auto mit dem goldenen Lenkrad geklaut.*
A stranger has the car with the golden wheel stolen
- d. *Ein Unbekannter hat das Auto geklaut mit dem goldenen Lenkrad.*
A stranger has the car stolen with the golden wheel
'A stranger has stolen the car with the golden wheel.'

- (19) a. *Ein Mädchen hat ein Lied von einer neuen Boygroup vorgesungen.*
A girl has a song of a new boygroup sung
- b. *Ein Mädchen hat ein Lied vorgesungen von einer neuen Boygroup.*
A girl has a song sung of a new boygroup
'(At an audition), a girl sang a song by a new boygroup.'
- c. *Ein Mädchen hat das Lied von der neuen Boygroup vorgesungen.*
A girl has the song of the new boygroup sung
- d. *Ein Mädchen hat das Lied vorgesungen von der neuen Boygroup.*
A girl has the song sung of the new boygroup
'(At an audition), a girl sang the song by the new boygroup.'
- (20) a. *Der Schauspieler hat einen Vertrag für einen neuen Superheldenfilm unterschrieben.*
The actor has a contract for a new superhero film signed
- b. *Der Schauspieler hat einen Vertrag unterschrieben für einen neuen Superheldenfilm.*
The actor has a contract signed for a new superhero film
'The actor has signed a contract for a new superhero film.'
- c. *Der Schauspieler hat den Vertrag für den neuen Superheldenfilm unterschrieben.*
The actor has the contract for the new superhero film signed
- d. *Der Schauspieler hat den Vertrag unterschrieben für den neuen Superheldenfilm.*
The actor has the contract signed for the new superhero film
'The actor has signed the contract for the new superhero film.'
- (21) a. *Der ADAC hat ein Auto mit einem kaputten Reifen abgeschleppt.*
The ADAC has a car with a broken tyre towed
- b. *Der ADAC hat ein Auto abgeschleppt mit einem kaputten Reifen.*
The ADAC has a car towed with a broken tyre
'The ADAC (German automobile club) towed a car with a broken tyre.'
- c. *Der ADAC hat das Auto mit dem kaputten Reifen abgeschleppt.*
The ADAC has the car with the broken tyre towed
- d. *Der ADAC hat das Auto abgeschleppt mit dem kaputten Reifen.*
The ADAC has the car towed with the broken tyre
'The ADAC (German automobile club) towed the car with the broken tyre.'
- (22) a. *Die Schatzsucher haben einen Sarkophag mit einer uralten Mumie ausgegraben.*
The treasure hunters have a sarcophagus with a age-olf mummy excavated
- b. *Die Schatzsucher haben einen Sarkophag ausgegraben mit einer uralten Mumie.*
The treasure hunters have a sarcophagus excavated with a age-olf mummy
'The treasure hunters have excavated a sarcophagus with an ancient mummy.'
- c. *Die Schatzsucher haben den Sarkophag mit der uralten Mumie ausgegraben.*
The treasure hunters have the sarcophagus with the age-olf mummy excavated
- d. *Die Schatzsucher haben den Sarkophag ausgegraben mit der uralten Mumie.*
The treasure hunters have the sarcophagus excavated with the age-olf mummy
'The treasure hunters have excavated the sarcophagus with the ancient mummy.'
- (23) a. *Ein Notarzt hat einen Verletzten mit schweren Knochenbrüchen behandelt.*
A emergency physician has a injured person with severe bone fractures treated
- b. *Ein Notarzt hat einen Verletzten behandelt mit schweren Knochenbrüchen.*
A emergency physician has a injured person treated with severe bone fractures
'An emergency physician has treated an injured person with severe bone fractures.'
- c. *Ein Notarzt hat den Verletzten mit den schweren Knochenbrüchen behandelt.*
A emergency physician has the injured person with the severe bone fractures treated
- d. *Ein Notarzt hat den Verletzten behandelt mit den schweren Knochenbrüchen.*
A emergency physician has the injured person treated with the severe bone fractures
'An emergency physician has treated the injured person with the severe bone fractures.'
- (24) a. *Eine Freundin hat ein Rezept von einem berühmten Fernsehkoch nachgekocht.*
A friend has a recipe of a famous TV chef cooked-after
- b. *Eine Freundin hat ein Rezept nachgekocht von einem berühmten Fernsehkoch.*
A friend has a recipe cooked-after of a famous TV chef
'A friend has prepared a dish following a recipe of a famous TV chef.'
- c. *Eine Freundin hat das Rezept von dem berühmten Fernsehkoch nachgekocht.*
A friend has the recipe of the famous TV chef cooked-after
- d. *Eine Freundin hat das Rezept nachgekocht von dem berühmten Fernsehkoch.*
A friend has the recipe cooked-after of the famous TV chef
'A friend has prepared a dish following the recipe of the famous TV chef.'