Nominal Modification in Language Production:

Extraposition of Prepositional Phrases in German

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Abstract

In my dissertation, I investigate the phenomenon of extraposition of PP out of NP in German in language production. Four production experiments, using the method of production of memory, and three experiments testing the acceptability of extraposition were conducted.

In extraposition, a constituent is realized in a position to the right of what would be considered the canonical position. A special case is extraposition out of a nominal phrase (NP), in which a constituent is moved out of NP to the end of the utterance. There are two main aspects to consider: the length of the extraposed constituent (the PP), and the length of the intervening material.

Experiment 1 investigated the influence of constituent length on extraposition. The hypothesis is that longer and more complex constituents are harder to produce and are therefore produced towards the end of the utterance. In the experiment, PPs of three different lengths (2-3, 5-6, 9-11 words) had to be reproduced in either adjacent or extraposed position. As to the length of the intervening material, the hypothesis is that sentences with more intervening material between head noun and extraposed PP will tend to be reproduced with the PP in adjacent position to the head noun. In order to test this hypothesis, the length of the intervening material (1, 2 and 4 words) was manipulated in Experiment 2. The same material was used in an acceptability experiment, using the method of magnitude estimation (Experiment 5). Previous studies found that extraposition is preferred over verbal material only, thus Experiment 3 investigated the influence of different lengths of purely verbal intervening material. Experiment 4 was concerned with the differences between PP and RC extraposition in production.

Experiment 6 and 7 used Likert scales to assess the acceptability of extraposition. Experiment 6 investigated whether the acceptability of extraposition is influenced by the definiteness status of the NP out of which is extraposed and if a soft constraint for definiteness can be found for PP extraposition in German. Experiment 7 asked if the inner structure of the extraposed constituent (PP only vs. PP+RC) influences its acceptability. An extraposed PP that includes an RC should be "heavier" than a PP without an RC, since the number of phrasal nodes is higher. If indeed heavier constituents are realized at the end of an utterance, the acceptability of an extraposed PP that includes an RC should be higher than that of an extraposed PP without one.

The results of the production experiments show that sentences are mostly reproduced in their original linear sequence, which suggests that extraposed position seems to be just as canonical as adjacent position, especially when extraposition takes place over verbal material only. With regard to constituent length, in extraposed position long PPs are shortened less often, supporting the hypothesis that longer and more complex constituents tend to be produced at the end of the utterance. Recency effects were found for intervening material as participants dropped intervening material rather than change syntactic position of constituents. The length and type of the intervening material is important with respect to how much intervening material is acceptable. Verb clusters were not shortened in sentences with extraposed PPs, however, ⅓ of adverbs and ½ of PP adverbials including

a lexical NP were shortened to "verb only". Extraposed PPs are more often reproduced in adjacent position than adjacent PPs are reproduced in extraposed position. However, the position of RCs is more often changed from adjacent to extraposed than from extraposed to adjacent.

While producing extraposed PPs seems not to be any more difficult than producing adjacent ones, adjacent constituents are consistently rated higher than extraposed constituents in grammaticality judgment tasks. This is in line with findings of Konieczny (2000) on German RC extraposition. The number of phrasal nodes, as suggested by Rickford et al. (1995), did not have an influence on the acceptability of extraposition, while the length of the constituent, measured in words, seems to play a role. Definiteness had no effect on adjacent PPs, but when the PP was extraposed, sentences with an indefinite antecedent were rated higher than sentences with a definite antecedent. This suggests that there is a "soft constraint" for definiteness with regard to PP extraposition out of NP in German.

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To my family.

Chapter 1

Introduction

1.1   Extraposition?... of PPs?... out of NP?... in German?

This thesis investigates the extraposition of prepositional phrases (PPs) out of nominal phrases (NPs) in German. A constituent is extraposed when it appears to the right of the position in which it would be expected (given its syntactic and semantic properties). The following example by Baltin (2006) shows a PP in its expected position (1a) and in its extraposed position (1b):

(1)   a. A review of Chomsky's book appeared. (Canonical)
      b. A review appeared of Chomsky's book. (Extraposition)

A key property of extraposition is the discontinuity of the phrase out of which a constituent is extraposed. In the above sentence, the NP 'A review of Chomsky's book' is split, in this case by a verb, resulting in the extraposition of the PP ('of Chomsky's book') out of its NP. This property sets it apart from other operations in which constituents appear to the right of their expected positions, such as Heavy NP Shift (HNPS). In (2), taken from Arnold et al. (2000), the heavier of the two constituents is placed at the right edge. Unlike in the case of extraposition, however, there is no discontinuity of constituents. It is rather a change in constituent order.

(2)   a. The waiter brought the wine we had ordered to the table. (Canonical)
      b. The waiter brought to the table the wine we had ordered. (HNPS)

This thesis is concerned with the extraposition of prepositional phrases (PPs), as illustrated in (3a). Relative clauses (RCs) are another type of constituent that is commonly extraposed, as shown in (3b). RC extraposition has been investigated widely, and in many languages (e.g. English, German, Hebrew, and Japanese). Apart from theoretical approaches, RC extraposition has been studied empirically, using natural language corpora as well as different experimental methods investigating sentence processing and production. To the best of my knowledge there has been no prior research on PP extraposition from a psycholinguistic perspective.

(3) a. A woman entered the room with long dark hair.

  b. A woman entered the room who had long dark hair.

A specific case of extraposition is extraposition out of NP, as illustrated in (4). In (4a), the PP is adjacent to its NP, while in (4b) the PP is extraposed out of the NP. Another case of PP extraposition is extraposition out of VP. An example sentence is shown in (5). In (5b) the PP is extraposed out of VP.

Extraposition out of NP

(4) a. Maria hat ein Buch von einem bekannten Schriftsteller vorgelesen.
    Maria has a   book by a   known   author   read out loud

  b. Maria hat ein Buch vorgelesen   von einem bekannten Schriftsteller.
    Maria has a   book read out loud by a   known   author

Extraposition out of VP

(5) a. Der Lehrer hat Anna mit ihrer Zwillingsschwester verwechselt.
    The teacher has Anna with her   twin sister   mixed-up

  b. Der Lehrer hat Anna verwechselt mit ihrer Zwillingsschwester.
    The teacher has Anna mixed-up   with her   twin sister

Quite often, sentences can be (locally) ambiguous, because the PP could modify the NP just as well as the VP. The ambiguity has to be resolved semantically rather than structurally. An example sentence with a local ambiguity is shown in (6). In (6a) the PP modifies the NP, while in (6b) it modifies the VP.

(6) a. Der Arzt   hat einen Patienten behandelt mit schweren Blutungen.
    The doctor has a   patient   treated   with severe   bleeding

  b. Der Arzt   hat einen Patienten behandelt mit einem neuen Medikament.
    The doctor has a   patient   treated   with a   new   medication

Extraposition already occurred in Middle High German texts and was generally even more common in earlier versions of German up to the 16th century than it is in Modern Standard German (Sapp, 2014). In German, extraposition means that a constituent is moved from the *Vorfeld* ('pre-field') or *Mittelfeld* ('middle field') to the *Nachfeld* ('post-field'), which is to the right of the *rechte Satzklammer* ('right bracket'). In verb-second clauses, the finite verb is within the *linke Satzklammer* ('left bracket') und the rest of the predicate (if available) is within the right bracket, as shown in (7a). In verb-last clauses, the finite verb is within the right bracket as well, as shown in (7b). In German, a constituent is typically extraposed over (at least) a verb. In English, for example, extraposition is more common over non-verbal material, such as an adverb, as shown in (8) (taken from Baltin, 1984:159).

(7) a. Maria [LEFT BRACKET hat] ein Buch [RIGHT BRACKET vorgelesen]   von einem
    Maria   has a   book   read out loud by   a
    bekannten Schriftsteller.
    known   author

2

> b. ..., dass Maria ein Buch [RIGHT BRACKET vorgelesen hat] von einem
> ..., that Maria a book   read out loud has by a
> bekannten Schriftsteller.
> known author

(8) I saw a picture yesterday of Sally.

Further differences between English and German extraposition behaviour are discussed in Chapter 2.1.4.1. Inaba (2007) even assumes that RC extraposition is a syntactic operation in English, while it is a purely phonological phenomenon in German.

1.2 Factors Under Investigation

This thesis is concerned with extraposition of PPs out of NP in German in language production. Furthermore, the acceptability of extraposition is investigated. In order to give a more complete picture of the phenomenon, theoretical approaches in syntax and phonology are discussed in Chapter 2, but the aim of this thesis is to contribute to the understanding of extraposition from a psycholinguistic perspective (an overview of psycholinguistic factors of extraposition is given in Chapter 3).

There are two aspects that are key factors in language production and processing, and which are also essential to the experimental work in this thesis: the heaviness of the (extraposed) constituent and the extraposition distance between head noun and extraposed PP.

Length of the extraposed PP

Heavier constituents are assumed to be preferred at the end of utterances (Behagel, 1930; Quirk et al., 1972; Arnold et al., 2000). A number of corpus studies on RC extraposition (Uszkoreit et al., 1998*a*; Francis, 2010; Bader, 2014; Strunk, 2014) have found that extraposition occurs more often when the RCs are longer than the intervening material. Studies that conducted production experiments on HNPS (Stallings et al., 1998; Stallings & MacDonald, 2011) found that NPs were shifted more often when they were longer. Therefore, it is expected that longer PPs should be preferred in extraposed position. Thus, the manipulation of the length of the PP plays a role in this thesis, as illustrated in (9).

(9) a. Auf dem Tisch hat ein Korb gestanden **mit Wein**.
>   On the table has a basket stood   with   wine
>   'On the table stood a basket with wine.'

>   b. Auf dem Tisch hat ein Korb gestanden
>   On the table has a basket stood
>   **mit Rotwein und französischem Käse**.
>   with   red-wine and french cheese
>   'On the table stood a basket with red wine and french cheese.'

    c. Auf dem Tisch hat ein Korb   gestanden
         On the   table has a   basket stood
         mit einer Flasche Rotwein, französischem Käse und frischem Baguette.
         with

         a bottle red-wine, french cheese and fresh baguette
         'On the table stood a basket with a bottle of red wine, french cheese and fresh baguette.'

The length of the intervening material is one verb in all conditions, while the length of the PP differs between short (2-3 words), medium (5-6 words), and long (9-11 words). If indeed longer constituents are preferred at the end of utterances, extraposition rates should increase as the length of the PP increases.

Length and make-up of the intervening material

    The second factor of importance is the distance between head noun and extraposed PP. Connected to this is the make-up of the intervening material. Thus, one question is if an increase in extraposition distance, as illustrated in (10), decreases likelihood of extraposition, and another question is if purely verbal material intervening between head noun and PP, as shown in (11), has a different influence on extraposition than intervening material consisting of an adverb (10b) or a PP adverbial including a lexical NP (10c). The verbal material in (11) differs between a verb particle, a verb, and an auxiliary and verb.

(10)   Vor dem Fenster ist ein Schmetterling…
       (In front of the window, a butterfly…)

     a. geflattert
        fluttered

     b. fröhlich geflattert
        happily fluttered

     c. in der Sonne geflattert
        in the sun   fluttered
    …mit großen gelben Flügeln.
    (…with big yellow wings.)

(11)   a. Anna suchte sich   ein neues Kleid **aus** für den Abschlussball.
        Anna picked herself a   new   dress out for the prom
        'Anna picked a new dress for the prom.'

     b. Anna hat sich   ein neues Kleid **ausgesucht** für den Abschlussball.
        Anna has herself a   new   dress picked-out for the prom
        'Anna has picked a new dress for the prom.'

     c. Anna soll   sich   ein neues Kleid **ausgesucht haben** für den
        Anna is-supposed herself a   new   dress picked-out have   for the
        Abschlussball.
        prom

'Anna is supposed to have picked a new dress for the prom.'

Corpus studies on RC extraposition (Uszkoreit et al., 1998*a*; Francis, 2010; Bader, 2014) have found that extraposition is preferred over verbal material. Therefore, purely verbal intervening material should facilitate extraposition. It will be interesting to see what kind of influence the length of verbal material has on extraposition rates. Extraposition should occur even more often over verb particles than two-word verbal material, such as an auxiliary and verb.

Differences between PP and RC extraposition

The differences and similarities between PP and RC extraposition in elicited production are further aspects of interest. As for natural language production, there have been a number of corpus studies on RC extraposition (Uszkoreit et al., 1998*a*; Francis, 2010; Bader, 2014; Strunk, 2014), all of which found that the preferred extraposition distance is one word. Furthermore, RC extraposition is more likely when the intervening material consists of purely verbal material. The length of the RC also played a role. Francis (2010) found that RC extraposition occurred in 90% of the cases when the RC was four times longer than the intervening material and when the intervening material consisted of one or maximally two words of verbal material.

Bader (2014) conducted two elicited production experiments, using the method of Production of memory. Participants saw a sentence, as shown in the example in (12), on the computer screen. Then followed a prompt *Max sagte, dass* 'Max said that' and participants had to repeat the sentence. The prompt ensured that participants had to produced a sentence with the RC either in adjacent or extraposed position. The length of the intervening material differed between purely verbal material, a bare NP object, and a NP object containing a determiner. The results showed that extraposition was preferred over purely verbal material. When a noun was added to the intervening material, extraposition rates decreased rapidly.

(12)   Gratulieren   wollte Max dem Lehrer, der gestern   zu Besuch war
       Congratulate wanted Max the   teacher who yesterday to visit   was
       'Max wanted to congratulate the teacher who came to visit yesterday.'

In this thesis, PP and RC extraposition over the shortest possible distance of verbal material, a verb particle, is tested. The length of the PP and RC is matched, measured in syllables. An example sentence is shown in (13).

(13)   a. Das Museum stellt   eine Skulptur aus   von einem weltweit   bekannten
            The museum exhibits a   sculpture PART of   a   world-wide known
            Bildhauer.
            sculptor
            'The museum exhibits a sculpture of a world-renowned sculptor.'

    b. Das Museum stellt   eine Skulptur aus,   die   von einem bekannten
       The museum exhibits a   sculpture PART which of   a   known
       Bildhauer stammt.
       sculptor   comes
       'The museum exhibits a sculpture, which was made by a known sculptor.'

Definiteness status of the NP

Another aspect of interest is the definiteness status of the NP out of which is extraposed. In English it has been observed that extraposition out of definite NPs is less acceptable than extraposition out of an indefinite NP (Guéron, 1980; Ziv & Cole, 1974). In some cases, extraposition out of definite NPs is even judged to be ungrammatical, while extraposition out of an indefinite NP is fine, as is the use of a definite NP as long as the RC is in adjacent position, as illustrated by the examples given in (14).

(14)   a.   * The man is here who is carrying a large package.

        b.   A man is here who is carrying a large package.

        c.   The man who is carrying a large package is here.

Walker (2013) concluded that there is a soft constraint for definiteness of the NP in English. She conducted an acceptability experiment on RC extraposition, in which the NP out of which the RC was extraposed was either indefinite or definite, as shown in (15). Walker (2013) found that sentences were rated higher when the NP was indefinite, but extraposition out of definite NPs was still acceptable in general.

(15)   a. I saw **a** girl faint who was hugging a doll.

        b. I saw **the** girl faint who was hugging a doll.

The question is if a similar constraint exists in PP extraposition in German. Experiment 6 therefore tests the acceptability of extraposition with the definiteness status of the NP either indefinite or definite. An example sentence is shown in (16).

(16)   a. 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.'

        b. 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.'

Definition of constituent weight

Finally, another aspect is the influence of constituent weight on the acceptability of extraposition. "Heaviness" is not a clearly defined term. Sometimes it means "longer" as in the number of words in a constituent. Hawkins (1990, 1994), for example, applies this definition of weight in his local complexity metric. Experiments 1-3 and 5 in this thesis also measure weight in number of words. In Experiment 4, the length of the constituents is matched, measured in number of syllables.

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*b*) 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 Heavy NP Shift. He concluded that "counting words, nodes, or phrasal nodes all work well" (Wasow, 1997*b*:102).

Experiment 7 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 7 thus tests sentences in which the inner structure of the PP differs between PP only vs. PP+RC, as shown in (17). Both PP only and PP+RC are matched in number of words.

(17)   a.   Gestern   hat eine Trauerfeier   stattgefunden für einen jungen und sehr
            Yesterday has a   funeral service taken place   for a   young and very
            beliebten Politiker.
            popular   politician
            'Yesterday a funeral service took place for a young and very popular politician.'

       b.   Gestern   hat eine Trauerfeier   stattgefunden für einen Politiker, der
            Yesterday has a   funeral service taken place   for a   politician who
            sehr beliebt war.
            very popular was
            'Yesterday a funeral service took place for a politician who was very popular.'

1.3   Organization of the Thesis

This thesis presents seven experiments that focus on extraposition in language production and on the acceptability of extraposition with regard to the factors introduced above.

Furthermore, it discusses theoretical work and previous empirical findings that are concerned with the phenomenon of extraposition. The thesis consists of six chapters and is organized as follows:

Chapter 2 introduces the theoretical background literature on extraposition from a syntactic and phonological perspective. Furthermore, discourse-pragmatic factors on extraposition are discussed. The two main approaches on extraposition in syntax, movement and base-generation are introduced, as well as a post-syntactic rightward movement analysis. Furthermore, key ideas within Prosodic Structure Theory as well as Optimality Theory are introduced, and it is discussed how extraposition may help with avoiding prosodic constraint violations.

Chapter 3 introduces the two main processing theories relevant for the topic of the thesis: the *Early Immediate Constituents* theory proposed by Hawkins (1994, 2004, 2014) and the *Dependency Locality Theory* proposed by Gibson (1998, 2000). Anticipation-based accounts are discussed which challenge locality-based accounts such as the *Dependency Locality Theory*. Furthermore, two key factors for the motivation to extrapose from a processing perspective are introduced: *heaviness* (of the extraposed constituent) and (extraposition) *distance*. The research questions addressed in this study are given at the end of the chapter.

Chapter 4 presents four elicited production experiments. First, the experimental method, *Production from memory*, is introduced. The first experiment is concerned with the influence of the length of the extraposed PP on extraposition rates in reproduction. The next two experiments deal with the influence of the intervening material on extraposition rates in reproduction: Experiment 2 investigates the influence of the length of the intervening material, which consists of either a verb, an adverb and verb, or a 3-word PP adverbial and verb. Experiment 3 investigates the influence of purely verbal intervening material, consisting of either a verb particle, a verb, or an auxiliary and verb. The fourth production experiment is concerned with the difference between PPs and RCs, and the influence of constituent type on extraposition in elicited production.

Chapter 5 presents three experiments on the acceptability of extraposition. Experiment 5 uses the same material as Experiment 2, but a different experimental method: *magnitude estimation*, thereby giving the opportunity to observe similarities and differences of language production and acceptability. The other two experiments both use Likert scales to gather the acceptability of extraposition. Experiment 6 is concerned with the definiteness status of the NP out of which is extraposed, and attempts to answer the question if a (soft) constraint of definiteness can be found for PP extraposition in German, similar to the one found for extraposition out of NP in English. Experiment 7 deals with the weight of the extraposed constituent and the question if the number of phrasal nodes within a constituent (PP only vs. PP including an RC) has an influence on the acceptability of extraposition.

Conclusions are drawn in **Chapter 6**. It summarizes the most important findings and results, and gives answers found with regard to the research questions asked in this thesis. Finally, it presents some open questions left for future work.

Chapter 2

Syntactic and Phonological Aspects of Extraposition

There has been a vast body of work on extraposition within the syntactic and phonological fields of linguistics. The most relevant theories and studies are introduced in the following sections.

An overview of the literature on extraposition from a syntactic perspective will be given in Section 2.1. The two main approaches within the syntactic literature are movement, especially rightward movement, and base-generation. Other accounts propose that extraposition is a post-syntactic operation. From a phonological point of view, a number of studies have proposed that extraposition is a mechanism to repair a suboptimal prosody-syntax interface. The literature that will be discussed in Section 2.2 will focus on the influence of prosodic constraints on extraposition, as well as on an analysis of extraposition within the framework of *Optimality Theory*. Prosodic stress also plays an important role in discourse-pragmatic factors of extraposition. As a matter of fact, it is a key ingredient of the two main aspects of information structure accounts: (i) focus and (ii) the distinction between given and new. Therefore, discourse-pragmatic factors of extraposition will be the focus of Section 2.3.

2.1 Syntactic Aspects of Extraposition

Extraposition is not the only construction in which a constituent is realized in a position to the right of what would be considered its *canonical* position. Other such constructions are, for example, *Heavy NP Shift* and *Right Dislocation*. Neither are PPs the only constituents that can be extraposed out of NP. Amongst other constructions, relative clauses are extraposed out of NP, and they have been the object of an extensive body of literature.

In the syntactic literature on extraposition, two main approaches can be identified: the first approach assumes *rightward movement* from an adjacent base position to an extraposed position, following derivational accounts of classical generative grammar. The main advocates of rightward movement are Ross (1967), Chomsky (1973, 1977, 1986),

Baltin (1981), and Akmajian (1975), and their theories will be introduced in Section 2.1.1. The second approach assumes that the "extraposed" constituent is *base-generated* in that position. The theories, however, differ in the specifics, not unlike those that assume rightward movement. Among the advocates of base-generation accounts are Culicover & Rochemont (1990), Haider (1996, 1997, 2010), Koster (2000), and Kiss (2005). An overview of their views will be given in Section 2.1.3. Apart from these two main groups, there are other approaches to extraposition. For German, Inaba (2005, 2007, 2008) proposes an account of post-syntactic rightward movement. His approach will be introduced in Section 2.1.4.

2.1.1 Rightward Movement
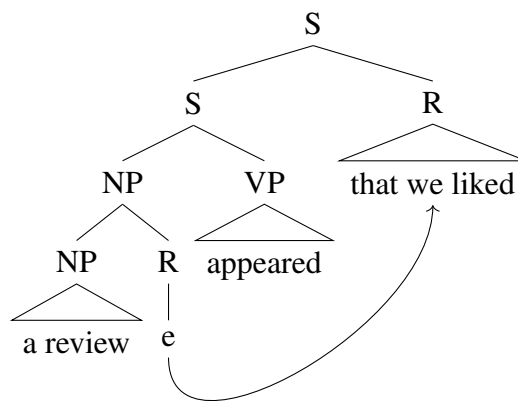
Figure 2.1: Rightward movement of a relative clause, according to Wittenburg (1987:429)

Ross (1967) was the first to propose that extraposition of RCs followed a syntactic rule, namely that the RC is base-generated adjacent to its head, and is then optionally moved to the right to an extraposed position.[1] He was also the first to note that extraposition is clause-bounded, which he formulated in the *Right Roof Constraint*.[2]

(18) **Right Roof Constraint**

An element cannot move rightward out of the clause in which it originates.

(Ross, 1967)

In effect, this constraint establishes that the locality restriction of extraposition is much stricter than that of leftward extraction. Chomsky and Baltin proposed further constraints, such as the *Subjacency Principle* (Chomsky, 1973), *Generalized Subjacency* (Baltin, 1981), and the *Barriers Approach* (Chomsky, 1986).

The *Subjacency Principle* (Chomsky, 1973), given in (19), is meant to regulate leftward as well as rightward movement.

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[1]The proposal by Ross (1967) was an adaptation of Rosenbaum's (1965) *rewriting transformation*.

[2]The name *Right Roof Constraint* originated in Grosu (1973).

(19) **Subjacency Principle**

A cyclic rule cannot move a phrase from position *Y* to position *X* (or conversely) in $X[\alpha[\beta Y]]X$, where α and β are cyclic nodes. (Chomsky, 1977:73)

Furthermore, Chomsky (1973) and Akmajian (1975) assume that S and NP are included in the set of cyclic categories.[3] Chomsky (1973) argues that this explains the *Right Roof Constraint*, since the movement of *Y* to the position of *X* means that the clause does not only cross the cyclic S node containing it, but also the cyclic NP projection of its antecedent. Also, since NP is assumed to be a cyclic node, RC extraposition out of an antecedent NP is not possible when that NP is embedded in another NP, as that would result in the crossing of *two* cyclic categories. Akmajian (1975:118) gives an example of this assumption, shown in (20):

(20) a. A photograph was published last year of a book about French cooking.

  b. * A photograph of a book was published last year about French cooking.

In (20a), the PP *of a book about French cooking* can be extraposed out of its NP *a photograph* as it only crosses *one* cyclic category, the subject NP. However, in (20b), the PP *about French cooking* crosses the subject NP (*a photograph*), as well as the NP embedded inside it (*a book*), thus resulting in a violation of the *Subjacency Principle*.

A variant of Chomsky's (1973) *Subjacency Principle* is *Generalized Subjacency* proposed by Baltin (1981).[4]

(21) **Generalized Subjacency**

In the configuration A ... [α ... [β ... B ...]β ...]α ... A',

  a. A and B cannot be related where α and β = NP, PP, and either one or both of S and S';

  b. A' and B cannot be related where α and β are maximal projections of any major category.

  (Baltin, 1983:155)

The principle in subclause (21b) restricts the number of maximal projections intervening between the extraposed RC and its in-situ position to one. In this regard, it is even stricter than Chomsky's (1973) *Subjacency Principle*, as it applies to any maximal projection, and not only cyclic categories. Hence, Baltin (2006:241) states that "an extraposed phrase is adjoined to the first maximal projection that dominates the phrase in which it originates." A number of similar generalizations have been proposed for both English and German (cf. Asakawa, 1979; Jacobson, 1987; Rochemont & Culicover, 1997; Keller, 1995; Wiltschko, 1997). In the case of RC extraposition, which is always extraposition out of NP, this means that the maximal projection of the antecedent is the one clause-boundary that the

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[3]S and NP correspond to IP and DP in more recent minimalist theory (cf. Abney, 1987; Radford, 1997).
[4]Subclause (21a) only applies to leftward extraction.

RC is allowed to cross. It cannot be extraposed to the end of a clause that is not a direct subconstituent of this clause.

In a corpus study, Strunk & Snider (2013) found counterexamples for the *Subjacency Principle* and *Generalized Subjacency*.[5] In the example in (22), taken from the TüBa-D/Z corpus, the RC crosses three cyclic NP nodes, which should lead to an ungrammatical sentence, according to the *Subjacency Principle*.

(22)   Und dann sollte ich [NP Augenzeuge [NP der   Zerstörung [NP einer Stadt]]]
       And then should I   eyewitness   the.GEN destruction   a.GEN city
       werden, [RC die mir am   Herzen lag] - Sarajevo.
       become   that me at the heart   lay - Sarajevo
       'And then I was about to become an eyewitness of the destruction of a city that was dear to my heart - Sarajevo.'
       (Strunk & Snider, 2013:109)

In the German sentence taken from the internet in (23), an RC is extraposed out of a PP in the prefield. According to *Generalized Subjacency*, a sentence like this should be ungrammatical. However, examples of this kind can be found not only in German, but also in English.

(23)   [PP An [NP wen   t]] kann ich mich   wenden, [RC der mir kluge Tips aus   der
            to   whom   can I   myself turn   who me clever tips from the
       Praxis   geben kann?]
       practice give   can
       'To whom can I turn who can give me clever tips from practice?'
       (Strunk & Snider, 2013:107)

Webelhuth et al. (2013) derive the *Relative Clause Extraposition Constraint*, given in (24) from a number of earlier locality constraints, amongst others the *Right Roof Constraint* and *Generalized Subjacency*.

(24)   **The Relative Clause Extraposition Constraint (REC)**
       At Spell-Out, a relative clause c-commands its associate and no unmodified verbal maximal category intervenes between the two.
       (Webelhuth et al., 2013:6)

One of the implications of the REC is that RC_1 in Figure 2.2 can move to IP_2, however, it could not move outside of IP_2. Similarly, RC_2 can move outside of VP_1, but it cannot leave VP_2. From this it follows that RCs cannot strand in medial position.

While many theories have adopted the principle of rightward movement (Reinhart, 1976; Baltin, 1978; Guéron, 1980; Taraldsen, 1981; Culicover, 1981; Truckenbrodt, 1995; Müller, 1996; Büring & Hartmann, 1996, 1997; Drummond, 2009), there are also problems with the approach. For one thing, empirical counterexamples, like the ones

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[5]Strunk & Snider (2013) used the internet and the TüBa-D/Z corpus (Tübingen Treebank of Written German) (Telljohann et al., 2006).
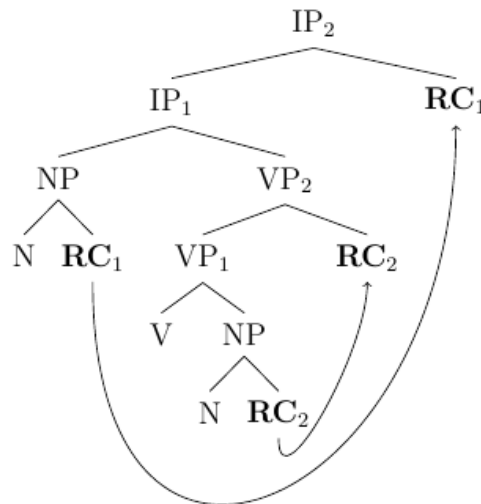
Figure 2.2: Illustration of the implications of the *Relative Clause Extraposition Constraint* (REC) (Webelhuth et al., 2013)

shown above, force syntacticians to come up with ever new additions to the principle. Another problem of rightward movement is concerned with RCs with conjoined and with split antecedents. The latter is shown in (25).

(25)   **A man** entered the room and **a woman** went out [$_{RC}$ who were quite similar.]
         (Perlmutter & Ross, 1970:350)

While the predicate and the verb of the RC require a *plural* subject antecedent, the only antecedents available are two *singular* NPs (*a man* and *a woman*). Finally, rightward movement is, at the same time, more and less constrained as leftward movement, meaning that a new set of constraints for rightward movement would have to be formulated.

An alternative version of rightward movement was proposed by Fox & Nissenbaum (1999) and Fox (2002): *rightward movement + deletion*. However, their proposal does not solve the problem of RCs with conjoined and split antecedents. Furthermore, it presupposes that all RCs have to be adjuncts.

2.1.2   Leftward Movement

An alternative to rightward movement theories is provided by Kayne (1994). His *Linear Correspondence Axiom* (LCA) implies that any kind of right-adjunction is forbidden, both for base-generated as well as for derived structures. Thus, instead of moving the RC rightward, Kayne (1994) suggests that it is actually the *antecedent* of the RC that is moving *leftward*. While parts of the theory are defended by some scholars (Bianchi, 1999, 2000; Bhatt, 2002; Sauerland, 2003), others have criticized it heavily (Borsley, 1997, ms.; Büring & Hartmann, 1997; Wilder, 1996; Koster, 2000; De Vries, 2002).

Extraposed RCs are usually positioned at sentence-final position, as shown in (26). Borsley (1997) points out that, according to Kayne's (1994) analysis, this means that all

other elements in the sentence have to be moved to the left in order to have the RC strand at the right edge position. This results in something similar to the structure shown in (27).

(26)   I saw a man on Monday who looked like Chomsky.

(27) $[I]_i$ $[saw]_j$ $[a\ man]_k$ $[on\ Monday]_l$ $[_{VP}\ t_i\ t_j\ [t_k$ who looked like Chomsky$]\ t_l\ ]$
       (Borsley, 1997:640-41)

Borsley (1997) remarks that Kayne gives no independent justifications for any of these leftward movements, and that there is no theoretical motivation for them. He concludes that their only use is that of having Kayne's (1994) theory fit the reality of RC extraposition. Another problem with leftward movement is that it does not rule out medial stranding of RCs. Following the REC, however, medial stranding of RCs should be prohibited.

Wilder (1996) proposes another variety of the leftward movement analysis: *leftward movement + deletion*. He still moves constituents to the left, however, he not only moves the antecedent of the RC to the left, but the whole DP including the RC. In the following step, he deletes the moved RC, and then, in a final step, he deletes all constituents except the RC from the original site. For the example sentence in (26), the steps to be taken according to Wilder's (1996) analysis would look as shown in (28).[6]

(28)   a. Step 1: I saw on Monday $[_{DP}$ a man who looked like Chomsky] (Basic)

       b. Step 2: I saw $[_{DP}$ a man who looked like Chomsky$]_i$ on Monday $[_{DP}$ a man who looked like Chomsky$]_i$
          (Leftward movement of the DP, leaving behind a copy)

       c. Step 3: I saw $[_{DP}$ a man ~~who looked like Chomsky~~$]_i$ on Monday $[_{DP}$ a man who looked like Chomsky$]_i$
          (Deletion of the moved relative clause)

       d. Step 4: I saw $[_{DP}$ a man ~~who looked like Chomsky~~$]_i$ on Monday $[_{DP}$ ~~a man~~ who looked like Chomsky$]_i$
          (Deletion of everything but the relative clause at the original site)

While Wilder's (1996) proposal solves some of the issues, others remain. He still applies leftward movements that are not theoretically motivated. Furthermore, medial stranding would require extensions of the theory, and split antecedents still pose a problem.

2.1.3   Base-Generation

The first to argue for a base-generation account for extraposed RCs was Andrews (1975). The observation that movement theories did not successfully capture the locality of extraposed RCs led Culicover & Rochemont (1990), Rochemont & Culicover (1990) and

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[6]The illustration scheme in (28) follows the one in Webelhuth et al. (2013:30).

Rochemont (1992) to question movement in general, and rather turn to an account which base generates the RC in extraposed position and in which it is licensed interpretively under government.

They follow Guéron's (1980) proposal in that the RC is interpreted as the *complement* of the head NP at LF (therefore known as *Complement Principle*).[7] Furthermore, they suggest that the government relation between the RC and its head has to hold in both directions at S-structure, as their approach allows the RC to appear lower or higher than its subject head. This, however, results in conceptual problems, as none of the traditional theories regard RCs as complements. Furthermore, the *Complement Principle* only applies to RCs, but not to other kinds of complements. Moreover, split antecedents remain a problem in Culicover and Rochemont's account as well.

Koster (2000) proposes an alternative base-generation approach on the basis of *Parallel Construal* and *Pied Piping*. In his account, elements are not directly licensed, but rather indirectly by being linked to licensed elements. The heads of parallel construals are Boolean heads of some sort. For example, the *and* is the Boolean head in conjunctions, and the *or* is the Boolean head in disjunctions. For extraposed constituents (amongst other constructions), he introduces a Boolean head, namely ":" (=colon), which is the head of a *Colon Phrase*, illustrated in (29). In the case of extraposed elements, the head NP is in Spec position of the Colon Phrase, and the extraposed constituent is the complement, thus "the checking XP is in the Spec and the specifying addition is in the complement position of the colon head" (Koster, 2000:21). The Boolean operator signals the addition of properties to the NP.

(29) **Colon Phrase**
      [XP [**:** [XP]]
      (Koster, 2000:21)

Since Koster's (2000) approach also applies Pied Piping, the specifier of the Colon Phrase can be as large as a CP, as long as the specified NP is still embedded in it. Drawing the limit at the CP also means that the *Right Roof Constraint* is still met. Unlike conjunction, extraposition from NP has no visible Boolean head. Koster (2000:22) thus proposes the structure in (30) as basis for optional extraposition of RCs.

(30) [$_{NP}$ [$_{NP}$ een vrouw] [**:** [$_{CP}$ die alles   wist]]]
            a   woman   who everything knew

He assumes a similar structure for optionally extraposed PPs, as shown in (31). Here, the PP provides a further specification of the head of the PP placed in the Spec of the colon.

(31) [$_{NP}$ [$_{NP}$ een man] [**:** [$_{PP}$ uit India]]]
            a   man   from India

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[7]Guéron (1980), however, still assumes that the RC is moved to its position to the right edge in overt syntax.

According to Koster's (2000:22) account, the head NP can also be included in a more inclusive phrase, such as an object-agreement phrase (AgrOP), as shown in the example sentence in (32b).

(32) a. Ik heb [$_{NP}$ [$_{NP}$ een vrouw] [**:** [$_{CP}$ die   alles   wist]]] gezien
          I have   a   woman   who everything knew   seen
          'I saw a woman who knew everything.'

      b. I heb [[$_{AgrOP}$ [$_{NP}$ een vrouw]] gezien] [**:** [$_{CP}$ die   alles   wist]]
          I have   a   woman seen   who everything knew

However, in some cases, the *Colon Phrase Theory* makes wrong predictions with regard to *Principle C* of the Binding Theory. It also does not solve the problem of the existence of determiners with obligatory relative clauses, and it makes wrong predictions for the scope effects of RC extraposition. Finally, it does not offer a solution to the problem of split antecedents.

Another approach is *Generalized Modification*, proposed by Kiss (2005, 2003).[8] He distinguishes between complement extraposition and extraposition of modifiers, and his proposal is a semantic analysis of modifier extraposition. Following Stucky's (1987:401) observation "that grammaticality is only half of the picture, with interpretability the other half," Kiss' proposal suggests that modifier extraposition is governed by principles of interpretation. Thus, a modified element (e.g. an NP) is semantically selected by its modifier, even if the modifier is not adjacent to the modified element. Syntactically, the extraposed modifier is simply an adjunct, but semantically Kiss (2005) adds the following condition of *Generalized Modification*:

(33) **Generalized Modification**
      The index of a modifying phrase has to be identified with a suitable index contained in the phrase to which the modifier is adjoined.
      (Kiss, 2005:288)

Kiss's (2005) theory is formulated within the framework of Head-Driven Phrase Structure Grammar (HPSG) (Pollard & Sag, 1994). HPSG is a constraint-based grammar, which not only considers syntactic constraints, but also semantically motivated constraints.[9] With regard to RCs, Kiss (2005) gives a specific condition of *Generalized Modification*:

(34) **Generalized Modification**
      A relative clause can be realized in a syntactic position which allows access to a suitable antecedent of the relative pronoun.
      (Kiss, 2005:301)

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[8]The main proposal is introduced in Kiss (2005), Kiss (2003) discusses a variant. Crysmann (2005, 2013) takes up the original proposal by Kiss and expands it further.

[9]Kiss (2005) employs the *Minimal Recursion Semantics* (MRS) framework developed by Copestake et al. (2005).

Thus, it does not matter where the RC attaches syntactically. It can still be semantically interpretable, as long as there is "(i) the semantic index of a modifiable nominal and (ii) a pointer to the quantifier which will bind that index and whose restrictor term the meaning of the modified nominal will be part of" (Webelhuth et al., 2013:40). In cases of adjacent RCs, the feature structure of the modified NP contains both parts of the above mentioned information, and since the RC modifies the NP locally, it has direct access to that information. In the case of RC extraposition, Kiss (2005) follows the HPSG framework, and formulates a non-local feature, ANCHOR, which contains the information needed, and which can then be passed up the phrase structure tree. Thus, if the head NP of the RC contains an ANCHOR value that allows an RC to modify it, this information is passed up all the way to the phrase to which the RC is attached syntactically. Since it is the NP that holds the ANCHOR value, it does not matter if the RC is in adjacent or extraposed position; the same schema licenses both RCs.

The *Generalized Modification Theory* is the first to account for RCs with conjoined antecedents, but other problems remain. Since it is the noun that licenses the RC with its ANCHOR value, determiners with obligatory relative clauses still pose a problem. The theory does not account for scope effects, and it does not address the issue of split antecedents.

Another base-generation account of extraposition is given by Haider (1996, 1997, 2010). He argues that the "right edge area is characterized as an optional, low shell of the phrase that is the locus of elements in extraposition" (Haider, 2010:233). Figure 2.3 illustrates extraposition in Haider's (2010) base-generation account.
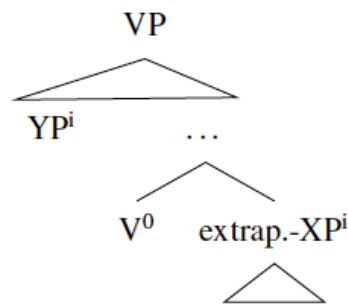
Figure 2.3: Extraposition according to the base-generation account of Haider (2010:233)

Crucially, in Haider's (2010) account, the extraposed constituent is always c-commanded by anything that precedes it. Furthermore, the extraposed phrase always has to be realized as a sister of the verb. Unlike Haider, Kiss (2005) proposes that the extraposed constituent is attached higher in the tree structure than its antecedent. He argues that Haider's account does not capture examples as the one given in (35).

(35) Man hat [die Frau   des   Boten   beschimpft, der den Befehl
     One has the woman of the messenger insulted   who the order
     überbrachte.]
     delievered
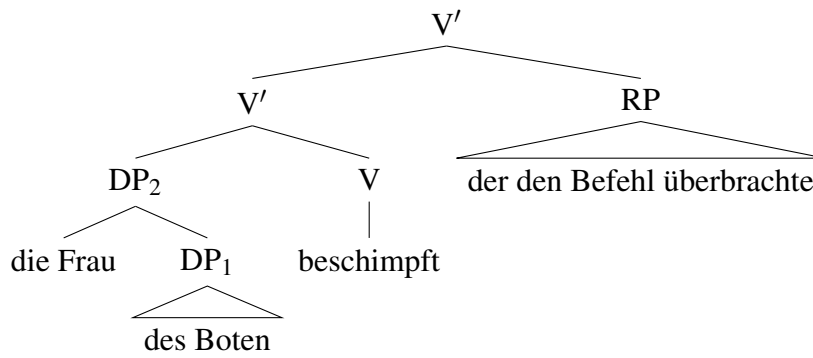
Figure 2.4: Illustration of the analysis of RC extraposition following Kiss (2005:320)
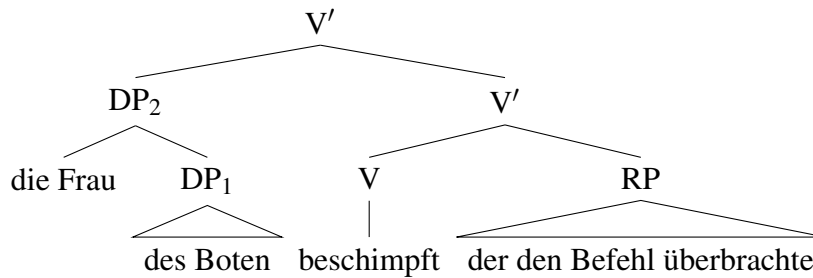
Figure 2.5: Illustration of the analysis of RC extraposition according to Haider (2010), taken from Kiss (2005:320).

'The woman of the messenger, who delivered the order, was insulted verbally.'

(Kiss, 2005:320)

Looking at the tree structures for (35), it becomes clear that the antecedent of the RC (*des Boten*) is embedded in another DP, and, therefore, cannot c-command the RC. Thus, Haider's account fails to explain cases such as this one. (Figure 2.4 illustrates the analysis following Kiss (2005), Figure 2.5 depicts the analysis according to Haider's (2010) account).

In summary, base-generation accounts do not seem to have the ultimate solutions to extraposition, either. Some accounts, like Kiss's (2005) *Generalized Modification Theory* give rise to hope, as they solve at least some of the problems (e.g. conjoined antecedents). However, none of them provides all the answers.

2.1.4 A Post-Syntactic Rightward Movement Analysis

Inaba (2007) proposes a post-syntactic rightward movement account of RC extraposition in German. He assumes that RC extraposition is a syntactic operation in English, while it is a purely phonological phenomenon in German.[10] He demonstrates the differences between English and German RC extraposition, using examples of Binding effects, the licensing of *Negative Polarity Items* (NPI), and Principle C effects.

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[10]However, Inaba (2007) assumes base-generation of complement clauses in the postfield.

2.1.4.1 Differences between English and German Extraposition Behaviour

In English, the position of the RC is relevant with regard to variable binding. In the
example shown in (36), the sentence is perfectly grammatical with the RC in adjacent
position (36a). However, when the RC is extraposed, as in (36b), Binding is not possible,
and the sentence is ungrammatical.

(36) a. I showed every book$_i$ to the professor [that wrote a review of it$_i$]

   b. * I showed every book$_i$ to the professor yesterday [that wrote a review of it$_i$]

  (Inaba, 2007:109)

In German, however, the position of the RC is not relevant with regard to variable binding.
Both sentences are grammatical, as shown in (37).

(37) a. Ich habe jedes Buch$_i$ dem Professor [der eine Rezension dar$_i$über
    I have every book the.DAT professor who a review about it
    geschrieben hat] gezeigt
    written has shown

   b. Ich habe jedes Buch$_i$ dem Professor gezeigt [der eine Rezension
    I have every book the.DAT professor shown who a review
    dar$_i$über geschrieben hat]
    about it written has

  (Inaba, 2007:112)

The consequences of Inaba's (2007) analysis are similar to those of the approach taken
by Büring & Hartmann (1997). While they insist on syntactic movement to explain the
following data, both accounts assume that extraposed RCs should generally behave like
their adjacent counterparts.

(38) a. weil wir jedem$_i$ die Daten t gegeben haben [die er$_i$ braucht]
    because we everyone the data t given have that he needs
    '... because we have given everyone the data that he needs.'

   b. * weil ein Mann t jedes Datum$_i$ kennt [der es$_i$ braucht]
    because a man t every date knows who it needs
    '... because a man knows every date that he needs.'

  (Büring & Hartmann, 1997:16)

Thus, the grammaticality of the sentences with extraposed RCs in (38) is identical to the
grammaticality of the sentences with the RCs in adjacent position (which is considered
the base position of extraposed RCs in movement accounts), as shown in (39). (38a) and
(39a) are both grammatical, while (38b) and (39b) are both ungrammatical.

(39) a. weil wir jedem$_i$ die Daten [die er$_i$ braucht] gegeben haben
    because we everyone the data that he needs given have
    '... because we have given everyone the data that he needs.'

b.   * weil   ein Mann [der es$_i$ braucht] jedes Datum$_i$ kennt
        because a man t   who it   needs every   date   knows
        '... because a man knows every date that he needs.'

(Inaba, 2007:113)

In English, extraposition affects the licensing of NPIs. The sentence in (40a), featuring the NPI *even*, is ungrammatical. When the RC is extraposed, however, the NPI is licensed, resulting in a grammatical sentence, as shown in (40b).

(40)   a.   * The rule [which has even the slightest effect on LF] hasn't been found yet

       b.   The rule *t* hasn't been found yet [which has even the slightest effect on LF]

(Inaba, 2007:109)

In German, extraposition does not seem to have any effects on NPI licensing. The NPI is licensed in both versions, and both sentences are grammatical, independently of the position of the RC, as shown in (41).

(41)   a.   Bis   jetzt wurde eine Regel [die   auch nur irgendeinen Effekt auf LF hat]
            Until now was   a   rule   which also only some   effect on LF has
            noch nicht gefunden
            yet   not   found

       b.   Bis   jetzt wurde eine Regel *t* noch nicht gefunden [die   auch nur
            Until now was   a   rule   t yet   not   found   which also only
            irgendeinen Effekt auf LF hat]
            some   effect on LF has
            'Until now, a rule which has even the slightest effect on LF has not been found
            yet.'

(Inaba, 2007:112)

In English, extraposition interacts with Principle C. The sentence in (42) becomes grammatical when the RC is extraposed, as in (42b).

(42)   a.   * I sent her$_i$ many gifts [that Mary$_i$ didn't like] last year

       b.   I sent her$_i$ many gifts *t* last year [that Mary$_i$ didn't like]

(Inaba, 2007:109)

Unlike in English, extraposition does not interact with Principle C in German, as shown in (43). Both sentences are grammatical, independently of the position of the RC.

(43)   a. Jeder   [der nur ein bisschen Verständnis   für Marias$_i$ Lage   hat]
            Everyone who only a   bit   understanding for Maria's position has
            würde ihr$_i$ in dieser Situation beistehen
            would her in this   situation assist

       b. Jeder   *t* würde ihr$_i$ in dieser Situation beistehen [der nur   ein bisschen
            Everyone t would her in this   situation assist   who only a   bit
            Verständnis   für Marias$_i$ Lage   hat]
            understanding for Maria's position has

'Everyone with just a bit of an understanding for Maria's position would assist
her in this situation.'

(Grewendorf, 1988:315)

2.1.4.2 Inaba's Post-Syntactic Rules for German RC Extraposition

With reference to all of the examples above, Inaba (2007) argues that extraposed RCs in
German are interpreted according to their base position, which is the position adjacent to
their head NP, thus questioning base-generation accounts that assume that the extraposed
RC is base-generated in extraposed position. With regard to movement, Inaba (2007)
remarks that the examples listed above have shown that RC extraposition does not have
to be analysed as a syntactic operation. He formulates the following post-syntactic rules
for extraposition in German:

(44) **Post-Syntactic Rules for German RC Extraposition** (Inaba, 2007:117)

    a. The target of extraposition is the next postfield.

    b. Extraposition may not linearly cross any NP that is a potential associate of the
relative clause.[11]

The rule formulated in (44b) raises some issues, as it is not entirely clear what counts as
a 'potential associate'. According to Altmann (1981), extraposition should be allowed
as long as the crossed NP is not a *morphologically* possible antecedent. However, Inaba
(2007) gives a counterexample, shown in (45).

(45) a. * Maria hat dem   Bekannten *t* die   Kollegen vorgestellt
          Maria has the.MASC.DAT acquaintance t the.ACC colleagues introduced
          [der   gerade im   Lotto gewonnen hat]
          who.SING.MASC just   in the lottery won   has
          'Maria introduced the colleagues to the acquaintance who has recently won
the lottery.'

    b. ?* Maria hat die   Kollegin *t* dem   Bekannten
          Maria has the.FEM.ACC colleague t the.MASC.DAT acquaintance
          vorgestellt [die   gerade im   Lotto gewonnen hat]
          introduced who.SING.FEM just   in the lottery won   has
          'Maria introduced the colleague who has recently won the lottery to the
acquaintance.'

(Inaba, 2007:120)

Kathol & Pollard (1995) suggest that, in principle, *any* NP can block extraposition.
However, the data is not clear in this case, either (see (46)). Inaba (2007) does not offer
any solution to these issues.

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[11]Within the theory of *topological fields*, each embedded clause has its own field structure, so simply
targeting the linearly next postfield will not produce grammatical sentences in all cases. Thus, Inaba (2007)
allows for some structure within the linear component, but he does not give any more details as to how
much exactly.

(46)   a.   ? Wir haben das Buch *t* ins   Regal gestellt [das   ich gestern   gekauft
          We have   the book t in the shelf put   which I   yesterday bought
          habe].
          have
          'We put the book onto the shelf which I bought yesterday.'

       b.   ? Ich habe die Briefmarke *t* der Mutter gezeigt [die ich gestern   gekauft
          I   have the stamp   t the mother shown who I   yesterday bought
          habe]
          have
          'I showed the stamp to the mother who/that I bought yesterday.'

     (Inaba, 2007:120)

Importantly, Inaba (2007) argues that his account for German RC extraposition is not just another option besides rightward movement accounts. He claims that his analysis can account for data which proves to be problematic for movement theories.

(47)   a.   * Peter hatte der Frau   *t* eine Rose geschenkt [die schwanger war].
          Peter had   the woman t a   rose given   that pregnant   was
          'Peter had given the woman a rose who was pregnant.'

       b.   Peter hatte sie/die Rose der Frau   *t* geschenkt [die schwanger war].
          Peter had   she/the rose the woman t given   who pregnant   was
          'Peter had given it (the rose) to the woman who was pregnant.'

     (Lenerz, 1977:34)

Due to the rule formulated in (44b), the sentence in (47a) is not acceptable, since the indirect object NP *eine Rose* is a potential associate for the RC. In (47b), the NP is no longer intervening between the the antecedent and the RC, so the sentence is perfectly fine. However, the *structural* position of the indirect object NP *sie (die Rose)* is the same in both sentences, as illustrated in (48). Since syntactically the indirect object is in the same position, a syntactic analysis should predict the same grammaticality for both sentences.[12]

(48)   a.

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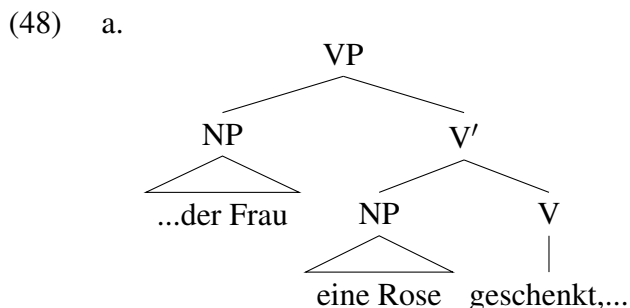
[12]The sentence in (47a) becomes acceptable if the determiner of the NP *der Frau* is focussed: 'Peter hatte DER Frau *t* eine Rose geschenkt [die SCHWANGer war].' The sentence is unacceptable when the prosody is neutral.

b.
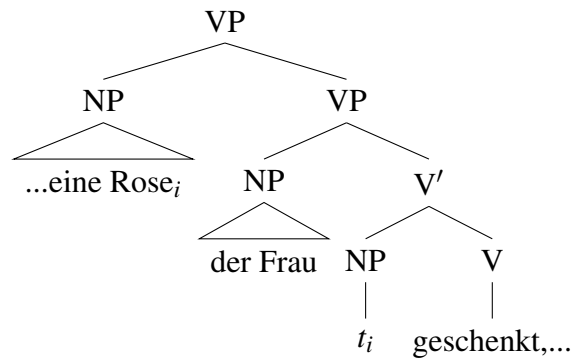
Inaba (2007) concludes that RC extraposition in German should preferably be analysed within a post-syntactic rightward movement theory. He assumes extraposed complement clauses to be base-generated as a sister of the verb. Therefore, he blames the identical treatment of RCs and complement clauses, as well as the influence of research done on English RC extraposition for the domination of syntactic analyses of German RC extraposition in the past.

The question is, however, if the issues with the example sentences in (45) - (47) are really grammatical issues or if they are not in fact issues of processing. The acceptability of the example sentences is first and foremost influenced by the processing complexity which increases due to the fact that there is more than one possible antecedent for the RC.

In summary, neither movement theories nor base-generation theories succeed in giving complete theoretical accounts for extraposition. Although subvariants of the theories range from rightward movement and rightward movement + deletion to leftward movement and leftward movement + deletion within the core movement theories, and from base-generated adjuncts to base-generated conjuncts within base-generation theories, some crucial issues remain. One of the most persistent problems is that of split antecedents, which proves to be especially problematic for movement theories. It has become more and more obvious that an exhaustive answer to the issue of extraposition can only be given by taking into account further perspectives from other linguistic fields, such as phonology and processing.

2.2 Phonological Aspects of Extraposition

For the longest time, research on the syntax-prosody interface was heavily one-sided, as most theories took the view that syntax influences prosody, but never the other way around. Thus, theories started off by developing syntactic accounts of given phenomena, and then, in a second step, showed how prosody is mapped to the specific syntactic structures of these phenomena (cf. Chomsky & Halle, 1968; Kiparsky, 1982; Nespor & Vogel, 1986). Some prosodic accounts, however, argue that syntax and prosody go hand in hand, and that extraposition can function as a repair-mechanism in case of a bad

syntax-prosody interface (Féry, 2015; Hartmann, 2013).

Some key ideas of prosodic structure theory will be introduced in Section 2.2.1. The influence of prosodic constraints and their violation will be discussed in Section 2.2.2. Section 2.2.3 introduces accounts of extraposition within the framework of *Optimality Theory* (OT), both for German (Féry, 2015) and English (Göbbel, 2007, 2013*a,b*). Studies providing empirical evidence for the influence of prosody on extraposition will be introduced in Section 2.2.4.

2.2.1 Key Ideas within Prosodic Structure Theory

The studies that will be introduced in this section make use of two key principles of prosodic theory, (i) the *Prosodic Hierarchy*, a hierarchical organization of prosodic constituents (Selkirk, 1978, 1981, 1984; Nespor & Vogel, 1982, 1986), and (ii) the *Strict Layer Hypothesis* (Selkirk, 1981, 1984; Nespor & Vogel, 1986).

In prosodic structure theory, a sentence has a hierarchically organized prosodic structure, which consists of categories taken from a set of categories defined in the *Prosodic Hierarchy*, as illustrated in Figure 2.6.

Utterance (utt)
(may consist of several syntactic clauses)
↓
Intonational Phrase (ip)
(corresponds to a syntactic clause (CP))
↓
Phonological Phrase (pp)
(corresponds roughly to a syntactic phrase (XP))
↓
Prosodic Word (w)
↓
foot, syllable, mora
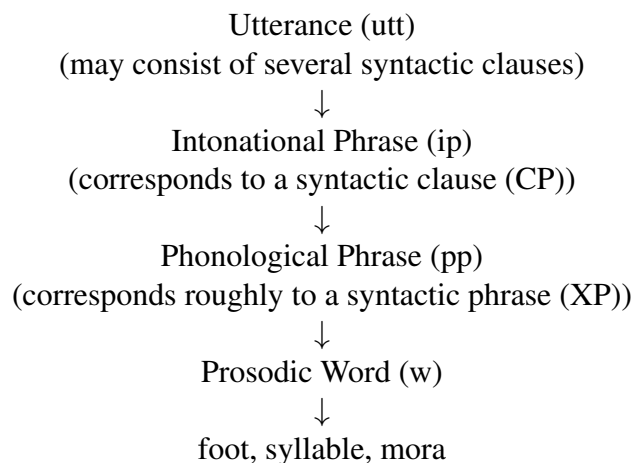
Figure 2.6: The Prosodic Hierarchy (Selkirk, 1978)

The biggest of these constituents is the *utterance*, which may consist of several syntactic clauses. Intonational phrases correspond to syntactic clauses (see Nespor & Vogel, 1986, 1989). Phonological phrases consist of several prosodic words and contain a phrasal accent (Uhmann, 1991). Unless narrow focus changes accentuation, the phrasal accent is realized on the rightmost element of the pp (at least in German). Phonological phrases also contain lexical syntactic phrases, as formulated in Truckenbrodt's (1999:228) WRAP-XP constraint ("Each XP is contained in a phonological phrase.").

The *Prosodic Hierarchy* follows from the *Strict Layer Hypothesis* (Selkirk, 1981, 1984; Nespor & Vogel, 1986), given in (49).

(49) **The Strict Layer Hypothesis**
 There is a hierarchy of prosodic domain types such that, in a prosodic tree, any

domain at a given level of the hierarchy consists exclusively of domains at the
next lower level of the hierarchy. (Ladd, 1996:238)

Selkirk (1996) defines the following four constraints on prosodic structure: (i)
Layeredness, which stipulates that no prosodic category dominates a prosodic category
of a higher level (e.g. a pp is not allowed to dominate an ip), (ii) *Headedness*, which
states that any prosodic category must dominate a prosodic category of the next lower
level (unless it is a syllable), (iii) *Exhaustivity*, which requires that any prosodic category
may only dominate categories of the next lower level (no levels may be skipped), and (iv)
Nonrecursivity, which states that no prosodic category may dominate a category of the
same level (e.g. no ip may dominate an ip).

Another type of constraints, which are, for example, used by Féry (2015), are the
Match Constraints proposed by Selkirk (2011), and given in (50).

(50) **Match Constraints** (Selkirk, 2011:439)

    a. MATCH CLAUSE

      A clause in syntactic constituent structure must be matched by a
      corresponding prosodic constituent, call it ι, in phonological representation.

    b. MATCH PHRASE

      A phrase in syntactic constituent structure must be matched by a
      corresponding prosodic constituent, call it Φ, in phonological representation.

    c. MATCH WORD

      A word in syntactic constituent structure must be matched by a corresponding
      prosodic constituent, call it ω, in phonological representation.

The *Match Constraints* call for syntactic constituents and phonological constituents to
correspond to one another, thus a grammatical word corresponds to a prosodic ω-word, a
syntactic phrase corresponds to a prosodic Φ-phrase, and a syntactic clause corresponds
to a prosodic ι-phrase. From this it follows that phonological domains tend to mirror
syntactic constituents. In ideal cases, the grammar reflects well-formed phonological
representations. However, it is also possible that syntactic constituents do not match with
their corresponding prosodic constituents, resulting in a violation of match constraints.

2.2.2 Avoiding Constraint Violations with the Help of Extraposition

Féry (2015) applies the constraints formulated by Selkirk (1978, 1981, 2011) in her study
on RC and PP extraposition in German. She argues that adjacent RCs violate the prosodic
principle of *Layeredness*, illustrated by the example given in (51), and calls the resulting
ill-formed prosodic structures 'prosodic monsters.'

(51)   a.   [(Sie hat ihre Mutter **getroffen**)$_\Phi$]$_\iota$ [die an dem Tag mit Freunden
                      She has her mother met   who on this day with friends
                      unterwegs   war]$_\iota$.
                      out and about was

(a) extraposed RC   (b) adjacent RC

Figure 2.7: Prosodic structures of the extraposed and adjacent versions of the sentence (Féry, 2015:19)

    b.   ? [(Sie hat ihre Mutter [die   an dem Tag mit   Freunden unterwegs
            She has her mother   who on this day with friends   out and about
            war]$_\iota$ **getroffen**)$_\Phi$].
            was   met
            'She met her mother who was out with friends on that day.'
    (Féry, 2015:18)

Following Selkirk's (2011) *Match Constraints*, the VP *Sie hat ihre Mutter getroffen* in (51) corresponds to a prosodic Φ-phrase. In (51b), however, an intonational phrase (ι-phrase) is embedded within the Φ-phrase. Thus, a prosodic constituent that, according to the *Prosodic Hierarchy*, is on a higher level is embedded within a lower level prosodic constituent. Crucially, the higher level constituent (ι-phrase) is also dominated by the lower level Φ-phrase. The prosodic structures of both sentences are illustrated in Figures 2.7a (extraposed RC) and 2.7b (adjacent RC).

In the extraposed version in Figure 2.7a, the Φ-phrase that is formed by the direct object and the verb of the matrix clause is not interrupted. Both the Φ-phrase and the extraposed RC form intonational phrases (ι-phrases) of their own. If the RC remains in adjacent position, as shown in Figure 2.7b, it forms an intonational phrase that is embedded within the Φ-phrase that corresponds to the VP. Hence, the ι-phrase is dominated by a Φ-phrase, which is a violation of the prosodic principle of *Layeredness*.

Extraposition of the RC is therefore one way of avoiding 'prosodic monsters.' If there is no 'prosodic monster' when the RC is in adjacent position, there is also no need to extrapose the constituent, which explains why extraposition is optional, and why the preference for RC extraposition depends (partly) on the prosodic well-formedness of the sentence. Féry (2015) argues that 'prosodic monsters' do not necessarily have to occur when an RC is in adjacent position. They can be avoided when the "final portion of the main clause, located after the embedded clause, is heavy enough to form a Φ-phrase all by itself" (Féry, 2015:14), as in the version shown in (52). The embedded RC is followed by two words, which form a well-formed Φ-phrase of their own.[13] Therefore, the ι-phrase

---

[13]Selkirk (2000) formulates the MINIMALBINARY constraint, which postulates that a well-formed

is placed between two Φ-phrase instead of being embedded within a Φ-phrase. This also means that the ι-phrase is no longer dominated by the lower level Φ-phrase, and the *Layeredness* principle is no longer violated.

(52) [(Sie hat ihre Mutter)$_\Phi$ [die mit Freunden unterwegs   war]$_\iota$ (nicht
       She has her mother   who with friends   out and about was   not
       getroffen)$_\Phi$]$_\iota$.
       met
       'She did not meet her mother, who was out with friends.'

Féry (2015) also discusses extraposition of PP out of NP. She remarks that, unlike RCs, PPs adjacent to their head noun do not violate *Layeredness*, and, therefore, the pressure to extrapose a PP is basically non-existent, meaning that extraposition of PPs is always optional. As long as a sentence with an extraposed PP is prosodically well-formed, it is just as acceptable as the adjacent version, as shown in (53).

(53) a. [(Maria)$_\Phi$ (wollte (das Kleid)$_\Phi$ tragen)$_\Phi$ (von ihrer Mutter)$_\Phi$]$_\iota$.
          Maria   wanted the dress   wear   of her   mother

      b. [(Maria)$_\Phi$ (wollte (das Kleid (von ihrer Mutter)$_\Phi$)$_\Phi$ tragen)$_\Phi$]$_\iota$.
          Maria   wanted the dress of her   mother   wear
          'Maria wanted to wear her mother's dress.'
       (Féry, 2015:20)

Figure 2.8 illustrates the prosodic structure for both sentences. In the extraposed version in Figure 2.8a, the lower VP *das Kleid tragen* forms a Φ-phrase of its own. The higher VP consists of two Φ-phrases, namely the lower VP and the extraposed PP, which likewise forms a Φ-phrase of its own.[14] In the adjacent version in Figure 2.8b, the PP forms a Φ-phrase, which is embedded in another Φ-phrase corresponding to the DP, which again is embedded in another Φ-phrase, the VP, which also includes the solitary verb.

However, not all sentences featuring extraposition are prosodically well-formed. In some cases, extraposition of RCs or PPs is less acceptable than their adjacent counterparts. Féry (2015) argues that this is the case when a potential intervener, namely an accented full XP, intervenes between the extraposed constituent and its antecedent. She formulates a NoIntervener constraint, given in (54), which "forbids the presence of an accented intervener between the antecedent of an extraposed constituent or its reconstructed position and its actual position" (Féry, 2015:24). However, this constraint should be seen as an optional OT constraint, and not as a hard constraint.

(54) NoIntervener (Féry, 2015:24)
      No intervener between antecedent or reconstructed position and extraposed
      relative clause
      $$^{*}...t_i...\overset{X}{(XP)}_\Phi(...YP_i...)_\Phi$$

Φ-phrase needs at least two ω-words.

[14]In German, recursion of Φ-phrases is not unusual, and by itself it does not result in ungrammatical sentences.

```
           VPΦ                                    VPΦ
          /    \                                 /    \
       VPΦ      PPΦ                           DPΦ       V
       /  \      |                            /  \      
    DPΦ    V     |                           D    NP    
    / \    |    /\                           |    /  \   
   D   N  /    /  \                          |   N    PPΦ 
   |   |  |   /    \                         |   |    /\   
  das Kleid tragen von ihrer Mutter        das Kleid von ihrer Mutter tragen
```

(a) extraposed RC   (b) adjacent RC
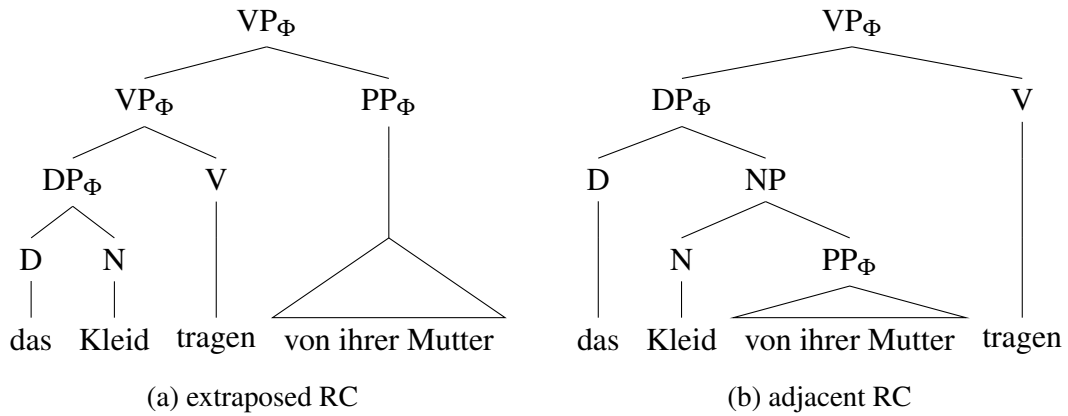
Figure 2.8: Prosodic structures of the extraposed and adjacent versions of the sentence (Féry, 2015:21)

Crucially, the NOINTERVENER constraint states that it is an intervener that makes extraposition unacceptable and not the number of prosodic constituents between an extraposed constituent and its antecedent. This is contrary to the prosodic constraint of extraposition out of NP proposed by Truckenbrodt (1995), cited in (55):

(55) **Prosodic Constraint for Extraposition from NP** (Truckenbrodt, 1995:503)
Let XP be a syntactic category that is canonically mapped into the prosodic category π upon extraposition (where π is either the phonological phrase or the intonational phrase in the following). Then extraposition from NP will take XP as far out of a prosodic constituent of the same category π.

$(...XP...)_\pi \rightarrow (...t_i...)_\pi (...XP_i...)_\pi$

According to Truckenbrodt's (1995) constraint, an extraposed constituent must leave the prosodic constituent in which it originates, but it may move no further than the next prosodic constituent of the same category. This concept is shown in the example sentences in (56).[15]

(56) a. (Peter)$_\Phi$ (hat einem KOLLEGEN)$_\Phi$ (ein BUCH t gekauft)$_\Phi$ (von
Peter has a.DAT colleague a book bought by
Chomsky)$_\Phi$.
Chomsky
'Peter has bought a book by Chomsky for a colleague.'

b. * (Peter)$_\Phi$ (hat einem KOLLEGEN t)$_\Phi$ (ein BUCH gekauft)$_\Phi$ (aus Italien)$_\Phi$.
Peter has a.DAT colleague a book bought from Italy
'Peter has bought a book for a colleague from Italy.'

(Truckenbrodt, 1995:510)

Both NOINTERVENER and Truckenbrodt's constraint make the same predictions for the sentences in (56). In (56a), there is no intervener between the antecedent *ein Buch* and the extraposed PP *von Chomsky*. Likewise, the PP has moved out of the phonological

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[15]Accented words are indicated by small caps.

phrase it originated in, and moved into the next phonological phrase, thereby adhering to the constraint set by Truckenbrodt (1995). In (56b), however, an accented NP (*ein Buch*) intervenes between the antecedent *einem Kollegen* and the extraposed PP *aus Italien*, violating the NOINTERVENER constraint. At the same time, the PP has moved *two* phonological constituents to the right, instead of just one, therefore violating the constraint by Truckenbrodt.

In the example in (57), however, the predictions differ. In (57b), there is an intervener (*das Kleid*) between antecedent and extraposed RC, thus NOINTERVENER predicts that the sentence should be unacceptable. However, the extraposed RC originated in an intonational phrase and was extraposed into the next intonational phrase. Thus, according to the constraint given by Truckenbrodt (1995), (57) should be acceptable.

(57) a. [(Linda)$_\Phi$ (hat dem   KIND)$_\Phi$ (das KLEID t geschenkt)$_\Phi$]$_\iota$ [(das
          Linda   has the.DAT the   dress   given that   she
          sie   selbst   ausgesucht hatte)$_\Phi$]$_\iota$.
          herself chosen had
          'Linda gave the child the dress that she had chosen herself.'

      b. ??/* [(Linda)$_\Phi$ (hat dem   KIND t)$_\Phi$ (das KLEID geschenkt)$_\Phi$]$_\iota$ [(das
              Linda   has the.DAT child   the dress given   twho
          gestern   geweint hat)$_\Phi$]$_\iota$.
          yesterday cried   has
          'Linda gave the dress to the child who cried yesterday.'

      (Féry, 2015:25)

Féry (2015) concludes that interveners reduce the acceptability of extraposition, although other factors, such as accents on other constituents, or syntactic and semantic factors, probably play a role as well. Furthermore, extraposition is an option to avoid 'prosodic monsters,' which occur whenever a prosodic phrase from a lower level dominates a prosodic category from a higher level, thereby violating one of the constraints of prosodic theory, *Layeredness*.

While Féry (2015) finds that the violation of *Layeredness* can trigger a preference for extraposition, Hartmann (2013) argues that the violation of yet another prosodic constraint, *Exhaustivity* (Selkirk, 1986), can lead to ungrammaticality. *Exhaustivity* states that all categories of the next lower level have to be parsed; skipping levels is not allowed. For example, an ι-phrase cannot dominate a ω-word directly, all categories on the Φ-level have to be parsed, hence the Φ-level cannot be skipped.

Hartmann (2013) argues that pre-verbal object clauses prevent the following verbal constituent to form a complete prosodic constituent. This verbal constituent cannot be parsed properly, according to the prosodic constraint of *Exhaustivity*. The example in (58) illustrates not only the violation of *Exhaustivity*, but also that of another constraint, *Nonrecursivity*.

(58)

```
                        *ip
              ┌──────────┴──────────┐
             ip                     ip────────────┐
              │                      │             │
             pp                     pp             │
          ┌───┼───┐         ┌───┬───┼───┐          │
          w   w   w         w   w   w   w          w
          │   │   │         │   │   │   │          │
        Peter hat mir,    dass Melanie kommt,    erzählt
        Peter has me      that Melanie comes     told
```
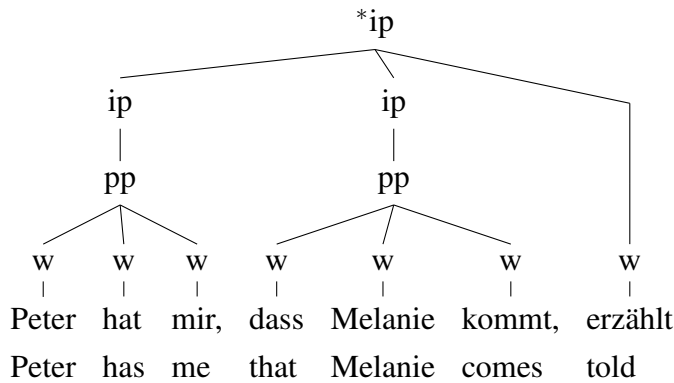
(Hartmann, 2013:452)

According to *Nonrecursivity*, an *ip* should not dominate another *ip*. Even if the highest *ip* is replaced by an *utt*, the structure still violates *Exhaustivity*, because the verb *erzählt* cannot be mapped onto a *pp* of its own. It represents a remnant, which is dominated directly by an *ip*, without a *pp* level.

Extraposition of the *dass*-clause results in two well-formed *ips*, because the verb can be integrated in the second *pp*, which is dominated by the first *ip*, as shown in (59).

(59)

```
                            utt
               ┌─────────────┴─────────────┐
              ip                           ip
          ┌────┴────┐                       │
         pp         pp                      pp
          │      ┌───┼───┐           ┌───┬───┼───┐
          w      w   w   w           w   w   w
          │      │   │   │           │   │   │
        Peter  hat  mir, erzählt,  dass Melanie kommt,
        Peter  has  me   told      that Melanie comes
```
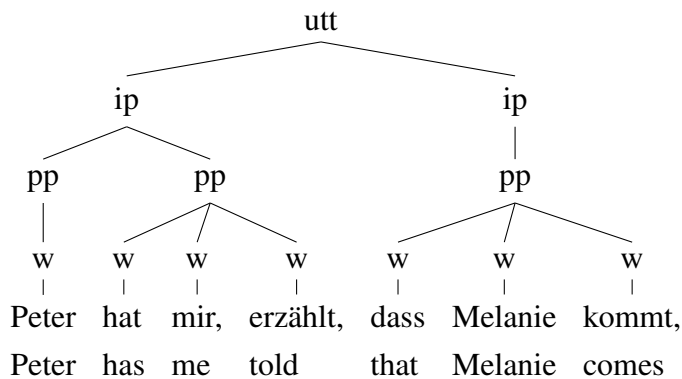
(Hartmann, 2013:452)

In conclusion, Hartmann (2013) and Féry (2015) agree that extraposition "is a result of the interaction of prosody and syntax: It is a repair strategy of a non-optimal syntax-prosody mapping" (Hartmann, 2013:469).

2.2.3 Analyses of Extraposition within Optimality Theory (OT)

Optimality Theory (Prince & Smolensky, 1993/2004; McCarthy & Prince, 1993*a,b*) is a grammatical framework which was developed mainly for phonology, but which can also be applied to other areas of grammar (for syntax, see Grimshaw, 1997 and Pesetsky, 1997). The main idea of OT is that the grammar generates a set of possible candidates which are then evaluated. The evaluation of the candidates is subject to conflicting constraints ($C_1, C_2, ..., C_n$), which are ranked in a hierarchy. The result is the optimal candidate, as illustrated in Figure 2.9.
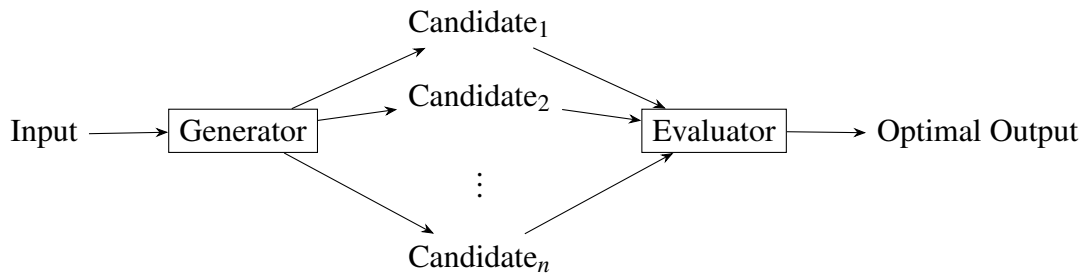
Figure 2.9: Mapping of input to output in OT grammar

An OT grammar consists of (i) the *lexicon*, which "contains lexical representations (or underlying forms) of morphemes, which form the input to" (ii) the *generator* (GEN), which "generates output candidates for some input, and submits these to" (iii) the *evaluator* (EVAL), which is "the set of ranked constraints, which evaluates output candidates as to their harmonic values, and selects the optimal candidate" (Kager, 1999:19). OT makes a number of assumptions about *constraints*, which are given in (60). Finally, the definition of *Optimality* is given in (61).

(60)   **Central assumptions about constraints in OT**

    a.   **Universality**

        Constraints are universal.

    b.   **Violability**

        Constraints can be violated.

    c.   **Ranking**

        Constraints are ranked on a language-particular basis; the notion of minimal violation (or best-satisfaction) is defined in terms of this ranking.

    d.   **Parallelism**

        Best-satisfaction of the constraint hierarchy is computed over the whole hierarchy and the whole candidate set.

    (McCarthy & Prince, 1993*b*:6; Müller, 1997:262)

(61)   **Optimality**

    An output is 'optimal' when it incurs the least serious violations of a set of constraints, taking into account their hierarchical ranking.

    (Kager, 1999:13)

Féry (2015) proposes an OT account of PP and clause extraposition in German. The assumption is that the syntax, following inviolable syntactic constraints, offers a number of possible linearizations of PPs and clauses, two of which are of concern here: adjacent and extraposed constituent orderings. Synactic and prosodic constraints, however, both play a role in the choice of the final output candidate. Thus, hierarchically ranked constraints of prosodic well-formedness now come into play.

In the case of RC extraposition, a number of constraints of prosodic well-formedness are of concern, four of which have been introduced above: *Layeredness*, *Non-Recursivity*, *Headedness* and *Exhaustivity*. Three further constraints are of relevance; their definitions are given below.

(62)   MINIMALBINARITY (Selkirk, 2000)

A prosodic constituent dominates at least two prosodic constituents of the next lower level.

(63)   EQUALSISTERS (Myrberg, 2013:75)

Sister nodes in prosodic structure are instantiations of the same prosodic category.

(64)   ADJACENCY

A relative clause or a possessive attributive is adjacent to its antecedent.

For sentences with RC extraposition, such as the example sentence in (51), here repeated as (65) for convenience, the four most relevant constraints are LAYEREDNESS, EQUALSISTERS, ADJACENCY, and MINIMALBINARITY. All of these constraints are violable. Féry (2015) assumes that LAYEREDNESS is ranked higher than the other three constraints, stating, however, that this ranking is preliminary.

(65)   a.   [(Sie hat ihre Mutter **getroffen**)$_\Phi$]$_\iota$ [die   an dem Tag mit   Freunden
            She has her   mother met   who on this day with friends
            unterwegs   war]$_\iota$.
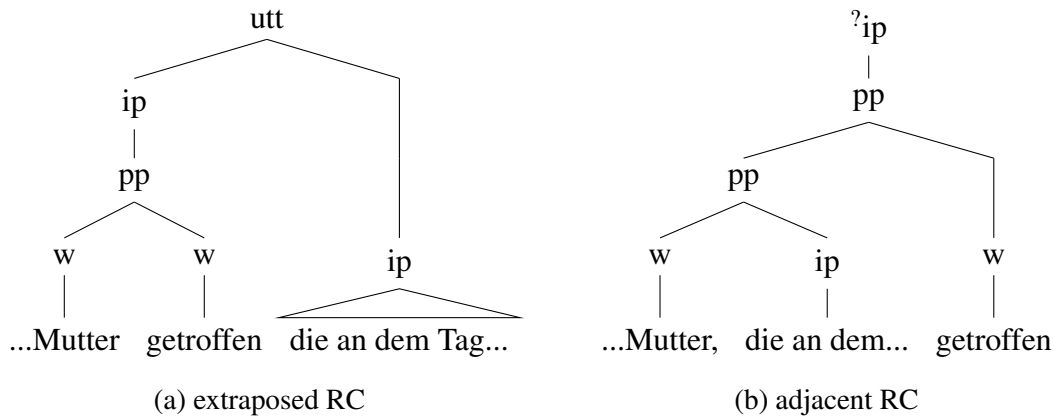   out and about was

       b.   ? [(Sie hat ihre Mutter [die   an dem Tag mit   Freunden unterwegs
            She has her   mother   who on this day with friends   out and about
            war]$_\iota$ **getroffen**)$_\Phi$].
            was   met
            'She met her mother who was out with friends on that day.'

The OT tableau in Figure 2.10 shows the adjacent and extraposed linearizations of the sentence given in (65). The optimal candidate is marked by the pointing finger.

RC extraposition	LAYERED	EQSIS	ADJ	MINBIN
☞ a. Ex: ...ihre Mutter getroffen, die...			*	
b. Adj: ...ihre Mutter, die..., getroffen	*!	**		

Figure 2.10: OT tableau for RC extraposition (Féry, 2015:31)

The extraposed version violates ADJACENCY.   The adjacent version violates LAYEREDNESS, as the Φ-phrase of the VP dominates the higher level ι-phrase of the RC, and it violates EQUALSISTERS twice: the Φ-phrase of the VP dominates a Φ-phrase and a ω-word, and the Φ-phrase of the DP dominates a Φ-phrase and a ι-phrase. The violation of LAYEREDNESS marks a *crucial* violation (marked by the exclamation mark),

which means that the candidate cannot be the optimal candidate, even if other candidates caused more violations of other constraints. Féry (2015) remarks that the adjacent version is still a grammatical option, which might be due to the influence of other constraints, such as NOINTERVENER. While both options are grammatical, the optimal candidate indicates which version should be preferred according to the constraints applied.

While LAYEREDNESS is crucially violated in RC extraposition, it is not violated in PP extraposition, as in sentences with adjacent PPs, no lower level prosodic phrase dominates a higher level one. MINIMALBINARITY does not play a role as a constraint in PP extraposition, therefore, the four relevant constraints are LAYEREDNESS, EQUALSISTERS, ADJACENCY, and finally, NON-RECURSIVITY. Féry (2015) assumes that ADJACENCY and NON-RECURSITIVITY are ranked equally in the hierarchy.

The tableau in Figure 2.11 shows the adjacent and extraposed versions of the sentence in (53), here repeated as (66) for convenience.

(66)   a.   [(Maria)$_\Phi$ (wollte (das Kleid)$_\Phi$ tragen)$_\Phi$ (von ihrer Mutter)$_\Phi$]$_\iota$.
       Maria   wanted the dress   wear   of   her   mother

     b.   [(Maria)$_\Phi$ (wollte (das Kleid (von ihrer Mutter)$_\Phi$)$_\Phi$ tragen)$_\Phi$]$_\iota$.
       Maria   wanted the dress of   her   mother   wear
       'Maria wanted to wear her mother's dress.'

When the PP is extraposed out of the NP, the constraint of ADJACENCY is violated. When the PP is adjacent to the head noun, NON-RECURSIVITY is violated. Since both constraints are ranked equally, both candidates are optimal, explaining why PP extraposition is always optional.

PP extraposition out of NP	LAYERED	EQSIS	ADJ	NORECURS
☞ a. Ex: ...das Kleid tragen von ihrer Mutter			*	
☞ b. Adj: ...das Kleid von ihrer Mutter tragen				*

Figure 2.11: OT tableau for PP extraposition out of NP (Féry, 2015:33)

Féry (2015) concludes that while planning an utterance, a speaker attempts to avoid violations of prosodic well-formedness. If certain constraints would be violated in a crucial way by one given candidate, a speaker would produce an alternative. In the case of PP extraposition out of NP in German, both candidates are optimal, so the speaker has the choice between both options. Thus, prosody plays an important role in RC extraposition, however other aspects, such as information structure, have an influence as well.

Göbbel (2007) proposes an OT account for PP extraposition in English, which is further developed in Göbbel (2013*a,b*).[16] Similarly to Hartmann (2013) and Féry (2015), Göbbel (2007) claims that the "complexity of the NP has a direct effect on the prosodic phrasing of the utterance and phonological interface constraints are responsible for the

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[16]Göbbel (2013*a*) focusses mainly on extraposition of defocused and light PPs; Göbbel (2013*b*) investigates extraposition of RCs.

optional adjustment of syntactic structure at PF." His account is for extraposition of PPs in neutral contexts, and apart from the MINIMALBINARITY constraint which is also applied by Féry (2015), two other constraints are of concern here: ALIGNXP and PH=PPH.

(67) ALIGN-XP (XP, R; PPh, R)

The right edge of any lexical XP in syntactic structure must be aligned with the right edge of a phonological phrase (PPh) in prosodic structure.

(68) PH[ASE]=PPH

   a. A Spell-Out Domain corresponds to a PPh, or

   b. All lexical terminals spelled out on a syntactic cycle form a PPh.

Göbbel (2007) assumes that the output of Spell-Out looks as in (69). The structure and phrasing of Spell-Out is the input of GEN, which generates the candidates to be evaluated, listed in (70). Göbbel (2007) claims that the complex NP provided by the syntax forms such a big PPh that it has to be broken up. The result is a number of candidates that offer alternatives to the big PPh version of Spell-Out.

(69) **Output of Spell-Out**

(You'll find a review of Turner in your in-tray)

(70) **Candidates generated by GEN**

   a. (You'll find a review of Turner in your in-tray)

   b. (You'll find a review of Turner) (in your in-tray)

   c. (You'll find a review in your in-tray) (of Turner)

   d. (You'll find a review) (in your in-tray) (of Turner)

The two nPs of the sentence want to be aligned with a PPh boundary. When the constraints are ranked ALIGN-XP » PH[ASE]=PPH, a PPh boundary will be forced after the complex object, as shown in (71). Since each nP that is not aligned with a PPh boundary causes a violation of ALIGN-XP, two violations will occur when two nPs are not aligning with a PPh boundary.

(71)   a. You'll [$_{VP}$ find a [$_{NP}$ review of [$_{NP}$ Turner]] in your in-tray]

    b. (You'll find a review of Turner) (in your in-tray)

If the ranking is PH[ASE]=PPH » ALIGN-XP, a structure with an extraposed PP (e.g. (72)) would be preferred, as the v*P phase would correspond to a PPh, thus satisfying PH[ASE]=PPH.

(72)   a. You'll [$_{VP}$ find a [$_{NP}$ review] in your in-tray] of Turner.

    b. (You'll find a review in your in-tray) (of Turner)

The two tableaux in Figures 2.12 and 2.13 show the optimal candidates according to the different rankings of the ALIGN-XP and PH[ASE]=PPH constraints. Göbbel (2013*b*) assumes that the constraints ALIGN-XP and PH[ASE]=PPH are freely ranked, thus accounting for the optionality of extraposition.

you'll find a review of Turner in your in-tray	ALIGN-XP	PH=PPH	MINBIN
a. (you'll find a review of Turner in your in-tray	*!*		
☞ b. (you'll find a review of Turner) (in your in-tray)		*	*
c. (you'll find a review in your in-tray) (of Turner)	*!		*
d. (you'll find a review) (in your in-tray) (of Turner)		*	**!

Figure 2.12: OT tableau of PP-EX out of NP in English (ALIGN-XP » PH[ASE]=PPH)
(Göbbel, 2013*b*:86)

you'll find a review of Turner in your in-tray	PH=PPH	ALIGN-XP	MINBIN
a. (you'll find a review of Turner in your in-tray		**!	
b. (you'll find a review of Turner) (in your in-tray)	*!		*
☞ c. (you'll find a review in your in-tray) (of Turner)		*	*
d. (you'll find a review) (in your in-tray) (of Turner)	*!		**

Figure 2.13: OT tableau of PP-EX out of NP in English (PH[ASE]=PPH » ALIGN-XP)
(Göbbel, 2013*b*:86)

2.2.4 Empirical Evidence for the Role of Prosody in Extraposition

Apart from theoretical approaches to the influence of prosody on extraposition, a number
of studies have conducted experiments, providing empirical evidence for the role of
prosody in constituent ordering.

Poschmann & Wagner (2016) investigated RC extraposition in German. In their
production experiment they looked at both appositive and restrictive RC types, and their
interaction with focus. In their experimental design, participants heard a pre-recorded
question, and then had to read out an answer that was given to them. Afterwards, they
had to judge how natural their answer felt to the particular question on a scale from
1 (completely unnatural) to 7 (completely natural). The pre-recorded questions were
manipulated with regard to the discourse context so that the answer either had Wide,
Subject, or Object focus, as in the examples given in (73).

(73) **Focus Contexts**

    a. Wide Focus

       War die Wanderung schwierig?
       was the hike   difficult

       'Was the hike difficult?'

    b. Subject Focus

       Wer hat das Riemannhaus erreicht?
       who has the Riemann house reached

       'Who reached the Riemann house?'

    c. Object Focus

       Welches Ziel hat der/jeder Wanderer erreicht?
       which   goal has the/every hiker   reached

'Which goal did the/every hiker reach?'

The responses that the participants had to give had two factors, (i) type of relative clause (appositive RCs (ARC) vs. restrictive RCs (RRC)), and (ii) position of the RC (extraposed vs. adjacent). The quantifier *jeder* 'every' in the head of the RC assured its restrictive interpretation, while the discourse particle *ja* 'as you know' forced an appositive reading. Examples for all four conditions are given in (74) and (75).

(74) **Answers with ARCs**

    a. Adjacent

        (Nein,) der Wanderer, der ja Schneeschuhe trug, hat das
        no the hiker who PART snow shoes was wearing has the
        Riemannhaus erreicht.
        Riemannhaus reached

        'No, the hiker, who was wearing snow shows, has reached the Riemannhaus.'

    b. Extraposed

        (Nein,) der Wanderer hat das Riemannhaus erreicht, der ja
        no the hiker has the Riemannhaus reached who PART
        Schneeschuhe trug.
        snow shoes was wearing

        'No, the hiker has reached the Riemann house, who was wearing snow shoes.'

(75) **Answers with RRCs**

    a. Adjacent

        (Nein,) jeder Wanderer, der Schneeschuhe trug, hat das
        no every hiker who snow shoes was wearing has the
        Riemannhaus erreicht.
        Riemannhaus reached

        'No, every hiker who was wearing snow shows has reached the Riemannhaus.'

    b. Extraposed

        (Nein,) jeder Wanderer hat das Riemannhaus erreicht, der Schneeschuhe
        no every hiker has the Riemannhaus reached who snow shoes
        trug.
        was wearing

        'No, every hiker has reached the Riemann house, who was wearing snow shoes.'

Poschmann & Wagner (2016) analysed the prosodic prominence of the RC and the VP. The results showed that, compared to answers with object focus or wide focus, answers with subject focus featured a lower prominence on the VP. For extraposed RCs, the

accentuation rate of the VP was significantly lower, indicating that speakers rather avoid having any accented material intervening between the head and the RC.

In the judgement task, adjacent RCs were overall rated higher than extraposed RCs, and wide focus had higher ratings than object focus. There was no effect for subject focus vs. object focus or wide focus. However, extraposed sentences were rated better when the subject was focussed.[17] The type of RC showed no effect in the ratings.[18]

Poschmann & Wagner (2016) conclude that speakers avoid producing accented material intervening between the head and the RC. Accented intervening material also had lower ratings in the judgement task and extraposed RCs were rated higher when the intervening material was unaccented. Thus, prosodic properties of the intervening material seem to have an influence on the acceptability of the intervening material, and, therefore, on the distance between the head and the extraposed constituent.

Bader (2015) investigated the influence of prosody on ambiguous antecedent resolution with regard to extraposed RCs in German, for which there were two possible antecedent NPs. The expectation is that the second NP will be the preferred construal site, as it is parsed more recently. In German, the sentence accent falls by default on the constituent that is directly preceding the clause-final verb. The question asked was if the first NP can be made more accessible as a construal site on first-pass parsing when it is stressed.

Bader (2015) tested sentences in which the second NP (the object NP) carried the sentence stress by default, in order to confirm the hypothesis that the second NP is indeed the preferred construal site for an extraposed RC. An example is given in (76).

(76) **Without focus particle**

a. Object RC

Der Direktor wunderte sich darüber, dass die Professorin einige
The director wondered himself about that the professor some
Studenten besucht hat, die letzte Woche krank waren.
students visited has who last week sick were

'The director was surprised that the professor visited some students who were sick last week.'

b. Subject RC

Der Direktor wunderte sich darüber, dass die Professorin einige
The director wondered himself about that the professor some
Studenten besucht hat, die letzte Woche krank war.
students visited has who last week sick was

---

[17]Poschmann & Wagner (2016) note that a number of earlier studies (Lötscher, 1972; Guéron, 1980; Culicover & Rochemont, 1990; Maynell, 2008) propose that extraposition is more acceptable when the head NP is in focus.

[18]Similarly, Schubö & Féry (2015) found that prosodic differences in RC types only occur when speakers actively choose to distinguish between the types due to contextual reasons.

'The director was surprised that the professor who was sick last week visited some students.'

In a second condition, sentences were tested which included the focus particle *gerade* 'just' so that the first NP (the subject NP) was stressed. Importantly, it is the *determiner* of the first NP that has to be stressed in order to license an extraposed RC. If the stress is on the noun, the extraposed RC is not licensed. Bader (1998) found that it is more likely that a word directly following a focus particle will be stressed when the focus particle "ends in one or more unstressed syllables" (Bader, 2015:200), as is the case with *gerade*. However, there is no guarantee that participants read the determiner as stressed, and not the noun. An example of the sentences with focus particle is given in (77).

(77)   **With focus particle**

   a. Object RC

   Der Direktor wunderte sich   darüber, dass gerade die Professorin einige
   The director wondered himself about   that just   the professor   some
   Studenten besucht hat, die letzte Woche krank waren.
   students   visited has who last   week   sick   were

   'The director was surprised that just the professor visited some students who were sick last week.'

   b. Subject RC

   Der Direktor wunderte sich   darüber, dass gerade die Professorin einige
   The director wondered himself about   that just   the professor   some
   Studenten besucht hat, die letzte Woche krank war.
   students   visited has who last   week   sick   was

   'The director was surprised that just the professor who was sick last week visited some students.'

The material was tested in both a self-paced reading task as well as in end-of-sentence speeded grammaticality judgements.[19] The results showed that sentences in which the second NP (object NP) was the antecedent of the RC were indeed easier to process than sentences in which the first NP (subject NP) was the antecedent. With an added focus particle in front of the subject NP, processing of sentences with the subject NP as the antecedent was facilitated, however, sentences with object-modifying RCs still did better overall. These findings may not be surprising. They are compatible with the *Recency Preference Principle* proposed by Gibson et al. (1996), given in (78), as well as with the *Focus Attraction Hypothesis* (Schafer et al., 1996), given in (79).

(78)   *Recency Preference Principle*
   Preferentially attach structures for incoming lexical items to structures built more recently.

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[19]In end-of-sentence speeded grammaticality judgements, participants have to read sentences on a computer screen and judge the grammaticality of each sentence as quickly and accurately as possible.

(79) *Focus Attraction Hypothesis*

It is more likely that a phrase that is neither a complement nor syntactically obligatory will be taken to modify a phrase P if P is focused than if it is not, grammatical and pragmatic constraints permitting.

In another experiment, Bader (2015) tested whether the acceptability of subject-modifying extraposed RCs can be increased when the subject noun is focussed by the determiner *diejenige* rather than a focus particle in front of the standard definite determiner. In a sentence such as (80) (Bader, 2015:206), the determiner *diejenige* causes an expectation for an upcoming RC, as the sentence would sound odd without a modifying element.[20] Moreover, the determiner *diejenige* will also be stressed, ensuring that the noun ('swimmer') is interpreted as belonging to a set of similar entities, thus calling for a specifying modification in the form of an RC.

(80) Ich glaube, dass diejenige Schwimmerin gewinnen wird, die am meisten
I   believe that that one swimmer   win   will who at most
trainiert.
exercises

'I believe that that swimmer will win that exercises most.'

In an end-of-sentence speeded grammaticality judgement, sentences with a focus particle, as in (77), were compared to sentences with the determiner *diejenige*, as in the example given in (81).

(81) **Determiner *diejenige***

a. Object RC

Der Direktor wunderte sich   darüber, dass diejenige Professorin einige
The director wondered himself about   that that one professor   some
Studenten besucht hat, die letzte Woche krank waren.
students   visited has who last   week   sick   were

'The director was surprised that that professor visited some students who were sick last week.'

b. Subject RC

Der Direktor wunderte sich   darüber, dass diejenige Professorin einige
The director wondered himself about   that that one professor   some
Studenten besucht hat, die letzte Woche krank war.
students   visited has who last   week   sick   was

'The director was surprised that that professor who was sick last week visited some students.'

---

[20]In their study about RC extraposition in English, Levy et al. (2012) found that processing difficulty of extraposed RCs can be "modulated and even neutralized" when sentences are manipulated in such way that participants *expect* a postmodifying RC to occur after a given noun.

The results showed that, overall, extraposed RCs were more difficult to comprehend when the construal site was the subject NP and an object NP was intervening. Comprehension could be facilitated somewhat when the subject NP was focussed. While adding the focus particle *gerade* increased ratings slightly, sentences with a subject-modifying RC were judged better than sentences with an object-modifying RC when they featured the determiner *diejenige*.

In conclusion, prosody had an influence on the processing complexity of extraposed RCs, as a stressed subject NP facilitated comprehension of a subject-modifying extraposed RC. The stress on the subject NP also meant that the intervening object NP was unaccented. This finding is compatible with prosodic accounts of RC extraposition, such as Féry's (2015) proposal, which introduces the NOINTERVENER constraint, and states that an accented full XP intervening between the antecedent and extraposed RC will decrease the acceptability of extraposition.

2.3 Discourse-Pragmatic Factors

Apart from syntactic and phonological theories about extraposition, there are also approaches which are concerned with the discourse-pragmatic factors that may influence or trigger extraposition. Such factors are, for example, the focussing of constituents, or the difference between new and "important" information versus old or "less important" information. So-called "stylistic factors" are part of this category, too. Representatives of this approach are Shannon (1992), Marillier (1993) and Maynell (2008).

The influence of information status on word order and choice of sentence structure has been recognized by many researchers, and evidence for such influence was found in a number of languages (Firbas, 1966; Chafe, 1976, 1994; Gundel, 1988; Vallduvi, 1990; Prince, 1992; Gundel et al., 1993; Birner & Ward, 1998). In the literature about information structure, many notions as to how information in discourse is represented in speakers' and hearers' minds have been proposed. Some of the terms that have been suggested to account for informational distinctions are "topic" vs. "comment" (Hockett, 1958), "focus" vs. "presupposition" (Chomsky, 1970) and "theme" vs. "rheme" (Firbas, 1966). Some have concentrated on the distinction between " old/given" vs. "new" and the accessibility of information to the speakers and hearers during discourse (Clark & Clark, 1977; Clark & Haviland, 1977; Halliday, 1967; Prince, 1981; for a unified theory of information structure, e.g. Lambrecht, 1994). While "new" information is always less accessible, the accessibility of "given" information varies. One of the many factors that influence the accessibility of "given" information is, for example, how recent a given information has been last mentioned in the discourse. A number of accounts have been proposed which consider this "continuum of accessibility" (Ariel, 1990; Arnold, 1998; Birner, 1998; Birner & Ward, 1998; Gundel et al., 1993).

2.3.1 The Influence of Focus and Discourse Status

Focus has been found to influence constituent ordering within a sentence in a number of studies (see Guasti & Nespor, 1999; Zubizarreta, 1998; Reinhart, 1995). Guasti & Nespor (1999) remark that "heaviness" can also be defined in terms of focus. Thus, "heaviness" can not only be measured by the number of phonological phrases, but also by the accentuation of a constituent. Similar to the preference for producing long and heavy elements after short and light ones, stressed and prosodically heavy elements are preferably produced after unstressed and prosodically light ones. This results in the focussed constituent occupying the most prominent position within the sentence, which is usually the most rightward positioned phonological phrase (cf. Hayes & Lahiri, 1991). Marillier (1993) concludes that focus is a deciding factor in RC extraposition. With reference to Beneš (1979), he remarks that one of the functions of extraposition is "to signal the higher communicative value of an element" (Marillier, 1993:229).

A number of studies on discourse-pragmatic factors have found evidence for a preference to extrapose relative clauses when they give new, contrastive or important information, while the VP gives old or background information (Rochemont & Culicover, 1990; Huck & Na, 1990, 1992; Shannon, 1995; Takami, 1999; Kuno & Takami, 2004). The tendency of focussed constituents to appear later in the sentence than constituents that give old or background information, might indicate that speakers use constituent order to mark the discourse status of constituents. However, in discourse, a lot of factors come into play. While in unmarked cases focussed constituents are realized after background information in German (cf. Jacobs, 1988), speakers might choose consciously to produce focussed material left of the right bracket. This is the case, because the postfield, and therefore the end of the sentence, is often overlapped by another speaker taking their turn (cf. Uhmann, 1997).

Lötscher (1972) investigated the influence of sentence stress on the extraposition of RCs in German in a corpus study. He found that the options for different positions of RCs were limited, which would also result in differences for restrictive and appositive RCs. Since appositive RCs already carry stress, they can only be extraposed if their antecedent is accentuated. According to Lötscher, this is only the case when the antecedent is positioned at the right edge of the middlefield. Restrictive RCs, on the other hand, can also be extraposed if the antecedent does not carry stress, as long as the restrictive RC is accentuated. In general, RCs can always be adjacent, independently of stress.

2.3.1.1 Empirical Evidence from Corpus Studies

In his corpus study, Shannon (1992) found that extraposition mostly occurs when the head noun is indefinite and stressed, as well as positioned at the right edge of the middlefield. According to Shannon, this can be summarized as meaning that the head noun has to be focussed. In order to be focussed, the head noun has to carry new or important information and has to be the rheme of the sentence (cf. Konopka, 2006). Additionally, it should be positioned as close to the right edge of the middlefield as possible. Therefore,

extraposition should not be possible out of the prefield. Shannon (1992) also concludes that there should be no explicit difference between the extraposition of restricted or appositive RCs. Furthermore, structural factors, such as length or grammatical function, are supposed to be only secondary, as they simply correlate with focus. Shannon argues that focussed constituents are usually longer, so increased length of extraposed constituents is simply a side effect of focus. Moreover, the observation that the head noun of extraposed RCs is more often an object than a subject is due to the object occurring in focussed position more often than the subject, which is mostly the theme of the sentence and, therefore, not focussed. Only if the subject carries the sentence stress (e.g. due to contrastive focus) is it possible for the subject to be the antecedent of an extraposed RC. According to Shannon (1992:273), all RC extraposition is due to focus factors:

> All RCE [relative clause extraposition] is focus extraposition. The only difference is that certain elements are normally not good candidates for focus, unless they receive heavy contrastive stress; but this should not disguise the fact that the antecedent of RCE is the focus in all instances.

Shannon (1992) remarks that focussed elements always carry new and important information, meaning that they are prominent and easily receive the attention of the hearer. Therefore, it poses no problem that an extraposed RC, which carries additional new information with regard to its head has to be integrated with a certain delay. Its antecedent will still be prominent when the RC arrives in the sentence structure. Extraposition, in this case, emphasizes the new and important information, which, according to Shannon, has a pragmatic advantage. From a processing point of view, the prominence of the head means that it will remain activated for a longer period, therefore, facilitating processing and integration of the extraposed constituent later on in the sentence. The fact that information of the head is still active in working memory helps connecting both elements. According to Shannon, the head noun always occurs at the right edge of the middlefield, which guarantees that no other NP can intervene between head and dependent. This prevents any kind of ambiguity as to where the extraposed constituent should be attached.

Miller (2001) investigated *it*-extraposition of sentential subjects (as shown in (82)) and infinitival clauses (as shown in (83)) in a corpus study.

(82) a. [That a bloodthirsty, cruel capitalist should be such a graceful fellow] was a shock to me.

b. It was a shock to me [that a bloodthirsty, cruel capitalist should be such a graceful fellow].

(Miller, 2001:683)

(83) a. Yet [to determine precisely to what extent and exactly in what ways any individual showed the effects of Christianity] would be impossible.

    b. Yet it would be impossible [to determine precisely to what extent and exactly in what ways any individual showed the effects of Christianity].

   (Miller, 2001:684)

Miller (2001) concludes that if the potentially extraposed constituent repeats information that has been given previously in the discourse, it will remain in adjacent position. If the constituent contains information that will be elaborated on in the on-going discourse, however, it will be extraposed. This is meant to keep the discourse coherent.

2.3.1.2 Theoretical Approaches

Huck & Na (1990) formulated a theory of focus, which is mainly derived from work by Schmerling (1976), Selkirk (1984) and Rochemont (1986). They assume that focus assignment to syntactic structures follows the rules presented in (84):

(84) **Focus Assignment** (Huck & Na, 1990:55)

    a. A constituent to which stress is assigned is a focus (Selkirk, 1984:207)

    b. A constituent may be a focus if either (i) or (ii) is true, or if both are true:

       i. the constituent that is its head is a focus;

      ii. a constituent contained within it that is an argument of the head is a focus (Selkirk, 1984:207)

    c. A constituent which has been extraposed from NP is necessarily focussed (Rochemont, 1986:110)

Huck & Na (1990) argue that the rules in (84) can explain some of the more problematic observations, such as the extraposition out of NP in English. In English, sentences in which a constituent is extraposed out of an indefinite NP are absolutely acceptable, but if the constituent is extraposed out of a definite NP instead, they become unacceptable. This phenomenon is known as the *definiteness restriction*. Walker (2013) found empirical evidence for the definiteness restriction in English RC extraposition, using the method of thermometer judgements (Featherston, 2007). She also found an interaction between the definiteness restriction and the predicate restriction, which states that the main verb of the sentence should preferably be a verb of appearance. Walker (2013) concludes that both definiteness restriction and predicate restriction are actually *soft constraints* (cf. Keller, 2000; Sorace & Keller, 2005) on RC extraposition in English. Ziv & Cole (1974) found this restriction in the sentences shown in (85):

(85)   a.   A guy that I met at Treno's yesterday just came in.

       b.   A guy just came in that I met at Treno's yesterday.

       c.   The guy that I met at Treno's yesterday just came in.

       d. ?? The guy just came in that I met at Treno's yesterday.

   (Ziv & Cole, 1974)

In sentences (85a) and (85c), the RC *that I met at Treno's yesterday* is adjacent to the head noun *guy*. In adjacent position both an indefinite and definite NP are perfectly acceptable. In (85b), the RC is extraposed, but the head noun is part of the indefinite NP *a guy*. The problematic sentence is the one in (85d). Here the RC is extraposed out of a definite NP (*the guy*). Guéron & May (1984) found the same restriction in a similar construction, shown in (86):

(86)   a.   I read a book during the vacation which was written by Chomsky.

   b.   * I read that book during the vacation which was written by Chomsky.
   (Guéron & May, 1984)

Guéron & May (1984) argue that there is a LF rule that moves quantified NPs, but not demonstrative and certain definite NPs to S-adjoined position. In this case, the demonstrative object NP *that book* in (86b) is not moved, and will therefore not govern the extraposed RC. Thus, the structural relationship between head and extraposed constituent is not proper and results in an ungrammatical sentence. Huck & Na (1990:53f), however, claim that both of the problematic sentences above are actually fully acceptable when "an element of the extraposed clause is stressed in a contrastive context." Thus, if a speaker was talking about two guys he expects to walk in any moment, and one of them he met at Treno's yesterday, and the other one he met somewhere else, e.g. at Andrea's, he could utter the sentence shown in (87) , with a stress on TRENO'S:

(87)   The guy just came in that I met at TRENO'S yesterday.

   (Huck & Na, 1990:54)

Similarly, a seemingly unacceptable sentence as in (86b), can be fully acceptable if an element of the extraposed clause is stressed, and if the sentence is uttered in a felicitous context, as shown in (89):

(88)   Did you read the book by Simpson we were assigned over the vacation?

(89)   No, but I read that book during the vacation which was written by CHOMSKY.

   (Huck & Na, 1990:54)

Huck & Na (1990) therefore argue that the definite NP has to be given in the discourse, and since the extraposed constituent, e.g. the RC, should be congruent with the information status of its head NP, the RC should likewise contain information that is given in the discourse. Under these circumstances, according to Huck & Na (1990), extraposition of RCs out of NP is acceptable.

   Maynell (2008) points out some problems with Huck & Na's (1990) analysis. Their claim that some element within the extraposed phrase has to be stressed in a contrastive focus is challenged by sentences, such as the one in (91):

(90)   Did a guy come in here who was holding a duck?

(91)   No, but a GIRL came in here who was holding a duck.

        (Huck & Na, 1990:58-59)

The contrast is provided for by the nouns *guy* and *girl* with a pitch accent on the latter.
Huck & Na (1990) attempt to fix this by adding a qualification to their rule, which states
that, in cases where there is a focus somewhere else in the sentence, there need not
be one in the extraposed phrase. Furthermore, Maynell (2008) demonstrates that the
extraposed RC does not have to contain discourse-given information, but rather it can
convey information that is new to the discourse. The information given in the RC in
sentence (93) is new to Speaker A.:

(92)   *Speaker A*: Weren't there five bottles on that shelf when I was here the other day?

(93)   *Speaker B*: Yeah, but during the earthquake, the TWO fell to the GROUND that
        were CLOSEST to the EDGE.

        (Maynell, 2008:120)

Maynell (2008) argues that extraposed RCs serve a discourse function: they answer the
"immediate (local) question under discussion" (IQUD) (Maynell, 2008, cf. Roberts,
1996)[21]. The *immediate question under discussion* (IQUD) is the question that occurred
last in the discourse. Crucially, this has not to be an explicit question. It can be a question
that derives from the context. With regard to this IQUD, the information conveyed in the
RC has to be new. If this is the case, the RC may be extraposed, but it does not have to
be.

De Kuthy (2000) investigated discontinuous NPs in German. With regard to the
NP-PP split in German, de Kuthy concludes that splitting an NP and the PP that modifies
it, is acceptable as long as their information status is different. Thus, if one of the phrases
contains new information, the other one has to contain background information. This
seems to contradict the statements from Maynell (2008) and Huck & Na (1990) who
agreed that the head and the extraposed constituent have to match with regard to their
information status. However, De Kuthy (2000) argues that extraposition and the NP-PP
split are two distinct linguistic phenomenons, and should not be analyzed the same way.
She points out that a PP modifying an NP can be extraposed by itself, but the NP cannot
be extraposed without the PP, as shown in (94) and (95):

(94)   a.   Er hat ein Buch ausgeliehen über Syntax.
              He has a   book borrowed   about syntax

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[21]Maynell (2008) adopts the theory of information structure in discourse formulated by Roberts (1996).
In Roberts's (1996) theory, "discourse is modelled as a series of questions and answers to those questions.
Her theory defines a *question under discussion* (QUD) as well as an *immediate question under discussion*
(IQUD)." The QUD "is defined as a function from the set of questions and answers that make up a discourse
to ordered subsets of accepted questions. When a question is asked and accepted, that question is added to an
ordered QUD stack. This question stays on the stack until it is answered, or until it is deemed unanswerable
by the speakers. If a subquestion of the first question is asked, it is also added to the stack." (Maynell,
2008:124). The RC has to be new with regard to the IQUD, and, therefore, should answer it. However, it
does have to answer the QUD.

b. * Er hat über Syntax ausgeliehen ein Buch.
He has about syntax borrowed a book
'He borrowed a book about syntax.'

(95) a. Es wurden einige Sonaten gespielt aus dem 17. Jahrhundert.
There were some sonatas played from the 17th century

b. * Es wurden aus dem 17. Jahrhundert gespielt einige Sonaten.
There were from the 17th century played some sonatas
There was some sonatas from the 17th century played.'

(De Kuthy, 2000:11)

De Kuthy (2000:12) concludes that extraposition out of NP must be "a different phenomenon than fronting of NP dependents or linearization in the *Mittelfeld*."

Discourse-pragmatic factors are often able to account for preferences for constructions which seem to be unacceptable from a structural point of view. Exceptions from the rule seem to be possible, for example when a speaker wants to express a specific communicative intention. It is possible that such a construction is only acceptable depending on a felicitous context. Thus, factors, such as focus, information status, and discourse context all can influence constituent ordering.

Chapter 3

Extraposition from a Processing Perspective

This thesis focuses on extraposition from a processing perspective. Two key factors under investigation are heaviness of the extraposed constituent and extraposition distance (also known as *locality*). The assumption that the weight of the extraposed constituent and the length of the intervening material are two main factors of extraposition was first made based on findings from a small corpus study on *Heavy NP Shift* in English conducted by Hawkins (1994), which suggested that the tendency to "shift" is dependent on the "relative weight" of *both* phrases, and not just the one that is shifted. Evidence that supports the assumption that it is the relative length of phrases that matters comes from corpus studies (Hawkins, 1994; Wasow, 1997*a*), acceptability judgements (Wasow & Arnold, 2003), and production studies (Stallings & MacDonald, 2011).

The two main representatives of locality-based approaches are Hawkins (1994, 2004) and Gibson (1998, 2000). The Early Immediate Constituents (EIC) proposal by Hawkins (1994, 2004, 2014) and the Dependency Locality Theory (DLT) by Gibson (2000) both assume that there must be higher processing costs associated with working memory when two constituents have to be connected over a long distance. While both theories make similar predictions in a number of cases, they also differ in some respects. Crucially, they take different approaches in measuring the distance between two dependent elements. Within the DLT, distance is measured by the number of new discourse referents in the intervening material; within the EIC, it is the number of words needed to construct the mother node and its immediate constituents that has to be considered. The two theories will be introduced in detail in Sections 3.1 and 3.2.

There are a number of accounts which challenge locality-based accounts. In Section 3.3 accounts such as the *Anticipation Hypothesis* and *Surprisal Hypothesis* (3.3.1) will be introduced and put into context with locality-based accounts. Empirical evidence concerned with the comparison of locality-based and expectation-based accounts of processing complexity will be discussed in Section 3.3.2.

Relevant factors proposed by processing approaches to extraposition will be discussed

in Section 3.4. It seems important to explain in more detail some of the key ideas which are not only important for a better understanding of theories discussed in this chapter, but which are also highly relevant for my own experimental work. Therefore, there will be separate sections for the notions of "heaviness" (Section 3.4.1) and "distance" (Section 3.4.2).

The research questions addressed in this thesis are presented in Section 3.5.

3.1   Hawkins' *Early Immediate Constituents Proposal* (EIC)

The basic assumption behind the EIC 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 (96):

(96)   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]]

In both example sentences in (96), when the verb *gave* is encountered the parser knows to expect a VP. In (96a) the ICs of that VP, namely V, PP and NP are only recognized once the parser arrives at the preposition *to*. Thus, out of the twelve words that make up the VP, eleven have to be parsed for the structure of that VP to be recognized. In (96b), on the other hand, *gave* is followed by the PP, which is a rather short two-word IC here. Due to the shortness of the PP, the first word of the NP (*the*) is parsed after four words, enabling the parser to recognize the structure of the VP already at that point in the sentence.

Importantly, Hawkins (1994) measures distance in *number of words*, a method that has been employed by many other studies (see Uszkoreit et al., 1998*b* and Gildea & Temperley, 2010 for corpus research, and Stallings & MacDonald, 2011 for a production study).[1]

3.1.1   Key Principles in Hawkins' Theory

Hawkins (2004, 2014) developed the original proposal of the EIC further into a wider and more general theory of efficiency and complexity. One of the efficiency principles

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[1]Gibson (2000) takes a different approach by measuring distance by counting the number of new discourse referents in the intervening material. Gibson's approach is discussed in detail in 3.2.

proposed within that theory is *Minimize Domains*, defined as follows:

(97) **Minimize Domains (MiD)**

The human processor prefers to minimize the connected sequences of linguistic forms and their conventionally associated syntactic and semantic properties in which relations of combination and/or dependency are processed. The degree of this preference is proportional to the number of relations whose domains can be minimized in competing sequences or structures, and to the extent of the minimization difference in each domain. (Hawkins, 2004:31)

Dependencies have played an important role since Kimball (1973).[2] In processing theories such as the EIC or Gibson's (1998, 2000) *Dependency Locality Theory*, however, the notion of *dependencies* is neither concerned with phrase structure nor with dependency grammars. Hawkins (2004) defines *dependency* as follows[3]:

(98) **Dependency (MiD)**

Two categories A and B are in a relation of dependency iff the parsing of B requires access to A for the assignment of syntactic or semantic properties to B with respect to which B is zero-specified or ambiguously or polysemously specified. (Hawkins, 2004:31)

One of the things that the principle of *Minimize Domains* predicts is that speakers should prefer to arrange constituents in such a way that domains are as short as possible, in order to ensure the fastest possible processing of any linguistic elements that hold relations within that domain. This assumption is actually part of the principle that was proposed as the EIC, defined in (99). The definition of the *Phrasal Combination Domains* (in earlier versions of this theory known as *Constituent Recognition Domains* (CRD)) is given in (100).

(99) **Early Immediate Constituents (EIC)**

The human processor prefers linear orders that minimize PCDs (by maximizing their IC-to-word ratios), in proportion to the minimization difference between competing orders. (Hawkins, 2014:12)

(100) **Phrasal Combination Domain (PCD)**

The PCD for a mother node M and its I(mmediate) C(onstituent)s consists of the smallest string of terminal elements (plus all M-dominated non-terminals over the terminals) on the basis of which the processor can construct M and its ICs. (Hawkins, 2014:12)

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[2]Theories which make use of the notion of dependencies are plentiful (see, e.g., Fodor & Frazier, 1980; Frazier, 1987; Stevenson, 1993; Vosse & Kempen, 2000; Pollard & Sag, 1987; Mel'cuk, 1987; Oehrle et al., 1988; Dik, 1989; Hudson, 1990; Radford, 1997).

[3]Hawkins (2004:31) also gives a definition for **Combination**:
"Two categories A and B are in a relation of combination iff they occur within the same mother phrase and maximal projections (phrasal combination), or if they occur within the same lexical co-occurrence frame (lexical combination)."

3.1.2 The Local Complexity Metric of the EIC

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.

The following example sentences of German RC extraposition in (101) (taken from Hawkins, 2004:137f will illustrate how IC-to-word ratios are calculated.

(101)   a. Er hat [$_{VP}$ [$_{NP}$ das Buch das der alte Professor verloren hatte] gefunden]
            He has   the book that the old professor lost   had   found

        b. Er hat [$_{VP}$ [$_{NP}$ das Buch] gefunden] [$_{NP}$ das der alte Professor verloren
            He has   the book   found   that the old professor lost
            hatte]
            had
            'He found the book yesterday that the old professor had lost.'

The IC-to-word ratios for the VP and NP are calculated by dividing the number of ICs by the number of words it takes until the last IC can be recognized. The VP consists of two ICs, namely the direct object NP (*das Buch das der alte Professor verloren hatte*), and the participial verb *gefunden*. The NP consists of three ICs, the definite determiner *das*, the noun *Buch*, and the relative clause *das der alte Professor verloren hatte*. The relative clause can be recognized at the point of parsing the relative pronoun (the second *das*). In the extraposed version of the sentence in (101b), the relative pronoun is "assumed to be discontinuously attached to NP" (Hawkins, 2004:137). In the non-extraposed version in (101a), nine words have to be processed until both ICs of the VP can be recognized, resulting in a ratio of $^2/_9$ (= 22.22%) 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 relative clause in (101b), the two ICs of the VP can be processed after only three words, resulting in a ratio of $^2/_3$ (= 66.66%) for the VP. This is an increase of 44.44%. In order to process the three ICs of the NP, however, four words have to be processed since there is now one word intervening between the noun and the relative pronoun. The ratio, therefore, goes down by 25% to $^3/_4$ (= 75%).

The structure to be preferred is the one with the maximal overall minimization of domains. The mean PCDs of the sentence are 61.11% in the non-extraposed version in (101a), and 70.83% in the extraposed relative clause version in (101b). The preference for the extraposed version is also reflected in the number of words needed to process the ICs, with twelve words in the non-extraposed version, and seven words in the extraposed one. The IC-to-word ratios for German RC extraposition calculated here are also illustrated in Table 3.1.

Table 3.1: IC-to-word ratios for German RC extraposition.

Adjacent RC											
Er hat	das	Buch	das	der	alte	Professor	verloren	hatte	gefunden	**IC/word**	
VP	1	2	3	4	5	6	7	8	9	2/9	=22.22%
NP	1	2	3							3/3	=100%
Total IC-to-word ratio										**5/12**	
Mean percentage											**61.11%**

Extraposed RC										
Er hat	das	Buch	gefunden	das	der	alte	Professor	verloren	hatte	
VP	1	2	3							2/3	=66.66%
NP	1	2	3	4						3/4	=75%
Total IC-to-word ratio										**5/7**
Mean percentage										**70.83%**

3.1.3 Empirical Evidence for the EIC

Evidence for the EIC was found in a corpus study on German relative clause extraposition by Uszkoreit et al. (1998*a*).[4] The EIC predicts that the distance of the RC to its head noun should be as short as possible. However, a long RC in adjacent position to its head noun increases the distance between head noun and verb. Therefore, a RC is expected to be extraposed when it is longer than the (then) intervening material. Uszkoreit et al. (1998*a*) found that the preferred distance of extraposition is very small (the mean distance of extraposition in the corpus was 1.6 words). It was also found that the category of the material matters as well. Extraposition was more likely over purely verbal material than over any non-verbal material. Furthermore, extraposition occurred more often when the relative clause was long (10-15 words), although extraposition distance clearly had more influence than the length of the relative clause.

Uszkoreit et al. (1998*a*) also conducted an acceptability experiment[5], in which they tested for the factors of *extraposition distance* (1-2 words, 3-4 words, and 5-7 words, illustrated in (102)) and *RC length* (3-5 words, 6-8 words, and 9-11 words, illustrated in (103)).

(102) *Extraposition distance, Uszkoreit et al. (1998*a*)*

    a. Er hat die Rose [ADJACENTRC] hingestellt [EXTRAPOSEDRC].
       He has the rose [ADJACENTRC] put down [EXTRAPOSEDRC]

    b. Er hat die Rose [ADJACENTRC] auf den Tisch gestellt [EXTRAPOSEDRC].
       He has the rose [ADJACENTRC] on the table placed [EXTRAPOSEDRC]

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[4]Uszkoreit et al. (1998*a*) used the NEGRA-corpus (Skut et al., 1997), which is made up of newspaper articles of the German newspaper "Frankfurter Rundschau."

[5]The method used was that of *magnitude estimation* (Bard et al., 1996), in which participants rate the acceptability of sentences proportionally to a given reference sentence.

    c. Er hat die Rose [ADJACENT RC] auf den kleinen runden Tisch gestellt
      He has the rose [ADJACENT RC] on the small round table placed
      [EXTRAPOSED RC].
      [EXTRAPOSED RC]
      'He placed the rose [RC]/on the table/on the small round table.'

(103) *Relative clause length, Uszkoreit et al. (1998a)*

    a. ..., die   wunderschön war.
      ..., which beautiful   was

    b. ..., die   auffällig schön   und farbenpraächtig war.
      ..., which strikingly beautiful und colourful   was

    c. ..., die   sehr schön   gewachsen und ganz-besonders prächtig war.
      ..., which very beautifully grown   and especially   splendid was
      '..., which was beautiful/strikingly beautiful and colourful/very beautifully
      grown and especially splendid.'

Extraposed sentences were rated higher when the extraposition distance was short, and the length of the RC was long. Canonical (adjacent) sentences, however, were rated higher in almost all cases. Contrary to the predictions of the EIC as well as to the findings in the corpus study, which predicted that all conditions with an extraposition distance of one word should be rated higher in the extraposed position, the results showed that this is only the case when the RC is also at least 9-11 words long.

Konieczny (2000) conducted an acceptability experiment as well as a self-paced reading task[6]. He investigated the effect of end-weight in the processing of German relative clause extraposition. The material resembled that of Uszkoreit et al. (1998*a*) shown in (102) and (103) and was used in both experiments. The findings in the acceptability judgement task were very similar to those of Uszkoreit et al. (1998*a*). 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. Otherwise, the findings fit the predictions of the EIC remarkably well.

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

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[6]In a self-paced reading experiment, sentences are presented word-by-word on a computer screen, with the participant pressing a key to prompt the next word. Times between key presses are measured, indicating the reading time for each word.

distance, so the expectation would have been that reading times become slower the longer the distance. With reference to Hemforth et al. (2000*a,b*) and Konieczny & Hemforth (2000), Konieczny suggests that the attachment of a relative pronoun of an extraposed RC is a *dualistic process*, "both syntactic and anaphoric in nature" (Konieczny, 2000:642). Thus, the binding of a relative pronoun to a discourse referent is not only dependent on the extraposition distance, but also on the discourse structure and focus aspects. The head noun stays prominent, even with an intervening PP, and is therefore easily accessible for the binding process. 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 *Dependency Locality Theory*. 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 (also known as "anti-locality", as processing seems easier for non-local structures) 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.

Konieczny (2000:644) concludes that "locality in unambiguous sentences is primarily a factor which determines word-order preferences in sentence production rather than in perception."[7] Language comprehension would therefore rely more on anticipatory processes. However, there are also studies which found locality effects in comprehension, such as Francis (2010).

Francis (2010) investigated RC extraposition in English, testing for hypotheses that were based on the *domain minimization principles* formulated by Hawkins (2004). She conducted a self-paced reading experiment, an acceptability experiment and a corpus study. For the self-paced reading task, the reading times of the whole sentence were measured, meaning that participants were shown the entire sentence on the computer screen, and they pressed a key once they had read and understood the sentence. They were then asked to answer a true-or-false question about the content of the sentence. The experimental design was 3 x 3. There were three levels of RC weight, measured in number of words[8] (four, eight, and fifteen words), and three levels of RC structure (canonical/adjacent, extraposed, and adjunct clause). The length of the VP was five words in all cases. An example set of RCs in extraposed position in all three lengths is shown in

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[7]According to Konieczny (2000), sentence production includes acceptability judgements. He argues that participants in his acceptability judgement experiment compared presented sentences with their structural alternatives, which they would have to construct first, therefore tapping into processes of language production. It is questionable if acceptability judgements should be included in sentence production. Uszkoreit et al. (1998*a*) explains the differences he found in his corpus study and acceptability judgement task with the opposite argument: corpus data is supposed to resemble production data, while acceptability judgements reflect comprehension.

[8]Hawkins (2004) measures distance in number of words as well.

(104).[9]

(104) a. **"Light"(four words)**

   Three people arrived here early yesterday morning *who were from Chicago*.

   b. **"Medium" (eight words)**

   Three people arrived here early yesterday morning *who were from a northern suburb of Chicago*.

   c. **"Heavy" (fifteen words)**

   Three people arrived here early yesterday morning *who were originally from a far northern suburb of Chicago which is called Lake Forest*.

The hypotheses formulated by Francis (2010) followed Hawkins (2004). She expected faster reading times for extraposed RCs when the RC was longer than the intervening VP. At the same time, faster reading times for adjacent RCs were predicted for cases where the RC was lighter/shorter than the VP. Reading times for the adjacent RCs were expected to increase as the length of the RC increased. The adjunct clauses were added as a control condition.

Francis (2010) found support for for the predictions made by Hawkins (2004). The reading times for extraposed RCs were significantly faster than for adjacent RCs when the RC was heavy (fifteen words). This finding is contrary to that of Konieczny (2000) who found that reading times on the main verb were always faster in adjacent condition. The reason for this difference in the findings is most likely due to a difference in method. Konieczny (2000) measured reading times at the verb, whereas Francis (2010) measured reading times for the whole sentence. Maybe the faster reading times on the main verb in adjacent position do point to an anticipatory effect in RC extraposition in German, however, there is no way of telling if Konieczny (2000) had still found this effect if he had measured reading times for the whole sentence. Furthermore, Konieczny's (2000) study looked at RC extraposition in German which is an SOV language, and in which the verb is base-generated in the sentence-final position. It is more likely to find anti-locality effects in a verb-final language, since the arguments of the verb are preceding the verb, and can therefore give information on its syntactic and semantic properties. This helps narrow down the list of possible candidates, therefore making anticipation of the verb more likely. In an SVO language like English, such a priming effect is unlikely (cf. Lewis et al., 2006).

The second prediction was not entirely confirmed. When the RC was light, reading times for adjacent RCs were only slightly faster than for extraposed ones, however, this effect did not reach statistical significance. The reason for this might be that in the light condition, the RCs were 4 words long. The VPs were always 5 word long. Thus, there was not a big difference in constituent length, and therefore, only a small effect on reading

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[9]Examples of the adjunct clause condition were omitted, as they only served as a control. Likewise, examples of adjacent RCs were omitted, since the RCs shown in (104) are simply in adjacent position to the noun. See Francis (2010:50) for examples of adjunct clauses and canonical/adjacent conditions.

times. Francis (2010) speculates that different results might have been found, if the VP had been twice as long as the light RC.

The same material was rated on a 9-point scale in an acceptability judgement task. The predictions were similar as well. Francis (2010) expected higher ratings for extraposed RCs than adjacent RCs when the RC was long, while in cases where the RC was lighter than the VP, the expectation was that adjacent RCs would get higher ratings. The predictions were partially confirmed. While adjacent RCs were rated higher when the RC was light, and ratings of adjacent RCs decreased as the RC increased in length, there was no significant difference in the ratings of adjacent and extraposed RCs when the RC was long. Thus, extraposed RCs were not rated higher than adjacent RCs when the RC was long. Interestingly, these findings are similar to those found by Uszkoreit et al. (1998*b*) and Konieczny (2000) in their acceptability judgement tasks. In both studies, adjacent RCs were rated higher overall, but extraposed RCs were rated just as high as adjacent RCs when the extraposition distance was short and the RC was long.

Francis (2010) also conducted a corpus study.[10] An example sentence with an extraposed RC found in the corpus is shown in (105).

(105)   New sets soon appeared [$_{RC}$ that were able to receive all the TV channels].

The hypotheses were similar to those in the other experiments. Francis (2010) expected that on average, RCs would be longer than the VP when they were in extraposed position. Conversely, the RC should be shorter on average than the VP when the RC was in adjacent position. The results confirmed the theory by Hawkins (2004). There was a strong effect of RC weight. Extraposition was strongly preferred when the intervening VP was only one or two words or when the RC was four times longer than the VP. When the RC was the same length or shorter than the VP, extraposition occurred hardly at all (in 2% of the cases). The corpus study also emphasizes the influence of both factors, length of the extraposed constituent, and distance between head and extraposed dependent. Thus, when the distance is one word, extraposition takes place in 90% of the cases, when distance is between two to four words, extraposition rates decrease to 32%, and if the distance is bigger than eleven words, extraposition does not take place at all.

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, the following 15 factors yielded at least a marginally significant result:

(106)   Factors that play a significant role in RC extraposition (Strunk, 2014:99):

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[10]The corpus used was the International Corpus of English Great Britain (cf. Nelson et al. (2002)

> **Antecedent:** cataphoric; definiteness; grammatical function; pronominal; topological field; type of determiner
>
> **Relative clause:** complex (contains subordinate clause); coordinated; **length**; restrictiveness
>
> **Matrix clause:** (hypothetical) **distance between antecedent and RC**; postfield already occupied; (potentially) intervening adverbial; (potentially) intervening DP; (potentially) intervening negation

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 (as proposed by Hawkins (1994, 2004)) are "indeed the most important factors influencing the likelihood of extraposition" (Strunk, 2014:105).

3.2 Gibson's *Dependency Locality Theory* (DLT)

The dependency locality theory (DLT) by Gibson 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. The DLT is a further development of the *Syntactic Prediction Locality Theory* (SPLT) proposed by Gibson (1998).[11]

Gibson identifies two important aspects of sentence comprehension for which computational resources are required. The first aspect concerns *storage cost*, 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 *integration cost* depends on the distance between two items in a dependency (e.g. a head noun and a PP).

3.2.1 Integration Cost

Whenever we parse a sentence, a number of processes are involved. A new word *w* has to be integrated into the structure built thus far on a syntactic as well as a semantic level. As soon as *w* is parsed, not only the maximal projection according to its lexical entry is constructed. A whole array of syntactic predictions as to which syntactic categories could possibly follow the given word *w* prompt the construction of maximal projections for all these possibilities which are then activated alongside the maximal projection of the newly parsed word *w*. The *structural integration* component thus involves matching the syntactic category of a newly parsed maximal projection with the syntactic predictions already active in the structure built thus far. The syntactic integration also involves head-dependent relationships, such as linking pronouns with their respective antecedents

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[11]The main difference between the SPLT and the DLT is that in the SPLT, *storage cost* also increases over distance between two dependents, while in the DLT only *structural integration cost* does. The reasoning behind this is that *integration cost* already reflects the decay of words in memory over distance due to intervening discourse referents, which would also be the basis for added *storage cost* over distance.

or linking the head of an extraposed PP with the projection of the head noun in the structure. On a semantic level, thematic roles are assigned to maximal projections. Other processes include the evaluation of the contextual plausibility of the resulting structure, and discourse integration.

Discourse processing is another critical component within the integration process because of its implications for the use of resources. The basic assumption of the DLT is that the integration cost depends on the distance between two elements. This assumption is based on activation-based accounts. The idea is that for integrating a newly input maximal projection XP, headed by *h2*, with a previous projection headed by *h1*, one has to keep certain grammatical information of *h1* activated in memory. The bigger the distance between these two elements, however, the bigger the decay of *h1* in memory. The discourse status of the intervening material is of immense importance here, as the use of resources during the integration of intervening words into the discourse influences the amount of resources that are available to keep *h1* highly activated in memory.

Gibson (2000) assumes that integrating a new discourse referent takes up more resources than the integration of previously activated discourse structures. Evidence for this hypothesis can be found in a number of studies within the discourse processing literature (e.g. Haviland & Clark, 1974; Garrod & Sanford, 1977; Garrod & Sanford, 1982; Garrod & Sanford, 1994; Murphy, 1984). For his approach, Gibson (2000) makes use of the notion of *discourse referents*, introduced as part of the *discourse representation theory* (DRT) by Kamp (1981) (see also Heim, 1982). A discourse referent is defined as "an entity that has a spatiotemporal location so that it can later be referred to with an anaphoric expression, such as a pronoun for NPs, or tense on a verb for events" Gibson (2000:103). Gibson (2000) assumes a distance metric with a binary distinction between processing new discourse referents, which consume resources and, therefore, come with a cost, and processing previously introduced discourse referents, which do not use resources and for which no cost is assumed. This assumption is a simplified version of the hypothesis formulated in Warren & Gibson (2002), in which a continuous metric is proposed, based on a fine-grained accessibility hierarchy of referents in discourse (see Gundel et al., 1993 for their proposition of a Giveness Hierarchy).[12] Thus, integration cost of a newly parsed word *w* increases with the distance to previously parsed words with which it holds dependent relations. Distance here is measured by the number of new discourse referents in the intervening material. Since new discourse referents are the only words assumed to consume resources, they are responsible for the faster decay of *w*'s activation in working memory.

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[12]Warren & Gibson (2002) base their hypothesis on findings in earlier studies (Garrod & Sanford, 1982; Gordon et al., 1993; Tanenhaus & Carlson, 1990), which suggest that neither are all new discourse referents difficult to process, nor are all previously activated referents easy to process. Warren & Gibson (2002:87) propose "a theory of NP processing such that cost is related to the amount of resources required to access and/or build a referent for an NP." Crucially, also NPs that do not have a referent come with a cost, since the failure of finding a referent is assumed to consume resources. The amount of resources used in the case of such a failure is higher for NPs which are usually used for less accessible referents, because the set of possible referents is larger in this case.

Gibson (2000) measures integration cost using *energy units* (EU). New discourse referents have to be established in the discourse. Therefore, parsing a head (*h2*) of a new discourse referent comes with the cost of 1 EU. Words that are not introducing entities with NPs or events with verbs (e.g. adverbs) are assumed to consume zero EUs. Gibson (2000) states his assumption about the discourse processing cost as follows:

(107)   **DLT simplified discourse processing cost** (the cost associated with accessing or constructing the discourse structure for the maximal projection of the input word head h2)

   1 energy unit (EU) is consumed if h2 is the head of a new discourse referent; 0 EUs otherwise. (Gibson, 2000:104)

In a second step, the structural integration cost has to be taken into account. As an example, let's consider a sentence in which a phrase headed by *h1* is in a head-dependent relationship with another phrase headed by *h2*. Above we established that parsing *h2* will cost 1 EU. Now we need to structurally integrate the phrase headed by *h2* with its head *h1*. For this, we have to consider all new discourse referents that have occurred between *h1* and *h2*. In our example, we will assume that two new discourse referents have been introduced in the interim, thus, we will have a structural integration cost of 2 EUs. Gibson (2000) sums up his assumptions about the structural integration cost as follows:

(108)   **DLT structural integration cost**

   The structural integration cost associated with connecting the syntactic structure for a newly input head h2 to a projection of a head h1 that is part of the current structure for the input is dependent on the complexity of the computations that took place between h1 and h2. For simplicity, it is assumed that 1 EU is consumed for each new discourse referent in the intervening region. (Gibson, 2000:105)

The logic behind this is that in order to integrate *h2* with *h1*, information that was introduced by *h1* earlier in the discourse has to be activated. For this, *h1* needs to be activated above a minimum threshold to ensure its activation in working memory. However, the activation of previous discourse referents decays over time. Resources that become available due to this decay are used for the integration of new discourse referents. The more of these new discourse referents happen to be introduced between *h1* and *h2*, the more likely it is that *h1* will not be activated in working memory above the required minimum once the parser arrives at *h2*, and *h1* needs to be reactivated.

3.2.2   Accounting for Processing Difficulties of Doubly Nested Structures within the DLT

The predictions of the DLT are supported by findings of studies on a number of linguistic phenomena. For example, Gibson (2000) demonstrates that nesting complexities of multiple center-embedded structures are not due to the number of incomplete syntactic dependencies, as suggested by many earlier theories on the subject (see Yngve, 1960;

Table 3.2: Discourse processing (DR) and structural integration costs (IC) for a singly and a doubly nested relative clause.

Single center-embedded RC

	The	reporter	who	the	senator	attacked	disliked	the	editor
DR	0	1	0	0	1	1	1	0	1
IC	0	0	0	0	0	2	2	0	0
Total	0	1	0	0	1	**3**	**3**	0	1

Double center-embedded RC

	The	reporter	who	the	senator	who	John	met	attacked	disliked	the	editor
DR	0	1	0	0	1	0	1	1	1	1	0	1
IC	0	0	0	0	0	0	0	1	6	4	0	0
Total	0	1	0	0	1	0	1	2	**7**	**5**	0	1

Chomsky & Miller, 1963; Miller & Chomsky, 1963; Miller & Isard, 1964; Bever, 1970; Hakuta, 1981; Abney & Johnson, 1991; Gibson, 1991; Pickering & Barry, 1991; Stabler, 1994). Rather, the difficulty with processing complex nested structures arises from the fact that too many long distance integrations take place at the same processing site. Gibson (2000) illustrates this by giving the calculations as predicted by the DLT for a singly nested relative clause (109a), as well as for a doubly nested relative clause (109b).

(109)   a. The reporter who the senator attacked disliked the editor.

      b. The reporter who the senator who John met attacked disliked the editor.

In (109a), a single relative clause (*who the senator attacked*) is center embedded in the main clause. In (109b), a second relative clause (*who John met*) is embedded within the first one. Table 3.2 shows the costs for discourse processing and structural integration for both sentences.

The discourse processing cost is established by counting 1 EU for every discourse referent (DR) in the sentence, namely all NPs and event referents (verbs). In the case of the single center-embedded RC in (109a) these are *the reporter*, *the senator*, *attacked*, *disliked*, and *the editor*. The structural integration cost (IC) counts 1 EU for every new discourse referent that intervenes between two dependencies in the sentence. We find the first integration site at the verb *attacked*. Three structural integrations take place here. The verb is integrated with its subject NP (*the senator*), which does not result in any costs, since NP and verb are adjacent. An empty category (which is coindexed with the RC pronoun) is integrated as the object of *attacked*. Again, there are no new discourse referents intervening and, therefore, no integration costs. The empty object category and the relative pronoun with which it is conindexed are, however, separated by two new discourse referents (*senator* and *attacked*), resulting in a structural integration cost of 2 EUs. Thus, at the verb *attacked*, we have a total integration cost of 3 EUs (1 EU for establishing a new referent in the discourse, and 2 EUs for structural integration).

Likewise, at the verb *disliked* we have 1 EU for discourse processing, and 2 EUs for structural integration, since between the verb (*disliked*) and the subject NP (*the reporter*) two new discourse referents intervene (*the senator* and *attacked*). The result is that we have 3 EUs of total processing cost at both verbs, making these two sites the most cost-intensive ones in the whole sentence.[13]

In the double center-embedded RC in (109b) the discourse referents are *the reporter*, *the senator*, *John*, *met*, *attacked*, *disliked*, and *the editor*. Just like in the singly nested RC, the highest integration costs occur at the verbs (*attacked* and *dislike*). However, the total integration costs at both sites are much higher in the doubly nested RC than in the singly nested one. The maximal integration cost occurs at *attacked*, totalling 7 EUs at this point in the sentence, made up of the following calculation steps:

1. 1 EU for the discourse processing cost, establishing *attacked* as a referent in the discourse, 2. 2 EUs for the structural integration of the verb to the subject NP (*the senator)*, with two new discourse referents in the intervening material (*John* and *met*), 3. 0 EUs for the integration of an empty category as the object of the verb *attacked*, and 4. 4 EUs for the structural integration of the empty object category with the coindexed relative pronoun over four new discourse referents (*the senator*, *John*, *met*, and *attacked*).

Hence, the high processing costs at the verb *attacked*, mainly caused by four new discourse referents in the intervening material, are responsible for the increased processing difficulty in the double nested structure.

Additionally, the DLT accounts for the lack of processing difficulties with doubly nested structures when the subject in the most center-embedded relative clause is a pronoun, as in (112).

(110)   The reporter who the senator who I met attacked disliked the editor.

According to the DLT, first- and second-person pronouns are cost-free when being structurally integrated, since they are already established referents in the discourse. Integration cost, however, only occurs when integration takes place over *new* discourse referents. The structural integration of the verb *attacked* with the subject NP *the senator* thus takes place over only one new discourse referent (*met*), and not over two, as in (109b), where *John* was the subject of the center-embedded RC. Likewise, while integrating the object empty category with the coindexed RC pronoun, three instead of four new discourse referents occur in the interim. Evidence in support for integration cost as proposed in the DLT has not only been found in English, but also other languages, including German, Dutch, Japanese, and Spanish.

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[13]Gibson (2000:105) states that "the maximal discourse and structural integration cost…occurs at the point of processing *attacked*." This assessment might be due to the fact that the structural integration at this verb takes three steps, while the structural integration at the verb *disliked* only takes one.

3.2.3 Storage Cost

Integration cost is the first component of the DLT. The second component is the storage cost, measured in *memory units* (MU). Gibson (2000) defines storage cost as follows:

(111) **DLT storage cost**

1 memory unit (MU) is associated with each syntactic head required to complete the current input as a grammatical sentence. (Gibson, 2000:114)

Gibson (2000:114) illustrates the calculation of the storage cost component on the object-extracted RC, shown in (109a), repeated for convenience here, as (112):

(112) The reporter who the senator attacked disliked the editor.

Crucially, the storage cost at each point in the sentence is not based on the actual, completed sentence, but on the minimum of potentially following syntactic heads that are required to form a grammatical sentence. Most syntactic theories for English identify a minimum of two syntactic heads to form a grammatical English sentence, one for the noun as the subject, and one for the verb as the predicate (e.g. Bresnan, 1982; Chomsky, 1981, 1995; Pollard & Sag, 1994). Accordingly, when processing the first word in the sentence, the determiner *the*, two syntactic heads are needed to form a grammatical English sentence: a noun for the subject, and a verb. Thus, at the determiner, the storage cost is 2 MUs. When the next word, *reporter* is processed, only a verb is still needed to make a full grammatical sentence, lowering the cost to 1 MU at this point. When the relative pronoun *who* is processed, a full relative clause has to follow, as well as the main verb of the sentence. Thus, the storage cost is 3 MUs, 1 MU for the verb of the relative clause, 1 MU for an empty category to be associated with the relative pronoun, and 1 MU for the main verb. The point with the maximal storage cost occurs at the second determiner of the sentence (*the*), costing 4 MUs: 1 MU for the noun of the determiner *the*, 1 MU for the verb of the relative clause, 1 MU for the empty category position to be associated with the relative pronoun, and 1 MU for the verb of the main sentence. As the next word (*senator*) is processed this cost is lowered to 3 MUs as the noun for the determiner is no longer required. The verb *attacked* satisfies not only the requirement of a verb in the relative clause, but also the empty category position associated with the relative pronoun, making the total cost at this point 1 MU. The 1 MU reflects the prediction that a main verb still has to follow, a prediction that is satisfied with the next word, *disliked*, which, however, requires an object NP to form a grammatical sentence, leaving the cost at 1 MU. The cost remains 1 MU when processing the determiner of the noun, and is finally fully satisfied when encountering the noun (*editor*), lowering the cost to 0 MUs at the end of the sentence. When processing a grammatical sentence, the storage cost at the last word of that sentence is therefore always 0 MU. Table 3.3 shows the storage cost at each word of the object-extracted relative clause, as well as the discourse processing and structural integration costs, giving the total cost at each point of the object-extracted relative clause.

Table 3.3: Costs for discourse processing (DR), structural integration (IC), and storage (SC) for an object-extracted relative clause.

	The	reporter	who	the	senator	attacked	disliked	the	editor
					Object-extracted RC				
DR	0	1	0	0	1	1	1	0	1
IC	0	0	0	0	0	2	2	0	0
SC	2	1	3	2	2	1	1	1	0
Total	2	2	3	2	3	**4**	**4**	1	1

The interrelation of structural integration cost and storage cost is not entirely clear. Gibson (1998, 2000) follows the assumption by Just & Carpenter (1992) that integration cost and storage cost tap into the same pool of resources. Furthermore, the resources in this pool are limited. And, finally, the more resources storage requires, the slower integration occurs. However, Gibson (2000:115) points out that no empirical data support these assumptions thus far, and only concludes by assuming that "larger quantities of either storage or integration cost cause slower integration times, and intuitive complexity is determined by the maximal integration time in the parse of a sentence."

More recently, there have been a number of empirical studies performed by Gibson and colleagues (Gibson & Tunstall, 1999; Gibson & Thomas, 1999; Grodner et al., 2002; Warren & Gibson, 2002; Hsiao & Gibson, 2003; Gibson & Warren, 2004; Chen et al., 2005; Gibson et al., 2005; Grodner & Gibson, 2005; Warren & Gibson, 2005) which aimed at testing the assumptions made about the interaction of structural integration costs and storage costs as proposed in the DLT. In their study about on-line syntactic storage/expectation costs in English, Chen et al. (2005) found evidence for a storage cost component as proposed in the DLT, namely one associated with predicted syntactic heads. Furthermore, all of these studies found evidence for storage cost being independent of any other factors, including syntactic integration. Gibson et al. (2005:339) propose a *multiple constraint framework* "in which three of the constraints are (a) syntactic expectations, giving rise to information flow effects; (b) integration resources; and (c) storage resources." Contrary to the assumptions made by Gibson (1998, 2000), storage cost and structural integration cost appear not to tap into the same resource pool after all. Instead, all three constraints are assumed to have additive effects on sentence comprehension. As mentioned above, the calculations illustrated by Gibson (2000) are based on a *simplified* version of the theory. Crucially, the structural integration cost function is not linear, meaning that a single long integration will not be as costly as multiple short integrations all happening at the same point. Also, apart from structural integration cost and storage cost, further factors are assumed to contribute to the comprehension difficulty at a given word in a sentence, namely the frequency of the lexical item being integrated, the contextual plausibility of the resulting structure, and the discourse complexity of the resulting structure (Gibson, 2000:105; cf. Wells et al., 2009).

3.2.4 Empirical Evidence for the DLT

Bader (2014) conducted a corpus study and two production experiments on German relative clause extraposition. The aim of the study was to test if the distance between dependencies should be measured in number of new discourse referents, as proposed by the DLT, or in number of words, as done, for example, by Hawkins (1994, 2004, 2014).

In the corpus study, 2000 sentences with RCs in either adjacent or extraposed position were analyzed.[14] Similar to the findings of Uszkoreit et al. (1998*b*), extraposition rates increased when the length of the RC increased. At the same time, extraposition rates decreased when the extraposition distance increased. Bader (2014) found that extraposition distance was a much more important factor in the decision to extrapose than the length of the RC. Importantly, when measuring the distance between head noun and extraposed RC, Bader (2014) only counts non-verbal material, since in German extraposition has to take place over a verb. Moreover, verbal material was shown to hardly have an effect on extraposition rates. Thus, with only verbal material intervening, extraposition took place in about 90% of the cases. With an extraposition distance of one word, extraposition rates decreased to 60%, with two words to 35%, and if the distance was four words, extraposition occurred in only 10% of the cases.

Since in the corpus study extraposition distance was shown to have such a strong effect, even when the difference in distance was only small, Bader (2014) conducted two production experiments, in which the distance was between zero words (verbal material only) and two words. The method used was a variant of the *Production from memory* task. First, participants read a main clause, as shown in (113), on a computer screen, then a visual prompt followed like *Max sagte, dass...* 'Max said that...', after which participants had to repeat the main clause in form of an embedded clause. The intervening material varied in number of words, as well as in number of discourse referents: In (113a), there is only verbal material (*gratulieren wollte*) that could intervene, thus zero words and one discourse referent.[15] In (113b), there is a bare NP object, and in (113c) an NP object containing a determiner. The latter two both have the same number of discourse referents (*Gedichte* and *vorlesen*), but differ in the number of words.

(113)   a. Gratulieren wollte Max dem Lehrer, der gestern   zu Besuch war
             Congratulate wanted Max the teacher who yesterday to visit   was
             'Max wanted to congratulate the teacher who came to visit yesterday.'

        b. Gedichte vorlesen wollte Max dem Lehrer, der gestern   zu Besuch war
             Poems   read to wanted Max the teacher who yesterday to visit   was
             'Max wanted to read poems to the teacher who came to visit yesterday.'

        c. Einige Gedichte vorlesen wollte Max dem Lehrer, der gestern   zu
             Some poems   read to wanted Max the teacher who yesterday to

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[14]The corpus used was the deWaC corpus (Baroni et al., 2009).

[15]In the DLT, auxiliaries do not count as discourse referents, a notion supported by empirical research reported in Demberg (2013).

> Besuch war
> visit was
> 'Max wanted to read some poems to the teacher who came to visit yesterday.'

The results showed that over verbal material, extraposition occurred in 38% of the cases. With an intervening bare NP object, extraposition rate sank to 15%, which was statistically significant. In the condition with the NP object including a determiner, extraposition took place in 11% of the cases. The difference in the conditions with a bare NP object and an object NP with determiner was not significant. Therefore, the results suggest that it is the number of discourse referents that increase processing cost in the intervening material, and not the number of words.

The second production experiment used the same method as the first. The only difference in the conditions was that the indefinite pronoun *etwas* ("something") replaced the bare NP object, as shown in (114).

(114) Etwas   vorlesen wollte Max dem Lehrer, der gestern   zu Besuch war
       Something read to   wanted Max the teacher who yesterday to visit   was
       'Max wanted to read something to the teacher who came to visit yesterday.'

While both the bare noun and the indefinite pronoun introduce new discourse referents, the indefinite pronoun causes less semantic integration cost, since it has no lexical content. However, while the results still showed a significant difference in extraposition rates between zero words and one word, the difference between the condition featuring an indefinite pronoun and the one with an NP object with determiner was still not significant.

Bader (2014) concludes that extraposition distance has a strong effect on constituent ordering in German RC extraposition. Furthermore, when a new discourse referent is introduced in the intervening material, the extraposition rate decreases rapidly. However, number of words in the intervening material showed no significant effect, since there was no difference found between a one-word discourse referent or a two-word discourse referent. The DLT proposes that it is the number of discourse referents and not the number of words in the intervening material that increases processing cost. Bader (2014) found that this not only applies to language comprehension but also to language production.

Strunk (2014) found further evidence that a "(potentially) intervening DP" will decrease the likelihood of extraposition, independently of a general negative effect of an increasing distance of antecedent and RC. In a binary logistics regression model fit to corpus data on RC extraposition in German, Strunk (2014) found that the hypothetical distance between antecedent and RC and a potentially intervening DP are two factors that play a role in RC extraposition in German (see (106) for a full list of all 15 factors). Thus, when the extraposition distance is two words, "the likelihood of extraposition is 71.65% if there is no intervening DP but only 29.17% if there is one" (Strunk, 2014:100).

It has to be noted that Strunk (2014:93) states that Gibson (1998, 2000) "defines dependency locality in terms of the number of discourse referents that intervene between two dependents." However, Gibson (1998, 2000) actually defines dependency locality in

the number of **new** discourse referents that intervene between two dependents. Strunk (2014) simply counts all intervening DPs in his corpus as discourse referents in the vein of Gibson (1998, 2000), but he does not mention if these DPs are actually new to the discourse.

Temperley (2007) investigated if the predictions made by the DLT for language comprehension hold also true for language production. In order to test the hypothesis that shorter dependency lengths are also preferred in language production, he formulated four "Dependency Length Minimization Rules" (DLMRs). The predictions made by these rules about the relative length of constituents were then tested with eleven statistical tests, using the Wall Street Journal portion of the Penn Treebank (Marcus et al., 1993, 1994).[16]

The proposal by Temperley (2007) differs from the DLT in two ways: First, Temperley (2007) measures constituent length not in number of new discourse referents, but in number of words, so that a head and dependent that are adjacent have a dependency length of one word. Temperley (2007) points out that Gibson (1998) admitted that all intervening words, no matter if new discourse referents or not, probably add some integration cost. Secondly, the two proposals differ in their definition of "complexity." In the DLT, "intuitive complexity" of a sentence depends on the *maximal* integration cost which can occur at any point in the sentence. Temperley (2007) on the other hand considers the *total* of all integration costs that occur in a sentence. While Gibson (1998, 2000) considers the number of discourse referents intervening between a dependency to calculate the maximal integration cost at that point in the sentence, Temperley (2007) considers the total of all words that intervened between all dependencies in a given sentence.[17]

Temperley's (2007) first rule, shown in (115), reflects the fact that dependency lengths are minimized when dependents are either all right-branching, or all left-branching.

(115)   **DLMR 1**

Dependency structures should be either consistently right-branching or left-branching. (Temperley, 2007:305)

The majority of languages obey this rule, as they tend to be either "head-first" or "head-last" (Hawkins, 1983; Chomsky, 1988). However, many languages do not follow this rule consistently. English, for example, is a mostly right-branching language. Direct objects are right-branching as they connect with the main verb preceding them. Subjects, however, are left-branching as they are followed by the finite verb. Therefore, a long subject NP results in a greater dependency length between the head of the subject and the

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[16]Since the Wall Street Journal has a style sheet, which might have affected the way writers compose their sentences, Temperley (2007) tested his hypotheses using a second portion of the Penn Treebank, the Brown corpus. The original Brown corpus (Francis & Kucera, 1964) included over 1 million words, but only a small part was added into the Penn Treebank. The results found in the corpus study using the Wall Street Journal portion of the Penn Treebank were mainly confirmed by the Brown corpus study.

[17]Another difference is that the DLT assumes the existence of empty categories. Temperley (2007) points out that it is not clear if they really exist, and if so, where (Pickering & Barry, 1991), thus he does not assume empty categories in his proposal.

verb, than when a direct object NP is to the right of the verb. Hence, Temperley's (2007) second rule of Dependency Length Minimization, shown in (116).

(116) **DLMR 2**

In a primarily right-branching language, the left-branching constituents should be short. (Temperley, 2007:306)

In order to test the DLMR 2, Temperley (2007) analysed the constituent length in subject-verb inversion in quotation constructions (as shown in (117)) in the corpus.

(117) a. "I agree", [said [Jane]].

b. "I agree", [[Jane] said].

c. "I agree", [said [Jane Smith, president of Smith, Brown, & Jones, a consulting firm]].

d. "I agree",[[Jane Smith, president of Smith, Brown, & Jones, a consulting firm,] said].

(Temperley, 2007:306)

The expectation was that long subject NPs, as *Jane Smith, president of Smith, Brown, & Jones, a consulting firm* should occur in V-S order, while in S-V order, subjects should be shorter in order to keep the dependency length short. The results confirmed the prediction. The average length of subject NPs in S-V order was 2.16 words, while in V-S order, it was 9.47 words.

The DLMR also predicts that long subject NPs should be avoided to minimize dependency length. Therefore, in a second test, the mean length of subject NPs was compared to the mean length of direct object NPs. The results showed that the average length of subject NPs was 3.13 words, and the average length of direct-object NPs was 5.80 words, thus confirming the predictions.

Another possible explanation for length differences between subject and direct-object NPs could be the "given vs. new" distinction. As Temperley (2007:309) points out, "new discourse entities tend to be longer", and some studies have suggested that new discourse entities are more often realized in object position (Branigan et al., 2003). Temperley (2007) attempted to control for this, by looking only at subject and direct object NP which featured new discourse referents. In order to make sure that only such NPs were analysed, he hand-picked 100 specific subject NPs and 100 specific direct-object NPs. In contrast to non-specific NPs, specific NPs feature new discourse entities for which the speaker has a specific referent in mind, as shown in (118).

(118) *A company spokesman* declined to elaborate on the departure.

(Temperley, 2007:310)

The results showed that subject NPs were still significantly shorter than direct object NPs, even when they contained new discourse entities (average length of subject NPs = 5.95

words; average length of direct-object NPs = 8.95 words). Therefore, the difference can not only be due to a given vs. new distinction.

Test 4 considered premodifying versus postmodifying adverbial clauses. The prediction was that premodifying adverbial clauses would be shorter in order to minimize dependency length. This prediction had already been tested and confirmed in another corpus study conducted by Diessel (2005). Temperley (2007) could confirm both the predictions of the DLT, and the previous findings of Diessel (2005): the average length of premodifying clauses was 9.76 words, while the average length of postmodifying clauses was 11.41 words. The same was found for premodifying versus postmodifying temporal adverbial clauses.

Another test was concerned with left-branching constituents that were embedded in another left-branching constituent, such as subject NPs of RCs embedded in another subject NP. The prediction was "that among subject NPs of relative clauses, those within subject NPs will be shorter than those within direct-object NPs" (Temperley, 2007:314). The prediction was once again confirmed. While all RC subject NPs were rather short, those embedded within another subject NP were significantly shorter than the ones embedded within a direct-object NP.

The third of Temperley's (2007) rules is concerned with words that have multiple dependents. It is argued that the shorter dependent constituent should be placed nearer to the head. This notion is similar to those expressed in accounts concerned with "heaviness" or "end-weight" (Wasow, 1997a; Arnold et al., 2000; Wasow, 2002; Hawkins, 1990, 1994, 2004, 2014).

(119) **DLMR 3**[18]

  If a word has multiple dependent constituents and there is a choice as to their ordering, the shorter one(s) should be placed closer to the parent head. (Temperley, 2007:315)

The DLMR 3 predicts that in clauses with two *post*modiyfing constituents, the second should be longer, as it is further away from the head. Test 7 confirmed this: the average length of the first adjunct was 3.04, and the average length of the second adjunct was 5.96. In the case of two *pre*modifying constituents, the expectation would be the opposite. the second constituent will be closer to the head, and should therefore be shorter. Surprisingly, this prediction was not confirmed. On average, the second constituent was slightly longer than the first (first = 3.15, second = 3.48). However, the difference found was small, and not statistically significant.

(120) **DLMR 4**

  If a word has multiple dependents and there is no choice as to their ordering, dependents closer to the head should be short. (Temperley, 2007:318)

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[18]The DLMR 3 also makes predictions about coordinate phrases. In a corpus study, Temperley (2005) tested several competing hypotheses about coordinate structures proposed by Mel'cuk (1987), Munn (1993), Hudson (1990) and Pickering & Barry (1993).
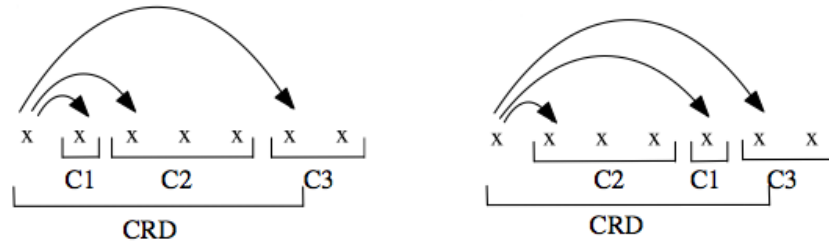
Figure 3.1: Dependency lengths, and CRDs according to the EIC, with the constituent order alternating between C1-C2-C3 and C2-C1-C3. (Temperley, 2007:321)

In order to test the DLMR 4, Temperley (2007) considered subject NPs in main clauses that had premodifying adjuncts, as in *When I arrived, the man left.* versus those that did not, as in *The man left.* The prediction that subject NPs tend to be shorter when there is a premodifying adjunct, was confirmed (with adjuncts, the average length of subject NPs was 3.17; without adjuncts, it was 4.10). Theoretically, writers might have tried to avoid long sentences, and therefore have avoided using premodifying adjuncts. In order to confirm that the findings were due to dependency length minimization, Temperley (2007) also tested direct-object NPs (such as [*When I arrived*], *I saw* [*a dog*]), with and without premodifying adjuncts. Since the adjunct is to the left of the verb, and the direct object NP to its right, the presence of the adjunct is not expected to have any effect. This prediction was confirmed, as the average length of direct-object NPs with adjuncts was 7.67, and the length without adjuncts was 7.93. This difference was not statistically significant.

In a final test, Temperley (2007) investigated heads with three right-branching dependent constituents. Gibson's DLT and Hawkins' EIC make different predictions as to the preferred ordering of the first two dependent constituents. Therefore, Temperley (2007) hoped to find evidence that would clearly support one of the theories more than the other.

In the case of a head with three right-branching dependent constituents, the EIC would predict that the ordering of the first two constituents is of no consequence to the processing complexity. In the EIC, the crucial factor is the distance between the head and the head of the last dependent, the so-called "constituent recognition domain" (CRD), as shown in Figure 3.1. The length of the CRD remains the same whether the first constituent is placed before the second or vice versa. The DLT, on the other hand, predicts that the preferable order is that in which the shorter constituent comes first and the longer one comes second. This way, dependency lengths, and therefore integration costs, are minimized.

Hence, Temperley (2007) looked at clauses with three postmodifying adjuncts. The DLT predicted that the first adjunct would be shorter than the second, the EIC predicted that there will be no difference in length of the first two constituents. The results showed that the average length of the first adjunct was 2.98, and the average length of the second adjunct was 3.65. The difference was statistically significant. Thus, the findings fit the predictions of the DLT better than those of the EIC.

In the case of head-last languages, such as Japanese, studies have shown that a long-short constituent order is preferred to a short-long order (Yamashita & Chang, 2001; Yamashita, 2002). The DLMR 3, following the DLT, predicts these preferences, as they ensure minimized dependency length, as illustrated in Figure 3.2.
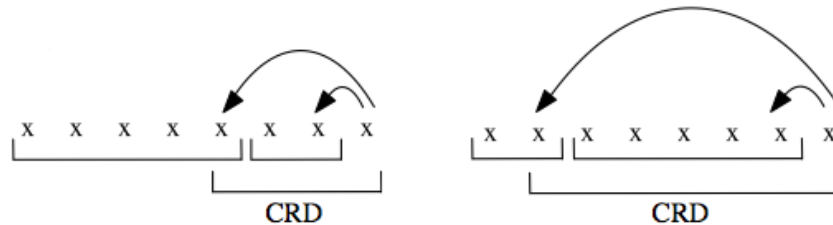
Figure 3.2: Dependency lengths, and CRDs according to the EIC, in a head-last language with the constituent ordering alternating between long-short and short-long (Temperley, 2007:322)

Following the logic originally proposed in the EIC, processing of sentences with a constituent head late in the sentence, as is mostly the case in head-last languages, should never allow for an "early" recognition of all immediate constituents. Hawkins (1994) therefore proposed a different, "bottom-up" parsing strategy for head-last languages like Japanese. The fact that Hawkins (1994) has to change his theory to accomodate head-last languages and Gibson's (2000) DLT accounts for both short-long preferences in head-first languages and long-short preferences in head-last languages gives an advantage to the latter theory.

In summary, empirical research has found evidence for the predictions made by the DLT. The statistical tests by Temperley (2007) provide evidence for the influence of dependency length on word ordering phenomena. In a test designed to compare the proposals made by Gibson's DLT and Hawkins' EIC, the findings fit the predictions made by the DLT slightly better. In a corpus study and two production experiments, Bader (2014) found dependency length to be the crucial factor for rates of extraposition in German relative clauses. Not only do his findings confirm that an increase in intervening material results in a decrease in extraposition rates, but they also show that it is not the number of words that matters but the number of new discourse referents, as proposed by the DLT. Furthermore, Bader (2014) showed that the predictions of the DLT not only hold true for language comprehension but also for language production.

3.3 Anticipation-based Accounts

Locality-based accounts mostly predict that processing of items at the end of longer sentences should be harder, and therefore be read more slowly, since they have to be connected with elements that appeared much earlier in the sentence. As a matter of fact, it has been commonly observed that reading times rather speed up towards the end of a sentence, than slow down. Moreover, these predictions are challenged by accounts which

predict that subsequent elements will be *anticipated* "through integration and projection of previous items" (Konieczny, 2000:628). Complements of a verb can be anticipated through the valency and thematic properties of that verb, encountered earlier in the discourse (MacDonald et al., 1994; Konieczny et al., 1997; Altmann & Kamide, 1999). In German subordinate clauses, verbs are placed at the end of the sentence. In these cases, and in all others in which the verb follows its complements, it can be anticipated by the number and the type of its arguments, all of which appeared previously in the sentence (cf. Konieczny, 1996; Konieczny & Hemforth, 1994). There is evidence for incremental pre-head integration, which suggests that information encountered earlier in the structure does not have to be kept unattached in a buffer until the head (e.g. a verb) is parsed. Processing of the head should therefore be facilitated (Hemforth et al., 1993; Bader & Lasser, 1994; Kamide & Mitchell, 1999). At the same time, locality effects might be expected in the case of head-final structures, since some theories assume thematic assignments to occur at the semantic head (cf. Ferreira & Henderson, 1991*a,b*).

Anticipatory effects have also been found in languages with case-marking (for German: Kamide et al., 2003*b*; for Japanese: Kamide et al., 2003*a*). In an eye-tracking experiment investigating head-final constructions in Japanese, Kamide et al. (2003*a*) found that when there are several arguments preceding the head verb, later arguments can be anticipated based on the information collected from earlier arguments, probably also due to expectations about the upcoming verb class. Kamide et al. (2003*a*:149) conclude "that this prediction was in part based on syntactic information regarding case-structure in Japanese, and not solely on interpretive processes operating independently of syntax." In an eye-tracking experiment in German, Konieczny & Döring (2003) found that reading times on the head verb were faster when it was preceded by three complements instead of only two. In their material (an example set is shown in (121)), they varied the number of arguments appearing before the verbal head. The distance between the first argument and head was controlled for by case-marking: In (121a), the three arguments are *der Freund* (nominative), *dem Kunden* (dative), *das Auto aus Plastik* (accusative). In (121b), the two arguments are *der Freund des Kunden* (nominative) and *das Auto aus Plastik* (accusative). The distance remains the same in both versions, since it is only one letter that makes the difference between case assignments (*dem Kunden* and *des Kunden*).

(121)   a. Die Einsicht, dass der   Freund dem   Kunden das   Auto
              The insight   that the.NOM friend the.DAT client   the.ACC car
              aus   Plastik verkaufte, erheiterte die Anderen.
              made from plastic sold   amused   the others
              'The insight that the friend sold the car made from plastic to the client amused the others.'

        b. Die Einsicht, dass der   Freund des   Kunden das   Auto aus
              The insight   that the.NOM friend of the client   the.ACC car   made from
              Plastik verkaufte, erheiterte die Anderen.
              plastic sold   amused   the others

> 'The insight that the friend of the client sold the car made from plastic amused the others.'

(Konieczny & Döring, 2003)

Anticipation-based accounts would predict that reading times on the verb are faster when it is preceded by three arguments, since more information on the head can be collected, and there is more time to form predictions about possible candidates for the verb. The DLT, as a locality-based account, would predict that reading times will be slower on the verb, when more intervening material (between the first argument and the head) has to be integrated, since processing complexity will increase when the number of new discourse referents in the intervening material increases. The DLT thus predicts that reading times will be faster with only two arguments before the verb. The findings of Konieczny & Döring (2003) clearly support anticipation-based accounts.

3.3.1 Surprisal Theory

Another expectation-based theory was proposed by Hale (2001). A very similar hypothesis is the *Surprisal Theory* proposed by Levy (2008).

Hale (2001) assumes the design of an incremental "top-down" *Earley parser* (cf. Earley, 1970; Stolcke, 1995), which makes predictions about forthcoming words based on information gathered in the previously parsed input on a word-by-word basis. Thus, words that are more predictable are also more easily processed, while words that were not expected increase processing complexity. An example of this difference is shown in (122), taken from Levy (2008:1138):

(122) a. He mailed the letter without a *stamp*.

  b. There was nothing wrong with the *car*.

Considering the input string given in the beginning of the sentences, the word *stamp* is more easily predicted than the word *car*. It seems to be an immense cognitive work load to predict the probability for any number of possible forthcoming words at every word in a sentence. Hale (2001) attributes this to an "eagerness" of the parser (cf. Stolcke, 1997). He also suggests a full parallel parser that computes the probability of all possible forthcoming structures at each point/word that is parsed. Levy (2008), on the other hand, suggests a limited parallelism, in which "more than one, but not all, of possible analyses are maintained in the course of online comprehension" (Levy, 2008:1135).

In his *Surprisal Theory*, Levy (2008) suggests that processing difficulty occurs when the predictions of the parser are not compatible with the actual incoming input string. Similarly, Roark (2001) suggests that from all the possible forthcoming syntactic structures, only those are kept which have a high probability, thus are ranking high in comparison to other structures which do not cross a certain minimum threshold. According to this hypothesis, garden-path effects occur when low-ranking structures, which are below the minimum threshold are parsed, and which then have to be

re-analysed. Thus, Levy's (2008) *Surprisal Theory* states that the probability of a forthcoming word is predicted based on the input encountered in the previous input string. The more information can be gained from the parsed structures the better the predictions about the forthcoming word. Thus, parsing more material between two dependent elements can actually help make the right prediction and, therefore, facilitate processing of an upcoming word.

On first sight, locality-based accounts (Hawkins, 1994, 2004, 2014; Gibson, 1998, 2000) and expectation-based accounts (Hale, 2001; Levy, 2008) seem to contradict each other. Studies that are concerned with the question which account gives more accurate answers with regard to empirical data will be discussed in Section 3.3.2.

3.3.2 Locality vs. Anticipation: Empirical Evidence

While the studies discussed above found support for locality effects predicted by theories, such as the DLT, other studies found anti-locality effects (e.g. Konieczny, 2000 for German, Vasishth & Lewis, 2006 for Hindi, Nakatani & Gibson, 2008 for Japanese). While locality-based accounts would predict slower reading times at a clause-final verb when the distance between the verb and its related noun increases, Konieczny (2000) found readings times faster with increasing intervening material. Levy (2008) ran simulations in order to calculate the predictions his *Surprisal Theory* would make with regard to the material used in Konieczny (2000), shown in (123):

(123)   a. Er hat den *Abgeordneten begleitet*, und...
             He has the delegate   escorted, and...
             'He escorted the delegate, and...'

          b. Er hat den *Abgeordneten* ans   Rednerpult *begleitet*, und...
             He has the delegate   to the lectern   escorted, and...
             'He escorted the delegate to the lectern, and...'

          c. Er hat den *Abgeordneten* an das große Rednerpult *begleitet*, und...
             He has the delegate   to the big   lectern   escorted, and...
             'He escorted the delegate to the large lectern, and...'
        (Levy, 2008:1145)

The distance between the noun *Abgeordneten* and the verb *begleitet* increases in each condition. The results of Levy's (2008) simulation fit the findings by Konieczny (2000). Longer distances between the noun and the verb result in faster reading times at the verb. According to Levy's (2008) *Surprisal Theory*, these findings were to be expected, as the greater distance and additional information provided by the intervening PP helps predict the verb, which can be processed more easily as a result. Levy (2008) found further evidence for the *Surprisal Theory* in a study reported by Jaeger et al. (2005). They investigated English subject-modifying relative clauses, as shown in (124).

(124)   a. The player [that the coach met at 8 o'clock] bought the house...

    b. The player [that the coach met by the river at 8 o'clock] bought the house...

    c. The player [that the coach met near the gym by the river at 8 o'clock] bought the house...

(Levy, 2008:1149)

They found that reading times at the matrix verb after the RC (*bought*) were faster as the number of constituents after the verb in the RC increased. Neither locality-based accounts nor anticipation-based hypotheses can account for these findings. The *Surprisal Theory*, however, can explain these findings, as "the comprehender's expectation for the end of the RC (and hence seeing the matrix verb next) should generally increase as the number of already-seen post-verbal constituents increases" (Levy, 2008:1150). Thus, the longer the RC, the higher the probability of the matrix verb coming next, resulting in easier processing and faster reading times at the matrix verb.

Demberg & Keller (2008) evaluated the predictions made by the DLT and the Surprisal Theory, using the English portion of the Dundee Corpus (Kennedy & Pynte, 2005). The Dundee Corpus is an eye-tracking corpus based on texts from *The Independent* newspaper. In a first experiment, they tested whether integration cost as defined in the DLT is a significant predictor of eye-tracking measures. Contrary to the predictions of the DLT, the findings showed that faster reading times occurred when the integration cost of the DLT predicted higher processing costs. Demberg & Keller (2008) point out that these findings are due to the DLT only providing "a partial definition of syntactic processing complexity" (Demberg & Keller, 2008:200), as integration cost is only assumed at nouns and verbs. Demberg & Keller (2008), however, found slower readings times than would be expected (considering frequency, word length and other non-syntactic factors) for adjectives, prepositions, sentence adjectives, and expletives.

In a second experiment, Demberg & Keller (2008) looked specifically at reading times for verbs and nouns, specifically those that the DLT expects to have an integration cost.[19] This time, the results showed slower reading times at nouns as well as verbs, although the effect was stronger for nouns. Thus, the findings are consistent with the predictions by the DLT concerning the integration cost at nouns and verbs.

The third experiment compared the predictions made by the DLT and the Surprisal Theory. There were two ways in which Demberg & Keller (2008) estimated *Surprisal*: lexicalized (which takes into account the exact words when calculating structural and lexical probabilities), and unlexicalized (only taking into account the structural probabilities, but not, for example, word frequency). The results showed that "unlexicalized surprisal" predicted reading times in the Dundee corpus with a significant effect, and not just for nouns and verbs, as did the DLT, but for all words. "Lexicalized surprisal" failed to show these effects.[20]

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[19]The DLT does not expect an integration for all nouns. In case of a noun-noun compound, for example, the first noun is not expected to have an integration cost.

[20]Demberg & Keller (2008) point out that this does not mean that lexical information is not important for sentence processing, as shown in studies on *subcategorization frame frequencies* (Garnsey et al., 1997;

Demberg & Keller (2008) conclude that both the DLT and the surprisal theory cover important aspects of processing complexity, albeit in a complementary manner. For first pass times, integration cost showed no effect, but it did have a significant effect in total time measures. Unlexical surprisal, on the other hand, showed significant effects for first pass, first fixation, and total time. This could indicate that Surprisal is associated with early as well as with later processes, and integration cost only with later processes. This would make sense, since the Surprisal theory proposes that predictions about forthcoming words are made, which could suggest that on first pass and first fixation these predictions are matched with the actual input. If prediction and input do not match, the predictions have to be discarded, which would result in processing cost at the later stage as well. At the same time, integration cost refers to the processing cost when a newly parsed word is integrated with related words in the structure built thus far. This could explain why there was only an effect for total time measures. Demberg & Keller (2008:207) conclude that "in order to capture both types of cost, we need to develop a unified model that encompasses both the prediction of upcoming material and the subsequent verification and integration processes."

Vasishth & Drenhaus (2011) investigated locality effects in German. They conducted a self-paced reading task, an eyetracking study, and an ERP study. The material created by Vasishth & Drenhaus (2011:62), as shown in (125), was similar to that of Konieczny (2000) and Jaeger et al. (2005). The increasing length of the RC also increases the distance between the argument *Direktor* and the verb *ignoriert*.

(125)   a.   Die Mutter von Paula und die Schwester von Sophie gruessten den
             The mother of   Paula and the sister   of Sophie greeted   the
             Direktor, den   Maria und Franziska **ignoriert** hatten.
             director   whom Maria and Franziska ignored   had
             'The mother of Paula and the sister of Sophie greeted the director whom Maria
             and Franziska had ignored.'

        b.   Paula und die Schwester von Sophie gruessten den **Direktor**, den   Maria
             Paula and the sister   of Sophie greeted   the director   whom Maria
             und die Mutter von Franziska **ignoriert** hatten.
             and the mother of   Franziska ignored   had
             'Paula and the sister of Sophie greeted the director whom Maria and the
             mother of Franziska had ignored.'

        c.   Paula und Sophie gruessten den **Direktor**, den   die Schwester von Maria
             Paula and Sophie greeted   the director   whom the sister   of Maria
             und die Mutter von Franziska **ignoriert** hatten.
             and the mother of   Franziska ignored   had
             'Paula and the sister of Sophie greeted the director whom Maria and the
             mother of Franziska had ignored.'

Trueswell et al., 1993) and *thematic role preferences* (Pickering et al., 2000). More recent models have attempted to integrate lexical information and structural probability (e.g. Narayanan & Jurafsky, 2002).

Locality-based accounts predict slower reading times at the verb as the distance increases, since the integration cost increases with distance. Expectation-based accounts, such as Levy's (2008) *Surprisal Theory*, predict faster reading times at the verb as the length of the RC increases. As soon as the relative pronoun is parsed, a verb is guaranteed to appear in the forthcoming input string. As the length of the RC increases, the probability that the verb is indeed the next word increases as well.

The first experiment by Vasishth & Drenhaus (2011) was a self-paced reading task. They found slower reading times at the verb as the distance between the verb and the argument increased. This result supports locality-based accounts, which predict that increasing distance between two dependents result in an increase in processing complexity. In a second experiment, Vasishth & Drenhaus (2011) used the same material as before in an eye-tracking study. The results were similar to the findings of Demberg & Keller (2008). The first pass measures support expectation-based accounts, and showed no effect for integration cost. However, second-pass and re-reading measures support locality-based theories. Their conclusion echoes that of Demberg & Keller (2008), namely that "both expectation-based facilitation and locality cost play a role in determining processing cost but that these two factors operate at different stages of processing" (Vasishth & Drenhaus, 2011:69).[21]

The third experiment conducted by Vasishth & Drenhaus (2011) was an ERP study. They found that in the conditions with longer RCs, the ERP patterns are "more negative-going" than the less complex versions. Vasishth & Drenhaus (2011) note that this could be comparable to the *Left Anterior Negativity*, which was found in studies on long-distance wh-dependency resolution (Kluender & Kutas, 1993*a,b*). Furthermore, other studies have also found negativity on the verb, when the parser was attempting to integrate dependencies (Osterhout & Holcomb, 1992; King & Kutas, 1995; Vos et al., 2001). Thus, the results of the ERP study provide further support for locality-based accounts, which predict an increase in integration cost as distance increases.

In summary, the self-paced reading task and the ERP study support locality-based accounts, the eye-tracking study provides evidence for both locality-based and expectation-based accounts, as measures on first pass showed no effect for integration, second-pass and re-reading, however, did show effects. This indicates that both accounts play a role in dependency length, albeit more evidence was found supporting locality-based theories.[22]

Vasishth & Drenhaus (2011) and Demberg & Keller (2008) are not the only researchers who conclude that both accounts independently influence processing. Boston et al. (2008, 2011) conducted a study using the Potsdam Sentence Eyetracking Corpus

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[21]In their study involving locality manipulations, Sommerfeld et al. (2007) came to a similar conclusion using data from eye-tracking and ERP studies.

[22]Vasishth & Drenhaus (2011) remark that the difference between their findings and those of Konieczny (2000) might be due to their material. In all of their conditions, proper names appeared multiple times in the sentence, which might have resulted in higher interference during the retrieval of the argument (cf. Van Dyke, 2007).

(Kliegl et al., 2006). They found that both locality-based and expectation-based accounts make accurate predictions for eye fixation durations. They conclude that "both probabilistic and working memory constraints" influence processing (Boston et al., 2011:25).

Levy & Keller (2013) came to the same conclusion investigating German verb-final structures in a corpus study and two eye-tracking experiments. They found that verbs in verb-final dative constructions were read faster when they were preceded by a dative noun phrase (compared to when there was no preceding dative NP), suggesting a facilitation effect when the verb can be predicted by additional material appearing previously in the sentence. However, when they increased the memory load by embedding the main clauses that served as test sentences in the first experiment within a RC, and added an adjunct phrase to the dative NP before the final verb, the presence of both phrases before the verb increased reading times at the verb. This suggests that the integration of the additional material at the verb does result in a distance-based cost. Levy & Keller (2013) conclude that both expectation-based as well as locality-based effects can be detected in the same structure.

Levy et al. (2012) conducted a self-paced reading experiment on RC extraposition in English, in which the expectation for a post-modifying RC was manipulated. By adding the premodifying collocation *only those* to the NP, a "very strong expectation for a postmodifier" (Levy et al., 2012:25) should be raised. An example set of sentences used in the study is shown in (126).

(126)   a. **adjacent, weak expectation**

The chairman consulted the executives about the company which was acquired recently by an aggressive rival firm.

      b. **extraposed, weak expectation**

The chairman consulted the executives about the company who were highly skilled and experienced in the industry.

      c. **adjacent, strong expectation**

The chairman consulted only those executives about the company which was acquired recently by an aggressive rival firm.

      d. **extraposed, strong expectation**

The chairman consulted only those executives about the company who were highly skilled and experienced in the industry.

The results showed that when the expectation for a post-modifying RC were weak, sentences with the RC in adjacent position were read considerably faster than sentences with an extraposed RC. If the expectation for a post-modifying RC was raised by inserting *only those* in front of the modified noun, sentences with extraposed RCs were read just as fast as sentences with adjacent RCs. Thus a strong expectation for a post-modifier can neutralize the reading-time difference between adjacent and extraposed RCs. Levy et al.

(2012:29) conclude that "a strong expectation for a relative clause modifying a given noun can strongly facilitate comprehension of an extraposed RC modifying that noun."

Strunk (2014) conducted an acceptability judgement experiment on RC extraposition in German, in which the salience of the noun and the expectation for a post-modifier were manipulated. In German, the demonstrative *derjenige/diejenige/dasjenige* 'that one' is "usually stressed and cataphoric" and often signals an upcoming RC (Strunk, 2014:102). In his experimental material, Strunk (2014) tested two factors: length of the intervening material between antecedent and RC (short vs. long), and type of determiner (article vs. demonstrative). An example set of sentences is shown in (127).

(127) a. Jens hat **die** Musikerin ausgelacht, die das einfache Stück nicht
Jens has the.FEM musician laughed-at who.FEM the easy piece not
spielen konnte.
play could
'Jens laughed at the musician who could not play the easy piece.'

b. Jens hat **die** Musikerin **nach dem Konzert** ausgelacht, die das
Jens has the.FEM musician after the concert laughed-at who.FEM the
einfache Stück nicht spielen konnte.
easy piece not play could
'Jens laughed at the musician after the concert who could not play the easy piece.'

c. Jens hat **diejenige** Musikerin ausgelacht, die das einfache Stück
Jens has that-one.FEM musician laughed-at who.FEM the easy piece
nicht spielen konnte.
not play could
'Jens laughed at that one musician who could not play the easy piece.'

d. Jens hat **diejenige** Musikerin **nach dem Konzert** ausgelacht, die
Jens has that-one.FEM musician after the concert laughed-at who.FEM
das einfache Stück nicht spielen konnte.
the easy piece not play could
'Jens laughed at that one musician after the concert who could not play the easy piece.'

The results showed that sentences with an article as a determiner were rated higher than sentences with a demonstrative when the RC was extraposed over a short distance (a verb). As expected, when the intervening material was long (a PP adverbial + verb), sentences with a demonstrative were rated higher than sentences with an article. Strunk (2014:105) concludes that raising the expectation for a post-modifying RC by using "a demonstrative can alleviate the negative effect of a longer distance on the acceptability of extraposition.

3.4 Relevant Factors of Extraposition in Language Production and Processing

In the previous sections, the influence of the weight of the extraposed constituent and the influence of the length of the intervening material on extraposition have already been mentioned. Since these two factors are of paramount importance to the experimental work in this thesis, Sections 3.4.1 and 3.4.2 will give more detailed discussions of the notions of "heaviness" and "distance".

3.4.1 Heaviness: Length or Complexity?

The observation that long and complex constituents follow short ones goes back to Behagel (1909, 1930, 1932). Behagel formulated the *Gesetz der wachsenden Glieder* (Law of the Growing Elements), which states that of two constituents of different size, the larger one follows the smaller one. The term "end weight" was first introduced by Quirk et al. (1972), and referred to the idea that long and complex phrases are realized at the end of the sentence.

Heaviness has been found to play an important role in a number of word order variations, not just in English, but also cross-linguistically (Arnold et al., 2000, 2004; Cheung, 2006; Hawkins, 1994, 2004; Konieczny, 2000; Lohse et al., 2004; Matthews & Yeung, 2001; Siewierska, 1993; Stallings et al., 1998; Stallings & MacDonald, 2011; Uszkoreit et al., 1998*b*; Wasow, 1997*a*; Yamashita & Chang, 2001). In English, there is even a construction that carries the assumption of heaviness in its name, *Heavy NP Shift* (the term was first used by Kimball (1973) and was then taken up by many other linguists.[23]) An example of *Heavy NP Shift* is shown in (128). In (128b) the "heavier" NP has been "shifted" to the right of the shorter PP.

(128)   a.   John [$_{VP}$ took [$_{NP}$ only his own personal acquaintances] [$_{PP}$ into account]]

   b.   John [$_{VP}$ took [$_{PP}$ into account] [$_{NP}$ only his own personal acquaintances]]
   (Wasow, 2002:33)

"Heaviness" is not a clearly defined term. It is not clear if "heavier" simply means "longer", as in the number of words in a constituent (a definition applied by Hawkins, 1990, 1994), of if "heavy" refers to the "complexity" of a constituent. The latter view is taken by Chomsky (1975:477):

> It is interesting to note that it is apparently not the length in words of the object that determines the naturalness of the transformation, but rather, in some sense, its complexity. Thus "they brought all the leaders of the riot in" seems more natural than "they brought the man I saw in". The latter, though shorter, is more complex.

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[23]Other denotations include "Complex NP Shift" (Ross, 1967), or simply "NP Shift" (Larson, 1988)

Sometimes only the absolute length or complexity is considered, meaning that only one constituent is considered and a decision has to be made as to which factors have to apply to make it count as long or complex (Ross, 1967; Emonds, 1976; Erdmann, 1988). Sometimes the weight of one constituent is considered relative to the weight of another constituent. Evidence for relative end-weight was found in a number of studies (Hawkins, 1994; Rickford et al., 1995; Wasow, 1997a; Wasow & Arnold, 2003; Stallings & MacDonald, 2011). With regard to relative clause extraposition, most studies assume that the length or heaviness of the relative clause has an influence on extraposition (Hawkins, 1994, 2004; Gibson, 1998, 2000; Uszkoreit et al., 1998b,a; Konieczny, 2000; Korthals, 2001; Francis, 2010; Strunk, 2014).

It is an open question whether the choice to extrapose is motivated from the perspective of the speaker, in other words, from a production point of view, or if the aim is to facilitate comprehension for the person who is addressed. Theories that advocate the idea that extraposition is motivated by comprehension factors are Miller & Chomsky (1963), Bever (1970), Kimball (1973), and Frazier (1985). Hawkins (1994) is mainly taking a comprehension approach as well, however, he does consider production factors in later versions of his theory (Hawkins, 2003, 2004, 2014). Production-motivated perspectives are taken by Wasow (1997b), Stallings et al. (1998) and Arnold et al. (2000), although Wasow (1997b:95) points out that "what makes things easier to produce tends to make them easier to analyze as well".[24]

From a production point of view, it is assumed that sentence elements that are more easily planned or accessible will be placed earlier in the sentence, and that shorter phrases are more accessible simply due to the fact that there are fewer words to be planned. This also gives more time for planning longer and more complex phrases, which are then expected to appear later in or at the end of the sentence (see Bock & Levelt, 1994; De Smedt, 1994; Wasow, 1997a; Chang, 2009; Yamashita, 2002).

Wasow (1997b) investigated whether the deciding factor is length or complexity. In his corpus study on *Heavy NP Shift*, the *Dative Alternation*, and *Particle Movement* in English he concluded that "counting words, nodes, or phrasal nodes all work well" (Wasow, 1997b:102). Wasow & Arnold (2003) looked at the same sentence structures, however, they did not only conduct a corpus study, but also an acceptability judgement task. In their material, they kept the length of the NP constant, while varying its structural complexity by modifying the noun, either with an adjective or a relative clause. For conditions with increased complexity, ratings were higher when the NP was shifted to the end of the sentence. Their results showed that length and complexity are both distinct factors of weight and both influence constituent ordering independently from each other. They conclude that both factors should be considered independently. These findings also show how important it is to explicitly state if "weight" is defined as "length", "complexity" or both.

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[24]Wasow (1997b) refers to a study by Gibson & Pearlmutter (1994) for a further discussion of this issue.

Arnold et al. (2000) conducted a corpus study and an elicited production experiment on *Heavy NP Shift* (HNPS) and *Dative Alternation* (DA). Example sentences for both constructions are shown in (129) and (130).

(129)   *Heavy NP Shift*

    a. The waiter brought the wine we had ordered to the table.

    b. The waiter brought to the table the wine we had ordered.

(130)   *Dative Alternation*

    a. Chris gave a bowl of Mom's traditional cranberry sauce to Terry.

    b. Chris gave Terry a bowl of Mom's traditional cranberry sauce.

    (Arnold et al., 2000:28)

Arnold et al. (2000) investigated the influence of heaviness (in terms of constituent length measured in number of words) and informational status (given vs. new) on constituent ordering in the above mentioned sentence structures. They point out that such a comparison is not easy to make, since there is such a high correlation between them. Information that has been mentioned recently in the discourse is still accessible to both speaker and hearer, thus given material does not have to be as complex as material that is new to the discourse (see Ariel, 1990; Arnold, 1998; Gívon, 1983). Niv (1992) even suggests that "all effects attributed to end weight can be explained in terms of information structure."

The corpus study[25] by Arnold et al. (2000) investigated both HNPS and DA. One of the sentences found in the corpus, featuring HNPS, is shown in (131).

(131)   It takes [$_{PP}$ into account] [$_{NP}$ the need not to be overtaken by the constant evolution of the labour market].
    (Arnold et al., 2000:35)

The main finding in the corpus study was that both constructions (HNPS and DA) are influenced by heaviness as well as newness. Newer and heavier constituents were produced later in the sentence. While both factors influence constituent ordering, Arnold et al. (2000) found that shifting was also influenced by another factor: constituents were more likely to shift if the other constituent was part of an idiom or a fixed expression, such as *take into account*.

Arnold et al. (2000) also conducted an elicited production experiment, or, more precisely, an "act-out task." One of the participants was given the task of giving instructions to his fellow participant. The second participant had to act out these instructions by manipulating a given set of objects. In the experiment by Arnold et al. (2000), participants were given sets of toy animals, and a number of different objects. They were then instructed to give certain objects to certain toy animals. Newness was

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[25]The corpus used was the "Aligned-Hansard corpus," which consists of transcriptions of debates in the Canadian parliament.

manipulated by either mentioning the animals or the objects previously, so that one group was given in the discourse, and the other one was new. For example, the second participant would get a cue card, prompting him to ask "What about the white rabbit, the black rabbit, and the pink rabbit?", thus establishing all three toy animals in the discourse, but not the possible objects. The first participant would then give an instruction (also prompted by a cue card) which could have been something like "Give the white rabbit the carrot." Heaviness was manipulated by changing the length/complexity of the objects given on the cue card, for example *the small green crayon*, or *the large yellow crayon.*

As a result of their production experiment, Arnold et al. (2000) found that both heaviness and newness significantly influence constituent order. Given and light constituents were produced earlier in the utterance, while new and heavy constituents were produced later. There was also a significant interaction between heaviness and newness: when both constituents were given, heaviness had a stronger influence on constituent order than when both constituents were new.

After evaluating the results of both the corpus study and the production experiment, Arnold et al. (2000) conclude that the strength of influence of each factor depends on how strong the other one is. This means that in cases where there is a big difference in weight between two constituents, the lighter one will most likely be produced earlier in the sentence, and information status does not have much effect. On the other hand, in cases where one constituent is particularly accessible (e.g. because it has just been mentioned in the last phrase), information status will influence constituent order more than weight. Arnold et al. (2000) point out that these findings are consistent with constraint-based models in language processing, in which the influence of one constraint is stronger when the other constraints are weak (Bates & MacWhinney, 1989; MacDonald et al., 1994; Trueswell & Tanenhaus, 1994).

In summary, there is evidence for the influence of heaviness on the ordering of constituents. It is important to specify if, in a given study, heaviness refers to length or complexity, since both factors have an independent influence on constituent order. Acceptability of extraposed RCs increased when they were long. In corpora, the majority of extraposed RCs are long, and the mean reading times of long extraposed RCs are shorter compared to RCs in adjacent position. As the length of the extraposed constituent decreases, so does the acceptability. Shorter constituents occur more often in adjacent position. However, it is not the absolute length of the extraposed constituent what matters, but the relative weight of the extraposed constituent and the intervening constituent(s). Therefore, weight is only one factor, another one is distance.

3.4.2 Distance

"Distance" refers to the distance between a head and its dependents. With regard to the subject of this dissertation, a more specific description would be the distance between a head noun and its (extraposed) PP. According to a number of studies (mostly on RC

extraposition), (extraposition) distance is the crucial factor for the "choice" to extrapose
or not (Hawkins, 1994, 2004, 2014; Gibson, 1998, 2000; Uszkoreit et al., 1998*b,a*; Bader,
2014; Strunk, 2014).

The example sentences in (132) illustrate the growing distance between a head noun
and its extraposed PP.

(132) a. Eine Frau   **kam herein** mit langen blonden Haaren.
           A   woman came in   with long   blond   hair

       b. Eine Frau   **betrat den Raum** mit langen blonden Haaren.
           A   woman entered the room   with long   blond   hair

       c. Eine Frau   **betrat unerwartet den Raum** mit langen blonden Haaren.
           A   woman entered unexpectedly the room   with long   blond   hair

Considering the sentences above, it seems that the sentence in (132a), in which
extraposition takes place over verbal material, is still acceptable, although some people
would argue that, in their reading, the woman is carrying the blond hair in her hands.
Sentence (132b) might still be acceptable, although the same reading as in (132a) is
possible, with an additional ambiguity. Syntactically, the PP could be attached to the
NP *den Raum* (the room) instead of to its actual NP, *eine Frau* (a woman)[26]. Sentence
(132c) would most likely be judged as unacceptable by most native speakers. The same
ambiguities apply as in the other two sentences. However, the growing distance of head
noun and PP would have most readers interpret the sentence in a different reading than
the one intended. The additional adverb causes the reading of a woman entering a room,
while holding a blond wig in her hand, which was quite unexpected, to be the most
likely one. Most people would simply judge the sentence as a not particularly good one.
The tendency to place the adverb and intervening NP outside the intervening material
would probably be strong, as in the sentence *Eine Frau mit langen blonden Haaren betrat
unerwartet den Raum* (A woman with long blond hair entered unexpectedly the room),
which is a perfectly fine sentence in German.

In the *Early Immediate Constituents Proposal* (EIC) by Hawkins (1994, 2004, 2014),
(extraposition) distance is considered relative to the length of the extraposed constituent
(the local complexity metric proposed by Hawkins (1994) in the EIC is discussed in detail
in Section 3.1). The basic assumption is that an ordering of constituents is preferred that
will guarantee the fastest possible processing of a phrase and its immediate constituents
(ICs). In the EIC, distance is measured in words, meaning that such a word order will be
preferred as will take the fewest words to be parsed in order for the phrase and its ICs to
be recognized. In the example sentences in (133), which are slightly modified versions
of the sentences above, we have a PP that is adjacent to its head noun in (133a), and
the same sentence with an extraposed PP in (133b). According to the EIC, the version
in which the VP and all of its ICs can be recognized by the parser the fastest, will be
preferred. In (133a), six words are needed to recognize the heads of the NP, PP and VP.

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[26]From a semantic perspective, this reading should be discarded.

In the extraposed version in (133b), the VP that intervenes between the head noun and its PP is slightly longer than the PP, resulting in a total number of seven words until the last IC can be parsed. While a difference of one word is not much, the EIC would predict a slight preference for the version with the adjacent PP.

In (134), the five-word RC *die bis zum Boden gingen* ('that to the floor went') was added to the PP. In the extraposed version in (134b), the number of words needed for the parser to arrive at the last IC remains seven. Due to the longer adjacent PP in (134a), however, the number of words needed to recognize all ICs in the adjacent version is twelve. At least according to the EIC, the extraposed version should be preferred.

(133)   a. [$_{NP}$ Eine Frau pp[mit blonden Haaren]] [$_{VP}$ betrat unerwartet den Raum]
                1   2   3   4   5   6

         b. [$_{NP}$ Eine Frau [$_{VP}$ betrat unerwartet den Raum] [$_{NP}$ [$_{PP}$ mit blonden Haaren]]
                1   2   3   4   5 6   7

(134)   a. [$_{NP}$ Eine Frau [$_{PP}$ mit langen blonden Haaren, die bis zum Boden gingen]]
                1   2   3   4   5   6   7 8 9   10   11
           [$_{VP}$ betrat unerwartet den Raum]
              12

         b. [$_{NP}$ Eine Frau [$_{VP}$ betrat unerwartet den Raum] [$_{NP}$ [$_{PP}$ mit langen blonden
                1   2   3   4   5 6   7
           Haaren, die bis zum Boden gingen]]

With regard to German RC extraposition, Hawkins (1994:203) makes two predictions: First, extraposition from NP will not, in general, be productive out of a complex NP in the *Vorfeld* (prefield), whereas it will be productive out of the *Mittelfeld* (middlefield); secondly, it should be highly productive in the event that V alone intervenes, and it should be much less productive when there is an additional intervening constituent. Therefore, the extraposition distance always has a stronger influence on extraposition than the length of the extraposed constituent. The second prediction is interesting, since it suggests that a sentence, as shown in (135a), should be more productive, than the version shown in (134a).

(135)   a. Gestern   hat eine Frau   unerwartet   den Raum betreten mit langen
           yesterday has a   woman unexpectedly the room entered with long
           blonden Haaren, die   bis zum Boden gingen
           blond   hair   which to the floor   went

         b. Gestern   ist eine Frau   gekommen mit langen blonden Haaren, die
           yesterday is a   woman come   with long   blond   hair   which
           bis zum Boden gingen
           to the floor   went

However, considering the other two predictions, the sentence in (135b) should be much better. In the material that was created for the experimental studies in this dissertation, the NP out of which was extraposed was also situated in the middlefield.

Marillier (1993) conducted a corpus study on German relative clause extraposition. He found that extraposition occurs almost always if the head is situated in the middlefield (preferably at the right edge), and the right bracket only holds one element. He adds that, when the relative clause is in adjacent position, verb particles, the past participle, and infinitives seem to be "too weak" to be the only elements in the right bracket. In this case, the relative clause seems to "disrupt the balance of the bracket structure around the middlefield" (Marillier, 1993:227). However, whenever there is more than one element in the right bracket, the adjacent position of the RC is preferred. According to these findings, the length of the RC does not influence extraposition all that much. Rather, it is the position of the head and the number of elements in the right bracket, or, in other words, the distance, that is the deciding factor.

Korthals (2001) conducted a corpus study on center-embedded relative clauses in German. In a multiple center-embedded RC, the noun of an RC is modified by another RC. This second RC can either be positioned adjacent to the first, or in extraposed position with an intervening VP. An example set of sentences is shown in (136).

(136)   a. Er hat den Termin, der   für die Konferenz, die   er besuchen wollte,
            He has the date   which for the conference which he visit   wanted
            festgesetzt war, gekannt.
            set   was known

       b. Er hat den Termin, der   für die Konferenz festgesetzt war, die   er
            He has the date   which for the conference set   was which he
            besuchen wollte, gekannt.
            visit   wanted known

            'He knew the date, which was set for the conference, which he wanted to visit.'

    (Korthals, 2001)

Korthals (2001) found an effect for extraposition distance. If the extraposition distance was more than three words, the second RC was always in adjacent position. Furthermore, adjacent RCs were significantly shorter when the possible extraposition distance was short. Extraposed RCs showed no lengths effects, they were average in length.

Distance is also a central factor in the *Dependency Locality Theory* (DLT) by Gibson (2000) (discussed in detail in Section 3.2). In the DLT, preferences for constituent ordering depend on the integration costs of a newly parsed linguistic element with its head previously encountered in the discourse. The greater the distance between these two dependents, the higher the processing cost. In the DLT, distance is measured by the number of "new discourse referents" in the intervening material between head and dependent. "New discourse referents" are basically all verbs and NPs appearing in the intervening material. Considering extraposition of PPs, this means that both the intervening material as well as the extraposed PP have to be considered, since in the adjacent position, it is the PP that intervenes between the head noun and the clause-final verb. The shorter the distance between head and dependents, the lower the integration

costs. Therefore, the preferred word order depends on which word order results in the lowest integration costs.

In summary, extraposition distance has been found to be a deciding factor in the decision to extrapose or to keep a constituent adjacent. It might even have more influence than the length or heaviness of an extraposed constituent (cf. Marillier, 1993). With regard to relative clauses, extraposition over one word (preferably a verb) seems to be acceptable, but with increasing distance acceptability decreases rapidly (Bader, 2014). As a matter of fact, ratings in acceptability studies have been found to be always higher for the adjacent position (Uszkoreit et al., 1998*b*; Konieczny, 2000; Francis, 2010), even if in theory (cf. Hawkins, 1994) extraposed variants should be rated just as high or even higher.

In a corpus analysis of RC extraposition in German, Strunk (2014) found a number of factors that influence the motivation to extrapose. A list of these factors is given in (106), here repeated as (137) for convenience:

(137)   Factors that play a significant role in RC extraposition (Strunk, 2014:99):
        Antecedent: cataphoric; **definiteness**; **grammatical function**; pronominal; topological field; type of determiner
        Relative clause: complex (contains subordinate clause); coordinated; **length**; restrictiveness
        Matrix clause: (hypothetical) distance between antecedent and RC; postfield already occupied; **(potentially) intervening adverbial**; **(potentially) intervening DP**; (potentially) intervening negation

Factors marked as bold are also investigated in this thesis, only with regard to PP extraposition.[27]

3.5 Research Questions Addressed In This Thesis

To the best of my knowledge, there are no prior studies on PP extraposition in German which investigate extraposition behaviour in elicited production. One aim of this thesis is, therefore, to test if the assumptions about extraposition with regard to the factors discussed above hold true for language production as well. Chapter 4 presents four elicited production experiments which investigate the influence of the length of the extraposed constituent as well as of the intervening material, differences within the make-up of the intervening material, and differences between PP and RC extraposition.

In order to give a more complete account of the phenomenon, and also to be able to discern differences as well as similarities between production and acceptability, Chapter 5 presents three experiments on the acceptability of extraposition, focussing on the influence of the definiteness status of the NP, and the influence of constituent weight, measured in phrasal nodes.

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[27]In the experimental material in this thesis, (potentially) intervening DPs occur as part of PP adverbials.

In the production experiments, 'heaviness' was defined as length of the constituent, measured in number of words. Experiment 7 investigated the influence of constituent weight, measured in phrasal nodes. Here, the length of the constituents, as in number of words, was matched across conditions.

The following questions will be in the focus of this thesis:

Concerning the length of the extraposed constituent

- How does the length of the extraposed PP influence extraposition rates? Are longer PPs reproduced in extraposed position?

- Since extraposed position is considered non-canonical, will there be a change of position from extraposed (non-canonical) to adjacent (canonical) in reproduction?

- Does number of phrasal nodes define weight of a constituent? Will therefore the number of phrasal nodes within an extraposed constituent influence its acceptability?

Concerning the length and make-up of the intervening material

- How does the length of the intervening material influence extraposition rates? Will there be an increase in position change from extraposed to adjacent as the intervening material increases?

- Does the make-up of the intervening material play a role in its influence on extraposition rates? Will the extraposition behaviour in reproduction be different when the intervening material consists of purely verbal material? Does the length of the verb cluster influence extraposition rates?

Concerning the acceptability of extraposition

- Are sentences with adjacent PPs more acceptable than sentences with extraposed PPs?

- How does the length of the intervening material influence the acceptability of extraposition?

Further questions

- Does there exist a (soft) constraint for definiteness of the NP out of which is extraposed, similar to the one found for RC extraposition in English and German?

- What are the differences and similarities between PP and RC extraposition in elicited production?

Chapter 4

Extraposition of Prepositional Phrases in Elicited Production

4.1 Method: Production From Memory

Extraposition has been investigated using a number of experimental methods, however, almost all of them are concerned with *comprehension*. While most studies conducted corpus studies as a means to look at production, the experimental designs mostly used acceptability/grammaticality judgements (e.g. Uszkoreit et al., 1998*a*; Konieczny, 2000; Francis, 2010), self-paced reading tasks (e.g. Konieczny, 2000; Demberg & Keller, 2008; Francis, 2010), eye-tracking (e.g. Demberg & Keller, 2008; Vasishth & Drenhaus, 2011), and ERP studies (e.g. Vasishth & Drenhaus, 2011).

An exception to the rule is Bader (2014), who looked at RC extraposition in German.[1] The method used was a variant of the *Production from Memory* task, in which participants read a sentence on the computer screen, followed by a prompt that required them to reproduce the sentence in the form of an embedded clause.

The basic idea for the *Production from Memory* method goes back to the 19th century, when Binet & Henri (1894) suggested that people remember the meaning, but not the surface structure when recalling sentences. The same was found by Sachs (1967, 1974), who concluded that "the specific wording of an utterance is forgotten within seconds after it is heard... In contrast, the meaning of that utterance can be retained for a very long period." In order to test this hypothesis, Bock & Brewer (1974) tested sentences that allowed optional transformation, giving participants the choice between two different surface realizations while preserving the meaning of the sentence. If it is the underlying syntactic form of a sentence that people remember, untransformed sentences should be recalled correctly more often. Moreover, transformed sentences should be recalled in their untransformed underlying version, resulting in a shift from the target sentence.

In the experimental design by Bock & Brewer (1974), the experimenter read aloud a

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[1]There are studies which have used elicited production experiments to investigate a construction that has similar features to extraposition: *Heavy NP Shift* in English (e.g. Arnold et al., 2000; Stallings et al., 1998, and Stallings & MacDonald, 2011).

list of target sentences to be recalled. Then a digit-recall task served as a distractor task. Immediately following the distractor task, participants had to recall and write down the target sentences. The results showed that sentences with two possible surface structures were harder to recall than control sentences for which only one possible structure was available. Only in one of the six tested sentence types were untransformed sentences recalled correctly more often (*Particle movement*). For the other sentence types there was no significant difference of correct recalls between untransformed and transformed target sentences.[2] Bock & Brewer (1974) observed a large number of shifts, in which the meaning of the sentence was preserved, but the syntactic surface structure was changed. Surprisingly, the shifting did not only occur from transformed target sentences to their untransformed underlying structure, but also vice versa.[3] This finding suggests that participants recalled the meaning of the sentence rather than the underlying syntactic structure.

Bock & Brewer (1974) had another group of participants rate the test sentences for "speech preference." It turned out that the shifts largely correlated with the preferred version of the sentences. They conclude that in sentence recall, participants remember the meaning of a sentence, but not the syntactic surface structure. Given the option of two possible surface structure realizations, participants often shift to the preferred version (in the case of an "unpreferred" target sentence they shifted to the preferred version about 50% of the time).[4]

The experimental design by Bock & Brewer (1974) is termed "delayed recall," since there was a delay between hearing the target sentence and the actual recall of the sentence. In Bock & Brewer's (1974) study, this delay took approximately one minute and included a distractor task. Most studies use "delayed recall" (e.g. Bock & Warren, 1985; McDonald et al., 1993; Lee & Williams, 1997; for Japanese see Tanaka et al., 2011), some however use immediate recall, in which the sentence has to be recalled immediately after hearing or reading it (see e.g. Bock, 1986).

Potter & Lombardi (1990) have argued that immediate sentence recall works just like long-term recall, in that a representation of the meaning of the sentence is recalled. The difference between immediate and long-term recall is that the lexical items used in the sentence are still activated and are thus more likely to be used in the regeneration of the sentence. They argue that this is also the reason why sentences which are recalled immediately are often verbatim or near-verbatim. Their conclusion is that it is not only one form of short-term memory that is accountable for sentence recall, but that the conceptual and the lexical systems of short-term memory work together in sentence recall.

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[2]The six sentence types tested were: Particle movement, genitive, pronominalization, dative, *that* deletion, and adverb preposing.

[3]Sentences with transformed particle movement and transformed adverb preposing shifted significantly more often to their untransformed counterparts. However, untransformed genitive and untransformed pronominalization sentences were recalled significantly more often in the transformed versions.

[4]A number of studies suggest that sentence recall reflects biases of language production (see Bock & Irwin, 1980). For example, English native speakers prefer to reproduce passive sentences in the generally preferred active form (e.g. Quirk et al., 1985).

In order to find further support of Potter & Lombardi's (1990) hypothesis, Lombardi & Potter (1992) investigated whether the syntactic surface structure is directly represented in working memory or if the syntactic structure is indeed regenerated just as in normal sentence production. They found that participants changed the syntactic structure of a recalled sentence when the verb they recalled did not match with the syntactic structure of the target sentence. However, when participants hear or read a sentence the syntactic structure is primed. Unless there is some reason to change the structure, for example because of a mismatched verb, participants are therefore likely to recall the primed syntactic structure (Potter & Lombardi, 1998). In conclusion, sentence recall relies on the conceptual representation of the meaning of the recalled sentence, the lexical items of the recalled sentence, which are still activated in memory, and syntactic priming of the recalled sentence.

Rummer & Engelkamp (2001, 2003), however, found differences between immediate and delayed recall of sentences. In their study, they investigated the contribution of phonological information in immediate and delayed sentence recall. They also compared the modality of presentation of the target sentences (auditory vs. visual). Their findings suggest that phonological information is available in sentence recall, but only when there is no delay, and, more specifically, no distractor task between target sentence and recall. While phonological information is supposedly more present when the modality of presentation is auditory, no statistically significant effect of modality of presentation was found.[5]

Polišenská et al. (2014) also compared immediate and delayed sentence recall. They had two different tasks during delayed recall: one group of participants had to count backwards from 10 to 1, another group had to perform a picture-naming task.[6] They found that "immediate sentence recall relies particularly on lexical phonology and morphosyntax, while delayed recall relies more on semantics" (Polišenská et al., 2014:74). Their findings also showed that recall performance was worse when the distractor task was harder. Similar results were obtained by Rose et al. (2014) who tested the effect of different distractor tasks on working memory. In one condition, there was a delay of 10 seconds in which participants rehearsed the one word to be recalled. The other two conditions were an easy math task and a hard math task. Recall was nearly perfect when participants could rehearse the word during delay. Solving a hard math task, on the other hand, made correct recall almost impossible. This is all the more interesting since they had to remember *one word*, and not a full sentence. If participants had to solve an easy math task during the delay, recall was slower and more errors occurred.

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[5]At least not in immediate recall. In delayed recall, participants which had heard the sentences performed worse in sentence recall than those who had read them. However, this might have been due to the experimental design, which included a list of words with potential "lure words." In delayed recall, participants with auditory presentation of the sentence and word list were more likely to recall the word list than the sentence.

[6]In the picture-naming task, participants had to name four items that were displayed on pictures, e.g. "milk, box, letter, tin" (Polišenská et al., 2014:69).

Interestingly, words that had to be recalled after a math task were significantly better recalled in a successive long-term memory task.

Overall, delayed recall seems to reflect spontaneous language production better than immediate recall. In immediate recall, sentences can be repeated without having been properly comprehended. With a delay, however, recall of non-comprehended sentences fails (McDade et al., 1982). Thus, in a delayed sentence recall task, participants have to understand the meaning of the sentence and then can regenerate the sentence, similar to natural language production.

The findings of the studies mentioned above illustrate why the method of *Production from Memory* is a good choice for the investigation of PP extraposition in language production. It is almost impossible to elicit extraposed PPs with the participant not noticing. Moreover, one of the aims is to give the participant a choice between the production of adjacent and extraposed versions. The results of Bock & Brewer (1974) show that participants will remember the meaning of the sentence but not the exact syntactic structure of it. More importantly, participants tend to regenerate the sentence according to their structural preference. Thus, by using the method of *Production from Memory*, it is possible to have participants produce their preferred version of the sentence, and with the addition of a large number of filler sentences, participants are unlikely to notice which structure exactly is under investigation. Delayed recall tasks in particular seem to reflect participants' preferences in spontaneous language production quite accurately.

4.2 Experiment 1: The Influence of the Length of the PP on Extraposition

Experiment 1 investigates the influence of the length of the PP, measured in words, on extraposition rates in elicited production.

The observation that long and complex constituents follow short ones goes back to Behagel's (1930) *Gesetz der wachsenden Glieder* (Law of the Growing Elements), which states that of two constituents of different size, the larger one follows the smaller one. Quirk et al. (1972) introduced the term "end weight", which refers to the idea that long and complex phrases are realized at the end of the sentence. The local complexity metric of the *Early Immediate Constituents theory* (EIC) proposed by Hawkins (1990, 1994) suggests that it is the relative weight of two constituents that matters, thus in the case of PP extraposition, the intervening material should be as short as possible, and the extraposed PP should be as long as possible. On the other hand, a long PP that is adjacent to its head NP increases the distance between head NP and clause-final verb. Thus long PPs should be preferred in extraposed position, especially when the intervening material is shorter than the PP. In adjacent position, however, long PPs should be less preferable.

Empirical evidence for these hypotheses was found in a corpus study on German relative clause extraposition by Uszkoreit et al. (1998*a*). However, there are also some interesting points that should be noted. While Hawkins's (1994) proposal suggests that the intervening material can measure several words as long as it is shorter than the extraposed constituent, Uszkoreit et al. (1998*a*) found that the mean distance of extraposition in the corpus was 1.6 words, and extraposition occurred more often when the relative clause was at least 10-15 words long. Thus, the extraposition distance was preferably very small (one word or two at most), independent of the length of the relative clause, although the relative clause was preferred to be at least five to seven times longer than the intervening material. Uszkoreit et al. (1998*a*) also note that extraposition was more likely over purely verbal material.

Uszkoreit et al. (1998*a*) also conducted an acceptability judgement experiment on RC extraposition in which the factors were *Extraposition Distance* and *RC Length*. Contrary to the predictions of Hawkins's EIC as well as to the findings in the corpus study, which predicted that all conditions with an extraposition distance of one word should be rated higher in the extraposed position, the results showed that this is only the case when the RC is also at least 9-11 words long.

There are no prior experimental studies on PP extraposition, neither in German nor in English. There are a number of studies on RC extraposition, but all but one are either corpus studies or concerned with comprehension using acceptability judgement tasks or self-paced reading tasks. The only exception is Bader (2014), who conducted two production experiments on RC extraposition in German. He tested the *Dependency Locality Theory* proposed by Gibson (2000), which suggests that it is not the number of words but the number of new discourse referents in the intervening material that influences extraposition rates. He found that extraposition was most likely over verbal material (which consisted of two words in his test sentences). When the intervening material included new discourse referents, it was indeed the number of discourse referents and not the number of words that influences extraposition rates, as there was no difference found between a one-word discourse referent or a two-word discourse referent.

In Experiment 1, the intervening material consisted of one verb, since all of the above mentioned studies clearly indicate that verbal material preferably consisting of only one word is the preferred or most acceptable kind of intervening material. The experiment tested three different lengths of the PP: 2-3 words, 5-6 words, and 9-11 words. Compared to studies on RC extraposition, a maximum length of 9-11 words might not seem that long, however, there are two points to consider. First, in natural language, relative clauses can easily attain a considerable length that is rarely or not at all found in PPs that are part of an NP. Secondly, the method of *Production from Memory* puts quite a strain on working memory, and if test sentences were too long, participants would likely fail to remember them either in whole or in part.

4.2.1 Method

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.

Materials

Thirty-six sentences were created, each in six conditions according to the factors *Position* (extraposed vs. adjacent), and *Length of PP* (short: 2-3 words, medium: 5-6 words, and long: 9-11 words). All sentences were main clauses, there were no subordinate or embedded clauses. 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. All NPs were placed on the right edge of the middlefield, to the left of the verb. The three prepositions tested were: *mit* 'with', *für* 'for' and *von* 'of', each being featured in ⅓ of the sentences. In all conditions, the intervening material consisted of one verb. Table 4.1 presents a set of example sentences in all six conditions; for the complete material, see the appendix (Appendix B.1).

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. In conditions with short PPs, the PP was 2-3 words long, meaning the preposition was either followed by a noun, or a determiner and a noun. In conditions with medium length PPs, the preposition was followed by either four or five words. In conditions with long PPs, the preposition was followed by 8-10 words.

When the PP was part of a subject NP, either a temporal adverb, such as *gestern* 'yesterday', or a PP adverbial (i.e., *auf dem Foto* 'on the picture') 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. In some cases, a temporal adverb, i.e., *gestern* 'yesterday', headed the sentence. All sentences were grammatical sentences of Standard German. All test sentences, as well as filler sentences, were read by the author and digitally recorded in a sound-proof cabin.

From the experimental sentences, six stimulus lists were generated which contained an equal number of sentences within each condition but each sentence only in one of its six versions. The experimental sentences within these lists were randomized for each participant individually. The thirty-six stimulus sentences in each list were interspersed in lists of forty-two filler sentences. There were two different sets of filler sentences. Twenty-four filler sentences were experimental items in a study about verb clusters. A sample set of filler sentences of this kind is shown in Table 4.2. Another eighteen filler sentences were made up especially and had no other use than to serve as distractors. All filler sentences were grammatical.

Table 4.1: A complete experimental stimulus from Experiment 1.

PP Length: 2-3 words

Condition 1: PP position: adjacent

Ein	Mann	hat	einen	Gutschein	für	eine	Reise	gewonnen.
A	man	has	a	gift coupon	for	a	trip	won

Condition 2: PP position: extraposed

Ein	Mann	hat	einen	Gutschein	gewonnen	für	eine	Reise.
A	man	has	a	gift coupon	won	for	a	trip

‘A man has won a gift coupon for a trip.’

PP Length: 5-6 words

Condition 3: PP position: adjacent

Ein	Mann	hat	einen	Gutschein	für	eine	Rundreise	durch	Italien
A	man	has	a	gift coupon	for	a	tour	through	Italy

gewonnen
won

Condition 4: PP position: extraposed

Ein	Mann	hat	einen	Gutschein	gewonnen	für	eine	Rundreise	durch
A	man	has	a	gift coupon	won	for	a	tour	through

Italien.
Italy

‘A man has won a gift coupon for a tour through Italy.’

PP Length: 9-11 words

Condition 5: PP position: adjacent

Ein	Mann	hat	einen	Gutschein	für	ein	Kofferset	und	eine	zweiwöchige
A	man	has	a	gift coupon	for	a	case set	and	a	two-week

Rundreise	durch	Italien	gewonnen.
tour	through	Italy	won

Condition 6: PP position: extraposed

Ein	Mann	hat	einen	Gutschein	gewonnen	für	ein	Kofferset	und	eine
A	man	has	a	gift coupon	won	for	a	case set	and	a

zweiwöchige	Rundreise	durch	Italien.
two-week	tour	throughout	Italy

‘A man has won a gift coupon for a case set and a two-week tour throughout Italy.’

Procedure

Participants were tested individually in the psycholinguistics lab of the University of Frankfurt using the PsychoPy software developed by J. W. Peirce (Peirce, 2007). Each experimental session consisted of two parts. In the first part, participants' reading span was assessed. Afterwards, the production experiment was administered.

Reading span task. The reading span task closely followed the automated reading span procedure described in Unsworth et al. (2005), which is a modified version of the original reading span task of Daneman & Carpenter (1980). Each trial consisted of two phases. In the study phase, participants read sentences and letters that appeared in an alternating sequence on the computer screen. First, participants read a sentence that was presented as a whole on the computer screen. After reading the sentence they clicked on a continue

Table 4.2: A sample set of filler sentences from Experiment 1.

3-verb cluster, finite auxiliary in first (a.) or second (b.) position

a. Ich weiß, dass man das Dach vor   dem Sturm **hätte** erneuern müssen.
   I   know that one the roof before the   storm had   repair   must
   'I know that one ought to have repaired the roof before the storm.'

b. Ich weiß, dass man das Dach vor   dem Sturm erneuern **hätte** müssen.
   I   know that one the roof before the   storm repair   had   must

4-verb cluster, finite auxiliary in first (a.) or second (b.) position

a. Ich weiß, dass das Dach vor   dem Sturm **hätte** erneuert werden müssen.
   I   know that the roof before the   storm had   repaired get   must
   'I know that the roof ought to have gotten repaired before the storm.'

b. Ich weiß, dass das Dach vor   dem Sturm erneuert **hätte** werden müssen.
   I   know that the roof before the   storm repaired had   get   must

button. The maximal reading time was 500 ms multiplied by the number of words. If participants did not click the continue button within this time frame, the trial continued automatically. They then had to judge the sentence as either "plausible" or "implausible" by clicking the respective button on the computer screen. The maximal judgement time was 2.5 seconds. After participants had given their judgement, one of twelve letters ("F", "H", "J", "K", "L", "N", "P", "Q", "R", "S", "T", "X") appeared in the middle of the computer screen for one second. The same letters were used as by Unsworth et al. (2005), with the exception of the letter "Y" which was replaced by the letter "X", since in German "Y" is pronounced with three syllables.

After participants had read a certain number of sentences and letters (depending on the list, the number was ranging from three to seven), they had to recall the letters in the order of presentation. In the recall phase, the twelve letters all appeared in a row on the computer screen. Above each letter was a button. Participants had to click on the buttons of the letters that had appeared previously and in the same order of appearance as during the study phase. After clicking on a letter's button, the serial number of the click was displayed within the button. Once participants were finished, they clicked on a continue button. They were then presented with the number of correct letters and the number of correct plausibility judgements they had made. This completed the trial.

The reading span task consisted of 15 trials overall. There were three trials for each of the five different list lengths (3, 4, 5, 6, 7). The order of sentences and letters within a list was random for each participant. In total, participants had to judge 75 sentences and to recall 75 letters. For each participant, a memory score and a processing score were defined. When a letter was recalled in the correct serial position within a specific letter list it was scored as correct. The memory score of each participant was determined by the percentage of correctly recalled letters overall. The processing score of each participant was determined by the percentage of sentences that were correctly judged as "plausible"

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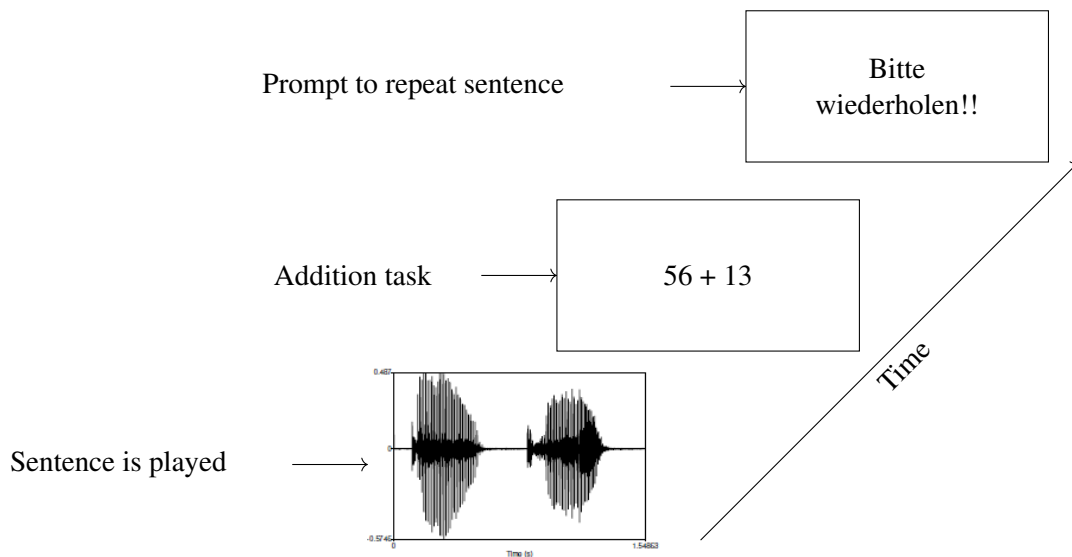
Figure 4.1: Illustration of the Production from Memory procedure used in Experiments 1-4.

or "implausible" throughout the entire reading span task.

Production experiment. Participants were seated in front of a computer monitor. They were given a written instruction on how the experiment was going to work. A research assistant was present who answered any questions that might come up. The instructions told participants that they were going to hear sentences and that their task was to repeat these sentences as faithfully as possible. There was also an example sentence and an example math task on the paper. Before the actual experiment, they were asked to perform a trial session, in which they had to recall five sentences. The sentences used in the trial session were structurally different from the test items in the experiment, but all sentences were grammatical. The trial session merely served as a means to make them accustomed to the procedure. After the trial session they were asked if they had questions, and then the experimental session and the digital recording started. On the computer monitor the sentence *Weiter mit Leertaste* 'Go ahead by pressing the space-bar' appeared. After pressing the space-bar, they heard one test sentence over loudspeakers, after which an addition task appeared on the computer screen. For the addition task, participants had to add two two-digit numbers, e.g. 27+31=? After speaking out loud the solution to the task, they pressed the space-bar again. On the screen the sentence *Bitte wiederholen Sie den Satz* 'Please repeat the sentence' appeared and they said the sentence out loud from memory. There was a time limit of 10 seconds, after which the text message *Zu langsam* 'too slow' appeared on the monitor. After recalling the sentence, participants pressed the space-bar and the next test item was played over the loudspeakers. The participants' recalled sentences were recorded. Figure 4.1 illustrates the procedure.

Participants took about 10 minutes to complete the reading span test and about 25 minutes to complete the main experiment. Including instructions and practice trials, each experimental session lasted for about 40-50 minutes.

4.2.2 Predictions

Studies of sentence memory (Lombardi & Potter, 1992; Potter & Lombardi, 1998) show that participants are not good at remembering the surface syntax of a sentence, but rather remember the meaning of a sentence. Thus the surface structure is regenerated from a representation of meaning in memory.

Using the method of Production from Memory, McDonald et al. (1993) investigated the influence of animacy on word order. Example sentences from their study are shown in (138) and (139) (taken from McDonald et al., 1993:198).

(138) **Animate subject, inanimate object**

Prompt: Appliances were rare in rural America until after World War II. What occasioned a lot of talk in Deadwood, South Dakota, one week in March, 1940?

  a. A farmer purchased a refrigerator.

  b. A refrigerator was purchased by a farmer.

(139) **Inanimate subject, animate object**

Prompt: After investigating the loud rumbling in the hallway, the elementary school teacher returned to find her entire class under their desks. Why?

  a. The sound frightened the students.

  b. The students were frightened by the sound.

The results showed that active sentences were almost always reproduced as active sentences, independently of the factor of animacy. However, passive sentences were often reproduced as active sentences, although less so when passive word order was favoured by animacy. Similar results were found in Japanese. In their study about the influence of animacy on SOV vs. OSV word order, Tanaka et al. (2011) also used the method of Production from Memory. The canonical word order in Japanese is SOV. A sample set of sentences from their experimental study are shown in (140) and (141) (taken from Tanaka et al., 2011:322). The results showed that SOV sentences were almost always reproduced with canonical SOV order. Sentences with an original (non-canonical) OSV order, however, were often reproduced with SOV word order, especially when the subject was animate.

(140) **Animate subject, inanimate object**

  a. Minato de ryoshi-ga   booto-o   hakonda
      Harbor in fisherman.NOM boat.ACC carried.ACT
      'In the harbor, the fisherman carried the boat.'

  b. Minato de, ryoshi-o   booto-ga   hakonda.
      Harbor in, fisherman.ACC boat.NOM carried.ACT
      'In the harbor, the fisherman, the boat carried.'

(141) **Inanimate subject, Animate object**

    a. Minato de, booto-ga ryoshi-o   hakonda.
        Harbor in, boat.NOM fisherman.ACC carried.ACT

        'In the harbor, the boat carried the fisherman.'

    b. Minato de, booto-o ryoshi-ga   hakonda.
        Harbor in, boat.ACC fisherman.NOM carried.ACT

        'In the harbor, the boat, the fisherman carried.'

Taking into account the results of studies which used Production from Memory as their experimental method, the following generalizations are proposed:

 i. Canonical structures are reproduced in their canonical form.

 ii. Non-canonical structures tend to be reproduced as canonical structures.

Applying these generalizations to Experiment 1, the predictions regarding the reproduction of adjacent and extraposed structures are as follows:

(142) **Predictions regarding the reproduction of adjacent vs. extraposed structures**

    i. PPs in adjacent (canonical) position to their NP will also be reproduced in adjacent position.

    ii. PPs in extraposed (non-canonical) position to their NP will tend to be reproduced in adjacent (canonical) position.

The structural position of the PP is only one of the factors under investigation. The second factor is the *Length of the PP*. In order to make predictions for the reproduction of the test sentences in all of their six versions, I will take a look at the predictions made by the two theories of processing complexity discussed in detail above: Hawkins's *Early Immediate Constituents Proposal* (EIC) and Gibson's *Dependency Locality Theory* (DLT).

Predictions made by the EIC

    Following the local complexity metric of the EIC, the IC-to-word ratios for the VP and NP are calculated by dividing the number of ICs (immediate constituents) 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 (in the version in which the PP is 3 words long: *einen Gutschein für eine Reise* 'a gift certificate for a trip'), and the participial verb *gewonnen* 'won'. The NP consists of three ICs, the indefinite determiner *einen* 'a', the noun *Gutschein* 'gift certificate', and the PP *für eine Reise* 'for a trip'. The PP can be recognized at the point of parsing the preposition *für* 'for'. The IC-to-word ratios for a sentence with a PP of the length of 3 words and an NP consisting of a determiner and a noun are shown in Table 4.3.[7]

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[7]The IC-to-word ratios calculated and shown in Tables 4.3 and 4.4 are for PPs of length 3 words and 5 words. In the experimental material, however, short PPs could have 2-3 words and medium length PPs 5-6

Table 4.3: IC-to-word ratios for a sample sentence from Experiment 1, PP length: 3 words.

Adjacent PP, length: 3 words								
Ein Mann hat	einen	Gutschein	für	eine	Reise	gewonnen	**IC/word**	
VP	1	2	3	4	5	6	2/6	=33.33%
NP	1	2	3				3/3	=100%
Total IC-to-word ratio							**5/9**	
Mean percentage								**66.66%**

Extraposed PP, length: 3 words								
Ein Mann hat	einen	Gutschein	gewonnen	für	eine	Reise		
VP	1	2	3				2/3	=66.66%
NP	1	2	3	4			3/4	=75%
Total IC-to-word ratio							**5/7**	
Mean percentage								**70.83%**

In the adjacent version, six words have to be processed until both ICs of the VP can be recognized, resulting in a ratio of 2/6 (=33.33%) 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 (= 66.66%) 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 66.66% in the adjacent version and 70.83% in the extraposed version. The EIC predicts a slight preference for the extraposed version, even with the PP being only 3 words long. However, the difference between 66.66% and 70.83% is negligible. The difference in mean percentages of IC-to-word ratios becomes more pronounced as the length of the PP is increased to 5 words, as shown in Table 4.4.

In the version in which the PP is five words long, the PCD of the sentence in the extraposed version is also 70.83%. In the adjacent version, the length of the PP makes a difference with regard to the number of words that have to be processed until both ICs of the VP can be recognized. Since the PP is now five words in length, the IC-to-word ratio changes to 2/8 (25.00%), resulting in a PCD of 62.50% for the adjacent version of the sentence.

When the PP is nine words long, the PCD of the extraposed version of the sentence is again 70.83%. The PCD of the adjacent version goes down to 58.33%, since the number

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words (long PPs could have 9-11 words). Furthermore, the make up of the NP influences the IC-to-word ratio of the NP: In 25 test sentences the NP consisted of a determiner and noun, 10 NPs consisted of either a mass or plural noun, and one NP consisted of a determiner, adjective and noun.

Table 4.4: IC-to-word ratios for a sample sentence from Experiment 1, PP length: 5 words.

	einen	Gutschein	für	eine	Rundreise	durch	Italien	gewonnen	**IC/word**	
...										
VP	1	2	3	4	5	6	7	8	2/8	=25%
NP	1	2	3						3/3	=100%
Total IC-to-word ratio									**5/11**	
Mean percentage										**62.50%**

Adjacent PP, length: 5 words

	einen	Gutschein	gewonnen	für	eine	Rundreise	durch	Italien		
...										
VP	1	2	3						2/3	=66.66%
NP	1	2	3	4					3/4	=75%
Total IC-to-word ratio									**5/7**	
Mean percentage										**70.83%**

Extraposed PP, length: 5 words

of words that need to be processed in order to recognize both of the ICs of the VP increases to twelve, resulting in an IC-to-word ratio of 2/12 (=16.66%).

For convenience, Table 4.5 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 tables above, as the different lengths of the PPs (2-3 words, 5-6 words, and 9-11) as well as the specific make up of the NP (det noun, mass/plural noun, det adj noun) over all conditions have been incoporated.

Table 4.5: Mean percentages of the efficiency of the test sentences in Experiment 1 as predicted by the EIC.

Length of the PP	Adjacent PPs	Extraposed PPs
2-3 words	69.93%	74.14%
5-6 words	62.06%	74.14%
9-11 words	57.96%	74.14%

In summary, the EIC predicts that sentences with extraposed PPs in Experiment 1 always have a mean PCD of 74.14%. This percentage is relatively high, considering that a. the PCDs of all versions with adjacent PPs are lower, and b. extraposed constituents are supposed to be non-canonical structures and should not be preferred in general. It has to be noted that since the intervening material in Experiment 1 is always one verb even short PPs are slightly longer. The EIC favours constructions in which the longer constituent comes after the shorter one.

When the PP is only 2-3 words long, the EIC predicts a good 4% preference for the extraposed version. For PPs with 5-6 words and 9-11 words, the preference for the

Table 4.6: Discourse processing (DR) and structural integration costs (IC) in EUs for an example sentence from Experiment 1, PP length: 3 words.

	Ein	Mann	hat	einen	Gutschein		für	eine	Reise	gewonnen
					Adjacent PP, length: 3 words					
DR	0	1	0	0	1		0	0	1	1
IC	0	0	0	0	0		0	0	0	1
Total	0	1	0	0	1		0	0	1	2

	Ein	Mann	hat	einen	Gutschein	gewonnen	für	eine	Reise
					Extraposed PP, length: 3 words				
DR	0	1	0	0	1	1	0	0	1
IC	0	0	0	0	0	0	1	0	0
Total	0	1	0	0	1	1	1	0	1

extraposed versions even increases to 12% and 16% respectively. Thus, the longer the PP the more likely a preference for extraposition.

Predictions made by the DLT

While the local complexity metric of the EIC presents an overall percentage corresponding to the efficiency of the given structure during parsing, the DLT gives the combined resource costs at each word while it is parsed. The combined resource costs are made up of:

a. discourse referent (DR): establishing a new referent in the discourse,

b. integration cost (IC): the structural integration of a new head into the structure built thus far, and

c. storage cost (SC): the resources needed to keep the structure built thus far activated in memory.

For every newly established discourse referent, Gibson (2000) assumes the cost of 1 energy unit (EU). Whenever a new phrasal head is parsed that has to be connected to another head in the structure built thus far, 1 EU is assumed for each new discourse referent in the intervening region.

Table 4.6 shows the total processing costs at each word of an example sentence of Experiment 1 with a PP that is three words long. The EUs associated with establishing a new discourse referent (DR) and structural integration (IC) are given as well.

At the point of parsing the clause-final verb *gewonnen* 'won' in the adjacent version of the sentence, the total cost is at 2 EUs: 1 EU for establishing the new discourse referent, and another 1 EU, since one new discourse referent (*Reise*) intervenes between the verb and noun (*Gutschein*). In the extraposed version of the sentence, the total cost at parsing the verb is only 1 EU, since no new discourse referents intervene between the noun and

Table 4.7: Storage cost (SC) in MUs for an example sentence from Experiment 1, PP length: 3 words.

	Adjacent PP, length: 3 words								
	Ein	Mann	hat	einen	Gutschein	für	eine	Reise	gewonnen
SC	2	1	1	2	1	2	2	1	0

	Extraposed PP, length: 3 words								
	Ein	Mann	hat	einen	Gutschein	gewonnen	für	eine	Reise
SC	2	1	1	2	1	0	1	1	0

verb. Thus the highest processing cost occurs at the verb in the adjacent version. In the extraposed version, the processing cost at the preposition *für* 'for' is 1 EU higher than in the adjacent version. Thus both versions have 1 EU less processing cost at some point in the sentence. Since a processing cost of 2 EUs only occurs at the verb in the adjacent version, the extraposed version might have a slight preference.

Storage cost is measured in memory units (MUs). 1 MU is assumed for 'each syntactic head required to complete the current input as a grammatical sentence' (Gibson, 2000:114). Table 4.7 shows the storage costs in MUs for an example sentence from Experiment 1 with a PP of 3 words length.

At the point of processing the sentence-initial article *ein* 'a', two syntactic heads are needed to form a grammatical sentence: a noun and a verb. Therefore, there is a cost of 2 MUs at this point. After processing *Mann* 'man', only one head is needed to complete a grammatical sentence: a verb. Thus the storage cost at this pint is 1 MU. The verb is still needed at the point of processing the auxiliary *hat* 'has'. At the point of processing the article *einen* 'a', the verb is still needed, as well as a noun. The storage cost at this point is therefore 2 MUs. At the noun *Gutschein* 'gift certificate', the verb is still needed to form a grammatical sentence. In the adjacent version, at the point of processing the preposition *für* 'for', the verb and another noun are still needed to form a grammatical sentence. The storage cost therefore is 2 MUs here. This is still the case at the point of processing the article *eine* 'a'. When the noun *Reise* 'trip' is processed only a verb is still needed, and when the verb *gewonnen* 'won' is finally processed the storage cost is 0 MUs, since no further syntactical heads are needed to form a grammatical sentence.

In the extraposed version, the verb already occurs after the noun *Gutschein*. Therefore the storage cost is 0 MUs here, since no more syntactical heads are needed to form a grammatical sentence. At the point of processing the preposition *für*, a noun is still needed. Therefore the storage cost is 1 MUs here. Nothing has changed at the point of processing the article *eine*. When the noun *Reise* is processed the storage cost is 0 MUs, because no more syntactical heads are needed. For the two words of the PP after the preposition, the storage costs are higher in the adjacent version, because the syntactic head of the verb is still required to complete a grammatical sentence.

Table 4.8: Discourse processing (DR) and structural integration costs (IC) for an example sentence from Experiment 1, PP length: 5 words.

	...	hat	einen	Gutschein	für	eine	Rundreise	durch	Italien	gewonnen
					Adjacent PP, length: 5 words					
DR		0	0	1	0	0	1	0	1	1
IC		0	0	0	0	0	0	0	0	2
Total		0	0	1	0	0	1	0	1	3

	...	hat	einen	Gutschein	gewonnen	für	eine	Rundreise	durch	Italien
					Extraposed PP, length: 5 words					
DR		0	0	1	1	0	0	1	0	1
IC		0	0	0	0	1	0	0	0	0
Total		0	0	1	1	1	0	1	0	1

Table 4.8 shows the discourse and integration costs at each word of an example sentence of Experiment 1 with a PP that is five words long. At the point of parsing the verb, the total costs remain at 1 EU for the extraposed PP sentence version, while they increase to 3 EUs in the version with the PP in adjacent position. This increase is due to the increase of discourse referents in the intervening region between noun and clause-final verb (*Rundreise* and *Italien*). This pattern continues as we look at the processing costs for a sentence with a PP of the length of nine words. The total costs at the verb increase to 4 EUs in the adjacent version as we now find three new discourse referents intervening between noun and clause-final verb (*Kofferset*, *Rundreise* and *Italien*).

Both for PPs of length five words and PPs of length nine words, the storage costs for each word of the PP after the preposition is 1 MU higher in the adjacent version as there is still the verb needed to complete the sentence. Table 4.9 shows the storage costs for PPs of length five words, and for PPs of length nine words.

In summary, the DLT predicts a preference for sentences with the PP in extraposed position for all three lengths tested. The preference increases as the length of the PP increases, since the integration costs at the clause-final verb in the adjacent sentence version increases with each new discourse referent introduced in the intervening PP. The storage costs for the PP (minus the preposition) are also higher in adjacent position, since the clause-final verb is still needed throughout the whole PP in order to have a complete and grammatical sentence.

Both the EIC and DLT predict a *slight* preference for extraposed PPs when they are short (2-3 words). As the length of the PP increases both theories predict an increase in preference for extraposition. Keeping in mind the corpus findings of Uszkoreit et al. (1998a) with regard to RC extraposition, a preference for extraposed PPs is more likely when they are at least 9-11 words in length. Thus, the following hypotheses are formulated:

Table 4.9: Storage costs (SC) for an example sentence from Experiment 1, PP length: 5 words, and 9 words.

Adjacent PP, length: 5 words

	...	hat	einen	Gutschein	für	eine	Rundreise	durch	Italien	gewonnen
SC		1	2	1	2	2	1	2	1	0

Extraposed PP, length: 5 words

	...	hat	einen	Gutschein	gewonnen	für	eine	Rundreise	durch	Italien
SC		1	2	1	0	1	1	0	1	0

Adjacent PP, length: 9 words

	Ein	Mann	hat	einen	Gutschein	für	ein	Kofferset	und	eine	zweiwöchige
SC	2	1	1	2	1	2	2	1	2	2	2

	Rundreise	durch	Italien	gewonnen
	1	2	1	0

Extraposed PP, length: 9 words

	Ein	Mann	hat	einen	Gutschein	gewonnen	für	ein	Kofferset	und	eine
SC	2	1	1	2	1	0	1	1	0	1	1

	zweiwöchige	Rundreise	durch	Italien
	1	0	1	0

Hypotheses

i. Target sentences with adjacent PPs will tend to be reproduced with PPs in extraposed position.

ii. As the length of the PP increases, the tendency to reproduce PPs in extraposed position will increase.

The hypothesis that target sentences with adjacent PPs will tend to be reproduced with PPs in extraposed position is converse to the predictions based on the canonicity of adjacent and extraposed structures given in (142). There the prediction was that PPs in extraposed (non-canonical) position to their NP will tend to be reproduced in adjacent (canonical) position.

4.2.3 Results

All of the data were analysed using the R statistics software, Version 3.2.1 (R Core Team, 2015). To test for significant effects, the data were analysed by means of mixed-effect modelling using the lme4 package (Bates et al., 2015). Only complete and grammatical sentences were taken into the analyses. All other sentences were coded as *error*. The experimental factors and all interactions between them were entered as fixed effects into the model. 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 *PP Length*.

Change of Position of the PP

Table 4.10: Percentages of sentences recalled with the position of the PP changed.

PP Length	Adjacent	Extraposed
2-3 words	0	4
5-6 words	1	6
9-11 words	2	5

Table 4.10 shows the percentages of sentences recalled with the position of the PP changed. The results show that the majority of sentences are recalled with the PP in target position. Only 1% of sentences with an adjacent PP of length 5-6 words and 2% with an adjacent PP of length 9-11 words were reproduced with a PP in extraposed position. There were more occurrences of a position change from extraposed to adjacent position. 4% of the sentences with an extraposed PP of 2-3 words, 6% of the sentences with an extraposed PP of 5-6 words, and 5% of the sentences with an extraposed PP of 9-11 words were reproduced in adjacent position.

Table 4.11: Mixed logit model fitted by maximum likelihood for Position in Experiment 1.

	Estimate	Std. Error	z value	p	
(Intercept)	-5.3711	0.7225	-7.434	$<.001$	***
Position	1.9463	0.9934	1.959	0.0501	.

. p$<$.1, *** p$<$.001

Formula: *changed $\sim$ position + (position||subject) + (position||sentence)*

A mixed logit model with participants and items included as random effects and Position as fixed effect showed a marginal effect of Position, as shown in Table 4.11. Due to the empty cell in the condition with adjacent PPs of length 2-3 words, caused by the 0% of position change in this condition, only Position was included as fixed effect in this model. Another model was fit including not only Position, but also PP Lengths and interactions between Position and PP Lengths as fixed effects. In this model the 0% in the above mentioned condition were changed to 1% in the statistical model. The model also showed a marginal effect of Position. There were no effects of PP Lengths and no interactions between Position and PP Lengths.

Material dropped in reproduction

Table 4.12 shows the percentages of sentences recalled with material of the PP having been dropped. The results show that as the length of the PP increases, more material is dropped in reproduction. More material is dropped in sentences with the PP in adjacent position. 28% of sentences with a PP of 5-6 words in adjacent position and 21% of sentences with a PP of 5-6 words in extraposed position are reproduced with a shortened

Table 4.12: Percentages of sentences recalled with material of the PP dropped.

PP Length in Original Sentence	Adjacent	Extraposed
2-3 words	0	1
5-6 words	28	21
9-11 words	66	56

PP. PPs with a length of 9-11 words are shortened in 66% of the sentences when they are in adjacent position, and in 56% of the sentences when they are in extraposed position.

Table 4.13: Mixed logit model fitted by maximum likelihood for Dropping Material in Experiment 1, with Intervener Lengths as fixed effects.

	Estimate	Std. Error	z value	p	
(Intercept)	-2.401	0.399	-6.019	$<.001$	***
Contrast 1: 2-3 words vs. 5-6 words	4.839	1.014	4.771	$<.001$	***
Contrast 2: 5-6 words vs. 9-11 words	2.325	0.275	8.455	$<.001$	***

*** $p<.001$

Formula: $dropped \sim PPLengthTarget1 + PPLengthTarget2 + (PPLengthTarget1 + PPLengthTarget2||subject) + (PPLengthTarget1 + PPLengthTarget2||sentence)$

A mixed logit model with participants and items included as random effects and PP Lengths as fixed effects showed a significant main effect for both PP Lengths (2-3 words vs. 5-6 words, and 5-6 words vs. 9-11 words), as shown in Table 4.13.

Table 4.14: Mixed logit model fitted by maximum likelihood for Dropping Material in Experiment 1, with Position and Intervener Lengths as fixed effects.

	Estimate	Std. Error	z value	p	
(Intercept)	-0.7983	0.3060	-2.609	0.00908	**
Position	-0.6209	0.2503	-2.481	0.01311	*
Contrast 2: 5-6 words vs. 9-11 words	2.4249	0.3080	7.873	$<.001$	***
Position × Contrast 2	-0.1731	0.5101	-0.339	0.73438	

* $p<.05$, ** $p<.01$, *** $p<.001$

Formula: $dropped \sim position + PPLengthTarget2 + position : PPLengthTarget2 + (position + PPLengthTarget2 + position : PPLengthTarget2||subject) + (position + PPLengthTarget2 + position : PPLengthTarget2||sentence)$

In order to avoid issues caused by the empty cell in the condition with adjacent PPs of length of 2-3 words, due to the 0% of dropped material in that condition, and also to accommodate the fact that hardly any material was dropped when PPs were 2-3 words long, a mixed logit model was fit with participants and items included as random effects and Position, PP Length 5-6 words vs. 9-11 words, and interaction between Position and PP Length 5-6 words vs. 9-11 words as fixed effects (see Table 4.14). The model showed a significant main effect of Position and PP Length 5-6 words vs. 9-11 words. There was

no interaction between Position and PP Length.

Error rates

Table 4.15: Percentages of erroneous sentences in Experiment 1.

PP Length in Original Sentence	Adjacent	Extraposed
2-3 words	3	4
5-6 words	4	2
9-11 words	15	11

The method of Production from Memory can be straining for working memory, thus errors occurred regularly and especially often in sentences with PPs of length 9-11 words, as shown in Table 4.15. In this condition, 15% of sentences with adjacent PPs and 11% of sentences with extraposed PPs were coded as errors.

A mixed logit model over the percentages of erroneous sentences with participants and items included as random effects and Position, PP Lengths, and the interactions of Position and PP Lengths as fixed effects showed a significant main effect for PP Length 5-6 words vs. PP Length 9-11 words, as shown in Table 4.16. There was no effect for Position and no interaction between Position and PP Lengths.

Table 4.16: Mixed logit model fitted by maximum likelihood for Error in Experiment 1.

	Estimate	Std. Error	z value	p	
(Intercept)	-3.98402	0.47161	-8.448	<.001	***
Position	-0.34056	0.47586	-0.716	0.474	
Contrast 1: 2-3 words vs. 5-6 words	-0.15881	0.53575	-0.296	0.767	
Contrast 2: 5-6 words vs. 9-11 words	1.87281	0.46922	3.991	<.001	***
Position × Contrast 1	-0.78688	1.06754	-0.737	0.461	
Position × Contrast 2	0.05424	0.99296	0.055	0.956	

*** p<.001

Formula: *error ~ position + PPLengthTarget1 + PPLengthTarget2 + position : PPLengthTarget1 + position : PPLengthTarget2 + (position + PPLengthTarget1 + PPLengthTarget2 + position : PPLengthTarget1 + position : PPLengthTarget2||subject) + (position + PPLengthTarget1 + PPLengthTarget2 + position : PPLengthTarget1 + position : PPLengthTarget2||sentence)*

Relation to reading span

Table 4.17 shows descriptive statistics for the main experiment and the reading span test of Experiment 1. *Accuracy* represents the percentage of correctly recalled sentences in Experiment 1. *Changed* represents the percentage of sentences in which the position of the PP was changed. *Dropped* refers to the percentage of sentences in which part of the PP was dropped. The reading span measures are similar to published results for this version of the reading span test (e.g., Redick et al., 2012; Unsworth et al., 2009). As

Table 4.17: Descriptive Statistics for Experimental and Reading Span Measures in Experiment 1.

Measure	Main experiment (%)			Reading span test (%)	
	Accuracy	Changed	Dropped	Memory score	Processing score
Mean	94	9	32	49	68
SD	0.06	0.09	0.12	14.9	3.9
Range	78-100	0-42	6-56	13-71	56-74

shown by Table 4.17, both the experimental results and the reading span results show a large amount of individual variation.

Table 4.18 shows the pairwise correlations for the mean values of the 24 participants. As has been found before (e.g., Unsworth et al., 2009), there is a positive correlation between memory score and processing score. Participants that were particularly good at recalling letters tended to be also particularly accurate at judging the plausibility of sentences. There is thus no evidence that participants traded off one subtask of the reading span test against the other subtask.

Table 4.18: Correlations Between Experimental and Reading Span Measures in Experiment 1.

Measure	Accuracy	Changed	Dropped	Memory score
Memory score	0.52**	-0.50*	-0.51**	—
Processing score	0.38	-0.26	-0.21	0.62**

* $p<.05$, ** $p<.01$

The data of the main experiment show positive correlations with the results of the memory score of the reading span test. There was no correlation between the data of the main experiment and the processing score of the reading span test. Participants who were good at recalling letters also performed well on the main experimental task and vice versa. This finding was not surprising because both measures are based on the same task, namely recalling from memory either letters or whole sentences.

4.2.4 Discussion

Experiment 1 yielded two major results. First, PPs were almost always reproduced in target position. Overall, 1% of adjacent PPs were changed to extraposed position, and 5% of extraposed PPs were changed to adjacent position. This difference did not reach significance in the statistical analysis. There was only a marginal effect for Position.

The second major result is that in extraposed position, longer PPs are reproduced. While the influence of PP length did not show itself in a change of PP position, it did show in the amount of dropped material in the reproduction of sentences. First of all, the length of the PP had an influence on how much material was dropped. When the PP measured 5-6 words in the original sentence, a statistically significant amount of

material was dropped in the reproduced sentences, in contrast to the condition in which PPs measured 2-3 words in the original sentence. Even more material was dropped in the reproductions of sentences in which the PP measured 9-11 words in the original target version. The contrast of the amount of material dropped in PPs of length 9-11 words to the amount of dropped material for PPs which measured 5-6 words in length was highly significant.

The fact that participants dropped material, especially as the sentences they had to memorize and reproduce increased in length, is certainly also due to limitations of working memory. However, working memory by itself is not enough to explain the findings. When the PPs were of length 5-6 or 9-11 words, significantly more material was dropped in adjacent position than in extraposed position. As less material was dropped in sentences with extraposed PPs, longer PPs were reproduced in extraposed position than in adjacent position. This finding confirms the expectations about the influence of the length of the PP on extraposition.

While the expectation that adjacent PPs, which are assumed to be canonical, would be reproduced in target position was confirmed, the finding that most of the extraposed PPs were also reproduced in target position was contrary to the expectations. As a non-canonical structure, extraposed PPs were expected to be reproduced as a canonical structure, meaning in adjacent position. However, the number of PPs changed from extraposed to adjacent position was not significant, thereby putting into question the notion of extraposition as a non-canonical structure, at least in production.

The results did not show a pronounced preference for extraposed PPs as predicted by the EIC and DLT. Hardly any adjacent PPs were reproduced in extraposed position. However, the findings show that longer PPs are reproduced in extraposed position, thus confirming that there is a preference for longer PPs in that position. This finding is in line with the predictions made by the EIC and the DLT. Both the EIC and DLT predicted increasing preferences for sentences with extraposed PPs. Uszkoreit et al. (1998*a*) found in their corpus study a preference for extraposed RCs when they were at least 9-11 words in length. Similarly, the current results show a significant difference between the length of reproduced adjacent and extraposed PPs when the target PP measured 9-11 words. Although working memory limitations lead participants to drop material, in extraposed position, longer PPs are reproduced.

The toll that the method took on working memory is also reflected in the error rates of reproduced sentences. As the length of the PP increased, the number of erroneous sentences increased. Position of PP had no influence on the number of errors, however the length of the PP did. The error rate reached statistical significance for PPs of length 9-11 words. 15% of sentences with adjacent PPs and 11% of sentences with extraposed PPs of that length were either reproduced incomplete or ungrammatical, or they were not reproduced at all.

In addition, Experiment 1 found significant correlations between the experimental

data and the accuracy of recalling letters in the reading span task. The fact that the correlations were only significant for the memory score of the reading span task confirms that reproducing sentences correctly, changing the position of the PP, and dropping material of the target sentence is strongly influenced by participants' individual working memory performance.

4.3 Experiment 2: The Influence of the Length of the Intervening Material on Extraposition

Experiment 2 investigates the influence of the length of the intervening material between head noun and PP, measured in words, on extraposition rates in elicited production.

In Experiment 1 the intervening material consisted of one verb, since this was assumed to be the most acceptable kind of intervening material following findings of Uszkoreit et al. (1998*a*) and theoretical predictions by Hawkins (1994) and Gibson (2000). The EIC proposal of Hawkins (1994:203) predicts that "extraposition from NP...should be highly productive in the event that V alone intervenes, much less so when there is an additional intervening constituent." The corpus study on RC extraposition in German conducted by Uszkoreit et al. (1998*a*) showed that extraposition was most likely over purely verbal material and when the intervening material consisted of only 1-2 words (the mean length of intervening material in Uszkoreit's corpus study was 1.6 words). However, sentences with longer intervening material have been found.

The maximal distance between a head noun and its dependent RC found in the corpus by Uszkoreit et al. (1998*a*) was nine words. However, 96.5% of sentences with extraposed RCs had an extraposition distance of one to four words.[8] When there was one word intervening the majority of RCs were extraposed (95.2%). With two words intervening the extraposition rate decreased to 77.1%. With an extraposition distance of three words, the extraposition rate decreased rapidly to 34.7%. An even stronger effect of extraposition distance was found by Korthals (2001). In his corpus study on center-embedded relative clauses in German they found that if the extraposition distance was more than three words, the second RC was always in adjacent position.

Uszkoreit et al. (1998*a*) also conducted an acceptability judgement experiment using the method of magnitude estimation. The two factors investigated were *Extraposition distance* (1 word vs. 3-4 words vs. 5-6 words) and *Length of RC* (3-5 words vs. 6-8 words vs. 9-11 words). The results showed that when the extraposition distance was three words or more, all RCs were preferred in adjacent position. When the extraposition distance was 1 word, RCs that were 3-8 words long were still preferred in adjacent position. Only when the RCs were 9-11 words long and the extraposition distance was 1 word were extraposed RCs judged better than adjacent RCs.

The empirical evidence mentioned above is either based on corpus studies or on

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[8]Only three sentences actually had four words intervening between head noun and RC.

acceptability judgement experiments. In his production experiments on RC extraposition in German, Bader (2014) also used Production from Memory, but in a different form than in Experiment 2. The results are similar to those found in the corpus study by Uszkoreit et al. (1998*a*). When the intervening material consists of one verb, extraposition rates are at over 95%. When the extraposition distance increases to four or more words, the extraposition rate decreases to less than 10%. Bader (2014) also concludes that extraposition distance is "a much more important predictor of relative clause placement than the length of the relative clause.

All of the findings above refer to RC extraposition. To the best of my knowledge, there are no experimental studies on extraposition of PP out of NP, and also no empirical findings as to the influence of extraposition distance on extraposition of PPs. The studies on RC extraposition and the apparent influence of the length of the intervening material in corpus studies, acceptability judgements as well as in production experiments generate the expectation that an experimental study on the influence of the intervening material on PP extraposition will provide further insights into extraposition behaviour.

4.3.1 Method

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.

Materials

Thirty-six sentences were created, each in six conditions according to the factors Position (extraposed vs. adjacent), and Length of Intervening Material (1 word (verb) vs. 2 words (verb+adverb) vs. 4 words (verb+PP adverbial)). All sentences were main clauses, there were no subordinate or embedded clauses. 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. All NPs were placed on the right edge of the middlefield. The three prepositions tested were: *mit* (with), *für* (for) and *von* (of), each being featured in one third of the sentences. The length of the (non-)extraposed PP was four words at minimum. Table 4.19 presents a set of example sentences in all six conditions; for the complete material, see the appendix (Appendix B.2).

Since German is a V2-language, in order to have the NP out of which is extraposed be in subject position, another constituent has to be in initial sentence position, e.g. an adverbial phrase. When the PP was part of a subject NP, either a temporal adverb, such as *heute* 'today', or a PP adverbial (i.e., *vor dem Fenster* 'in front of the window') was placed at the beginning of the sentence, followed by the auxiliary verb. Sentences in which the PP was extraposed out of a direct object NP had a subject NP in initial position, followed by the auxiliary verb. In adjacent conditions, the PP is adjacent to the NP,

Table 4.19: A complete experimental stimulus from Experiment 2.

Intervening material: verb

Condition 1: PP position: adjacent

Vor	dem	Fenster	ist	ein	Schmetterling	mit	großen	gelben	Flügeln
In front of	the	window	is	a	butterfly	with	big	yellow	wings

geflattert.
fluttered

Condition 2: PP position: extraposed

Vor	dem	Fenster	ist	ein	Schmetterling	**geflattert**	mit	großen
In front of	the	window	is	a	butterfly	fluttered	with	big

gelben	Flügeln.
yellow	wings

'In front of the window, a butterfly with big yellow wings fluttered.'

Intervening material: adverb and verb

Condition 3: PP position: adjacent

Vor	dem	Fenster	ist	ein	Schmetterling	mit	großen	gelben	Flügeln
In front of	the	window	is	a	butterfly	with	big	yellow	wings

fröhlich	**geflattert**.
happily	fluttered

Condition 4: PP position: extraposed

Vor	dem	Fenster	ist	ein	Schmetterling	**fröhlich**	**geflattert**	mit
In front of	the	window	is	a	butterfly	happily	fluttered	with

großen	gelben	Flügeln.
big	yellow	wings

'In front of the window, a butterfly with big yellow wings fluttered happily.'

Intervening material: PP adverbial and verb

Condition 5: PP position: adjacent

Vor	dem	Fenster	ist	ein	Schmetterling	mit	großen	gelben	Flügeln
In front of	the	window	is	a	butterfly	with	big	yellow	wings

in	**der**	**Sonne**	**geflattert**.
in	the	sun	fluttered

Condition 6: PP position: extraposed

Vor	dem	Fenster	ist	ein	Schmetterling	**in**	**der**	**Sonne**	**geflattert**
In front of	the	window	is	a	butterfly	in	the	sun	fluttered

mit	großen	gelben	Flügeln.
with	big	yellow	wings

'In front of the window, a butterfly with big yellow wings fluttered in the sun.'

and is followed by the verb (condition 1), an adverb and verb (condition 3) or a PP adverbial and verb (condition 5). In extraposed conditions, the PP is found at the end of the sentence, with either the verb (condition 2), adverb and verb (condition 4), or PP adverbial and verb (condition 6) intervening. All sentences were grammatical sentences of Standard German. All test sentences, as well as filler sentences, were read by the author and digitally recorded in a sound-proof cabin.

From the experimental sentences, six stimulus lists were generated which contained an equal number of sentences within each condition but each sentence only in one of its

Table 4.20: A sample set of filler sentences from Experiment 2.

4-verb cluster, finite auxiliary in first (a.), second (b.), or third (c.) position

a. Ich weiß, dass das Dach vor   dem Sturm **hätte** erneuert werden müssen.
   I   know that the roof before the storm had   repaired get   must
   'I know that the roof ought to have gotten repaired before the storm.'

b. Ich weiß, dass das Dach vor   dem Sturm erneuert **hätte** werden müssen.
   I   know that the roof before the storm repaired had   get   must

c. Ich weiß, dass das Dach vor   dem Sturm erneuert werden **hätte** müssen.
   I   know that the roof before the storm repaired get   had   must

---

six versions. The experimental sentences within these lists were randomized for each participant individually. The thirty-six stimulus sentences in each list were interspersed in lists of thirty-six filler sentences. There were two different sets of filler sentences. Eighteen filler sentences were experimental items in a study about verb clusters. A sample set of filler sentences of this kind is shown in Table 4.20. Another eighteen filler sentences were made up especially to serve as distractors. All filler sentences were grammatical.

Procedure

The same reading span task and production task were used as in Experiment 1 (see Section 4.2.1).

4.3.2 Predictions

With regard to the position of the PP in reproduction, it is still assumed that adjacent PPs represent the canonical structure and are reproduced in their canonical form, and that extraposed PPs are non-canonical structures and tend to be reproduced in canonical (adjacent) position. Thus the predictions are the same as in Experiment 1:

Predictions regarding the reproduction of adjacent vs. extraposed structures

i. PPs in adjacent (canonical) position to their NP will also be reproduced in adjacent position.

ii. PPs in extraposed (non-canonical) position to their NP will tend to be reproduced in adjacent (canonical) position.

Predictions made by the EIC

The predictions made by the EIC are based on the local complexity metric of the EIC, which calculates the IC-to-word ratios for the NP and VP by dividing the number of immediate constituents (ICs) by the number of words necessary in order to recognize the last IC. The length of the PP was not specifically investigated in Experiment 2. However,

Table 4.21: IC-to-word ratios for a sample sentence from Experiment 2, length of the intervening material (IM): one word (verb).

	ein	Schmetterling	mit	großen	gelben	Flügeln	geflattert	IC/word	
			Adjacent PP, IM length: 1 word (verb)						
VP	1	2	3	4	5	6	7	2/7	=28.57%
NP	1	2	3					3/3	=100%
Total IC-to-word ratio								**5/10**	
Mean percentage									**64.29%**

	ein	Schmetterling	geflattert	mit	großen	gelben	Flügeln		
			Extraposed PP, IM length: 1 word (verb)						
VP	1	2	3					2/3	=66.66%
NP	1	2	3	4				3/4	=75%
Total IC-to-word ratio								**5/7**	
Mean percentage									**70.83%**

the majority of PPs were four to five words long. In three sentences, the PPs were either six or seven words long.

Table 4.21 shows the IC-to-word ratios for a sample sentence from Experiment 2, with the intervening material consisting of one verb and the length of the PP measuring four words. The mean percentages are similar to those for sentences with one intervening verb and PPs with length of five to six words in Experiment 1. In the example sentence, the VP consists of two ICs, namely the subject NP (*ein Schmetterling mit großen gelben Flügeln* 'a butterfly with big yellow wings'), and the participial verb *geflattert* 'fluttered'. The NP consists of three ICs, the indefinite determiner *ein* 'a', the noun *Schmetterling* 'butterfly', and the PP *mit großen gelben Flügeln* 'with big yellow wings'. The PP can be recognized at the point of parsing the preposition *mit* 'with'.

In the adjacent version, seven words have to be processed until both ICs of the VP can be recognized, resulting in a ratio of 2/7 (=28.57%) for the VP. The three ICs of the NP can be recognized after three words, making the ratio 3/3 (= 100%). The sentences of the extraposed version has the same IC-to-word ratio as all of the extraposed sentences in Experiment 1. The two ICs of the VP can be processed after only three words, resulting in a ratio of 2/3 (= 66.66%) for the VP. With one word intervening between the noun and preposition, four words have to be processed in order to process the three ICs of the NP. As before, the preferred structure is the one with the maximal overall minimization of phrasal combination domains (PCDs). The mean PCDs of the sentence are 64.29% in the adjacent version and 70.83% in the extraposed version. Thus, the EIC predicts a higher efficiency for extraposed PPs when the intervening material is one verb.

When the intervening material increases to two words (an adverb and a verb) the

Table 4.22: IC-to-word ratios for a sample sentence from Experiment 2, length of the intervening material (IM): two words (adverb and verb).

		Adjacent PP, IM length: 2 words (adverb and verb)								
...	ein	Sch.	mit	großen	gelben	Flügeln	fröhlich	geflattert	**IC/word**	
VP	1	2	3	4	5	6	7	8	3/8	=37.5%
NP	1	2	3						3/3	=100%
Total IC-to-word ratio									**6/11**	
Mean percentage										**68.75%**

		Extraposed PP, IM length: 2 words (adverb and verb)							
...	ein	Sch.	fröhlich	geflattert	mit	großen	gelben	Flügeln	
VP	1	2	3	4					3/4 =75%
NP	1	2	3		4				3/5 =60%
Total IC-to-word ratio								**6/9**	
Mean percentage									**67.5%**

EIC predicts for the first time a (slightly) higher efficiency for sentences with adjacent PPs. However, the difference in the mean percentages is negligible. The preference for adjacent and extraposed PPs in this condition should be about the same: 68.75% and 67.5%, respectively. In the adjacent version, eight words have to be processed until the three ICs of the VP can be recognized. Compared to the version with only one verb intervening, the number of words thus increases by one word. However, the additional adverb also adds another IC which has to be recognized. Since this additional IC can be recognized with only one additional word to parse, the efficiency of the adjacent version increases to 68.75%. For the same reason, the efficiency of the VP in the extraposed version increases, since the additional IC can be recognized by processing only one additional word. The efficiency of the NP, however, decreases rapidly (to 60%), as an additional word intervenes between noun and preposition. The overall efficiency for the extraposed version thus decreases slightly to 67.5%.

When the intervening material increases to four words (PP adverbial and verb) the mean percentages for the extraposed version drop by over 20% to 46.43%. In this condition the adjacent version is predicted to be the more efficient and preferred structure (65%). However, the mean percentages for the adjacent version drop slightly as well. This is due to the additional words of the PP adverbial that have to be processed before the head of the VP can be recognized.

Table 4.24 shows the mean percentages of the efficiency of the test sentences in Experiment 2 as predicted by the EIC. The percentages differ slightly from those in the tables above, as the different lengths of the PPs as well as the specific make up of the NP (det noun, mass/plural noun, det adj noun) across all conditions have been incorporated.[9]

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[9]Twenty-seven sentences had a PP of length four words, six sentences had a PP of length five words,

Table 4.23: IC-to-word ratios for a sample sentence from Experiment 2, length of the intervening material (IM): four words (PP adverbial and verb).

	ein	Sch.	mit	gr.	gelben	Flügeln	in	der	Sonne	geflattert	IC/word	
Adjacent PP, IM length: 4 words (PP adverbial and verb)												
VP	1	2	3	4	5	6	7	8	9	10	3/10	=30%
NP	1	2	3								3/3	=100%
Total IC-to-word ratio											**6/13**	
Mean percentage												**65%**

	ein	Sch.	in	der	Sonne	geflattert	mit	gr.	gelben	Flügeln		
Extraposed PP, IM length: 4 words (PP adverbial and verb)												
VP	1	2	3	4	5	6					3/6	=50%
NP	1	2	3	4	5	6	7				3/7	=42.86%
Total IC-to-word ratio											**6/13**	
Mean percentage												**46.43%**

In summary, the EIC predicts that sentences with the PP in extraposed position are more efficient than sentences with the PP in adjacent position when the intervening material consists of one verb. When the intervening material increases to an adverb and verb, the efficiency of both sentence versions should be about the same. Once the intervening material increases to four words (a PP adverbial and verb), sentences with the PP in adjacent position are much more efficient, with the mean percentage of efficiency of extraposed sentence versions dropping below 50%.

Table 4.24: Mean percentages of the efficiency of the test sentences in Experiment 2 as predicted by the EIC.

Length of the intervening material	Adjacent PPs	Extraposed PPs
1 word (verb)	63.74%	71.20%
2 words (adverb + verb)	69.00%	67.69%
4 words (PP adverbial + verb)	64.56%	46.44%

Predictions made by the DLT

The total processing costs, including discourse processing (DR) and structural integration cost (IC), for a test sentence of Experiment 2 as predicted by the DLT are shown in Table 4.25. In the first condition the intervening material consists of one verb. The total processing costs at the verb are 2 EUs in the adjacent version and 1 EU in the extraposed version.

This pattern continues as the intervening material increases to two words (adverb and

two sentences had a PP of length six words, and one sentence had a PP of length seven words.

Table 4.25: Total processing costs (DR and IC) for a test sentence of Experiment 2 as predicted by the DLT.

Im Tropenhaus hat...

Adjacent PP, IM length: 1 word (verb)

	ein	Vogel	mit	tollen	bunten	Federn	gesungen
Total	0	1	0	0	0	1	2

Extraposed PP, IM length: 1 word (verb)

	ein	Vogel	gesungen	mit	tollen	bunten	Federn
Total	0	1	1	1	0	0	1

Adjacent PP, IM length: 2 words (adverb and verb)

	ein	Vogel	mit	tollen	bunten	Federn	laut	gesungen
Total	0	1	0	0	0	1	0	2

Extraposed PP, IM length: 2 words (adverb and verb)

	ein	Vogel	laut	gesungen	mit	tollen	bunten	Federn
Total	0	1	0	1	1	0	0	1

Adjacent PP, IM length: 4 words (PP adverbial and verb)

	ein	V.	mit	tollen	bunten	Federn	auf	einem	Baum	gesessen
Total	0	1	0	0	0	1	1	0	1	3

Extraposed PP, IM length: 4 words (PP adverbial and verb)

	ein	V.	auf	einem	Baum	gesessen	mit	tollen	bunten	Federn
Total	0	1	0	0	1	2	2	0	0	1

verb). The processing costs at the verb are 1 EU higher in the adjacent version compared to the extraposed version. The addition of the adverb does not change the total processing costs compared to having only one intervening verb. At the adverb the processing cost is at 1 EU in both versions, but just like in the sentence version with one verb intervening the total costs are at no point higher than 2 EUs.

With the introduction of a PP adverbial into the intervening material the processing cost at the clause-final verb in the adjacent version is at 3 EUs, while the cost at the verb in the extraposed version is at 2 EUs. At the preposition *mit*, which is the head of the first PP in the adjacent version and the head of the second PP in the extraposed version, the processing cost is 0 EUs in the adjacent version and 2 EUs in the extraposed version. At the preposition *auf*, which is the head of the first PP in the extraposed version and the head of the second PP in the adjacent version, the processing cost is 0 EU in the extraposed version and 1 EU in the adjacent version.

Table 4.26: Storage costs (SC) for a test sentence of Experiment 2 as predicted by the DLT.

Im Tropenhaus hat. . .

Adjacent PP, IM length: 1 word (verb)

	ein	Vogel	mit	tollen	bunten	Federn	gesungen
SC	2	1	2	2	2	1	0

Extraposed PP, IM length: 1 word (verb)

	ein	Vogel	gesungen	mit	tollen	bunten	Federn
SC	2	1	0	1	1	1	0

Adjacent PP, IM length: 2 words (adverb and verb)

	ein	Vogel	mit	tollen	bunten	Federn	laut	gesungen
SC	2	1	2	2	2	1	1	0

Extraposed PP, IM length: 2 words (adverb and verb)

	ein	Vogel	laut	gesungen	mit	tollen	bunten	Federn
SC	2	1	1	0	1	1	1	0

Adjacent PP, IM length: 4 words (PP adverbial and verb)

	ein	V.	mit	tollen	bunten	Federn	auf	einem	Baum	gesessen
SC	2	1	2	2	2	1	2	2	1	0

Extraposed PP, IM length: 4 words (PP adverbial and verb)

	ein	V.	auf	einem	Baum	gesessen	mit	tollen	bunten	Federn
SC	2	1	2	2	1	0	1	1	1	0

The storage costs for all conditions is given in Table 4.26. In all conditions, at each word of the PP *mit tollen bunten Federn* the storage cost in the adjacent version is 1 MU higher than in the extraposed version.

In summary, the DLT predicts a slight preference for the extraposed version in all conditions.

Unlike in Experiment 1, the predictions of the EIC and DLT are not the same for all three conditions. With one verb intervening, the EIC predicts a preference for the extraposed version, while the DLT also predicts a preference for the extraposed version, albeit a slight one. The DLT predicts the same slight preference for the extraposed version in the condition with an adverb and verb intervening, while the EIC now predicts a slight preference for the adjacent version. The real divergence between the predictions of the two theories occurs when a PP adverbial and verb intervene between noun and PP. While the EIC predicts a much higher efficiency for the adjacent version, the DLT still predicts

a preference for the extraposed version.

Taking into account the empirical findings of previous studies (e.g. Uszkoreit et al., 1998*a*; Bader, 2014), an increase in intervening material between noun and extraposed constituent should result in a decrease of extraposition rates, especially when the intervening material is non-verbal. As extraposed structures are also still assumed to be non-canonical, the following hypotheses are formulated:

Hypotheses

i. Target sentences with extraposed PPs will tend to be reproduced with PPs in adjacent position.

ii. As the length of the intervening material increases, the tendency to reproduce target sentences with the PP in extraposed position as sentences with the PP in adjacent position increases.

4.3.3 Results

Change of Position of the PP

Table 4.27: Percentages of sentences recalled with the position of the PP changed.

Intervening Material	Adjacent	Extraposed
Verb	1	2
Adverb + verb	3	5
PP adverbial + verb	2	4

Table 4.27 shows the percentages of sentences recalled with the position of the PP changed, either from adjacent to extraposed position, or vice versa. The majority of sentences is recalled with the PP in target position. Position was changed slightly more

Table 4.28: Mixed logit model fitted by maximum likelihood for Changing Position of the PP in Experiment 2.

	Estimate	Std. Error	z value	p	
(Intercept)	-4.92582	0.70359	-7.001	<.001	***
Position	0.72879	0.82844	0.880	0.3790	
Contrast 1	1.31201	0.74894	1.752	0.0798	.
Contrast 2	-0.28441	0.59636	-0.477	0.6334	
Position × Contrast 1	0.08989	1.47475	0.061	0.9514	
Position × Contrast 2	0.09773	1.17941	0.083	0.9340	

. p<.1, *** p<.001

Formula: $changed \sim position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 + (position||subject) + (position||sentence)$

often in sentences with two words (adverb and verb) as intervening material, compared to sentences with four words (PP Adverbial and verb) as intervening material.

A mixed logit model with participants and items included as random effects and Position, Intervener Lengths (Contrast 1: Verb vs. Adverb+Verb, Contrast 2: Adverb+Verb vs. PP Adverbial+Verb), and the interaction of Position and Intervener Lengths as fixed effects showed a marginal effect of the Intervener Length between Verb vs. Adverb+Verb, as shown in Table 4.28.

Material dropped in reproduction

Table 4.29: Percentages of sentences recalled with material of the Intervener dropped.

Intervener length in original sentence	Adjacent	Extraposed
1 word (verb)	0	0
2 words (adverb and verb)	10	31
4 words (PP adverbial and verb)	26	50

Table 4.29 shows the percentages of sentences recalled with material of the Intervener having been dropped. Dropping means that either the adverb was dropped in conditions with an adverb and verb, or that the PP adverbial or parts of it were dropped in conditions with a PP adverbial and verb. The results show that material is dropped both in sentences with the PP in extraposed position and the material intervening between noun and PP, and in sentences with the PP in adjacent position and the material appearing at the end of the sentence. Much more material is dropped in extraposed versions. While an adverb and verb are shortened to verb only in 10% of the sentences with an adjacent PP, they are shortened to verb only in 31% of the sentences with the PP in extraposed position. Intervening material consisting of four words (PP adverbial and verb) is shortened in 26% of the sentences with a PP in adjacent position, and in 50% of the sentences with an extraposed PP.

A mixed logit model with participants and items included as random effects and Intervener Lengths as fixed effects showed a significant main effect of both Intervener Lengths (Intervener 1: Verb vs. Adverb+Verb, Intervener 2: Adverb+Verb vs. PP

Table 4.30: Mixed logit model fitted by maximum likelihood for Dropping Material of the Intervener in Experiment 2, with Intervener Lengths as fixed effects.

	Estimate	Std. Error	z value	p	
(Intercept)	-2.7526	0.3984	-6.908	$<.001$	***
Intervener 1	4.2236	0.9020	4.683	$<.001$	***
Intervener 2	1.1276	0.4318	2.611	0.00902	**

** $p<.01$, *** $p<.001$

Formula: $dropped \sim Intervener1 + Intervener2 + (Intervener1 + Intervener2||subject) + (Intervener1 + Intervener2||sentence)$

Adverbial+Verb), as shown in Table 4.30. In the conditions with a verb as intervener, the 0% of dropped material resulted in empty cells in the statistical analysis. For computational reasons, the 0% were changed to 1% in the statistical model.

In order to accommodate the fact that no material was dropped when the intervener was a verb, and also to avoid issues caused by the empty cells in the conditions with a verb as an intervener, due to the 0% of dropped material in those conditions, a mixed logit model was fit with participants and items included as random effects and Position, Intervener 2 (Adverb+Verb vs. PP Adverbial+Verb), and interaction between Position and Intervener 2 as fixed effects (see Table 4.31). The model showed significant main effects of Position and Intervener Length (Adverb+Verb vs. PP Adverbial+Verb). There was no interaction between Position and Intervener Length.

Table 4.31: Mixed logit model fitted by maximum likelihood for Dropping Material of the Intervener in Experiment 2, with Position and Intervener Lengths as fixed effects.

	Estimate	Std. Error	z value	p	
(Intercept)	-2.11681	0.27360	-7.737	<.001	***
Position	1.37995	0.27725	4.977	<.001	***
Intervener 2	2.19012	0.40553	5.401	<.001	***
Position × Intervener 2	-0.06523	0.52736	-0.124	0.902	

** p<.01, *** p<.001

Formula: $dropped \sim position + Intervener2 + position : Intervener2 + (position + Intervener2 + position : Intervener2 || subject) + (position + Intervener2 + position : Intervener2 || sentence)$

Error rates

Table 4.32: Percentages of sentences coded as *error*.

Intervener length	Adjacent	Extraposed
1 word (verb)	10	4
2 words (adverb and verb)	19	11
4 words (PP adverbial and verb)	25	15

All sentences that were either incomplete, ungrammatical, or not reproduced at all, were coded as *error*. As with Experiment 1, the method of *Production from Memory* took its toll on participants' working memory, and a high number of errors were made. Table 4.32 shows the percentages of sentences coded as *error*. Error rates increased as the number of intervening/clause-final words increased. More errors were made in sentences with the PP in adjacent position, with the error rate increasing to 25% in sentences with a PP adverbial and verb at the end.

A mixed logit model over the percentages of erroneous sentences with participants and items included as random effects and Position, Intervener Lengths, and the interactions of Position with Intervener Lengths as fixed effects showed a significant main effect for

Table 4.33: Mixed logit model fitted by maximum likelihood for Error in Experiment 2,
with Position and Intervener Lengths as fixed effects.

	Estimate	Std. Error	z value	p	
(Intercept)	-2.6857	0.3361	-7.990	<.001	***
Position	-0.9291	0.2938	-3.163	0.00156	**
Contrast 1	1.0933	0.3695	2.958	0.00309	**
Contrast 2	0.2250	0.2779	0.809	0.41829	
Position × Contrast 1	0.2596	0.7165	0.362	0.71706	
Position × Contrast 2	-0.2850	0.7357	-0.387	0.69844	

** p<.01, *** p<.001

Formula: $error \sim position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 + (position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 || subject) + (position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 || sentence)$

Position and Intervener Length Verb vs. Adverb+Verb, as shown in Table 4.33. There was
no effect for Intervener Length Adverb+Verb vs. PP Adverbial+Verb and no interaction
of Position and Intervener Lengths.

The grammatical function had an influence on the production of erroneous sentences.
In adjacent position, more errors were made when the PP was part of a direct object NP. In
extraposed position, more errors were made when the PP was extraposed out of a subject
NP.

A mixed logit model over the percentages of erroneous sentences with participants
and items included as random effects and Position, Grammatical Function, and the
interaction of Position with Grammatical Function as fixed effects showed a significant
main effect for Position and an interaction between Position and Grammatical Function,
as shown in Table 4.34.

Relation to reading span

Table 4.35 shows descriptive statistics for the main experiment and the reading span
test of Experiment 2. As before, *Accuracy* represents the percentage of correctly recalled

Table 4.34: Mixed logit model fitted by maximum likelihood for Error in Experiment 2,
with Position and Grammatical Function as fixed effects.

	Estimate	Std. Error	z value	p	
(Intercept)	-2.44726	0.30273	-8.084	<.001	***
Position	-0.84989	0.25943	-3.276	0.00105	**
Grammatical Function	0.00401	0.37778	0.011	0.99153	
Position × Grammatical Function	1.29373	0.46109	2.806	0.00502	**

** p<.01, *** p<.001

Formula: $error \sim subobj * position + (subobj * position || subject) + (position || sentence)$

Table 4.35: Descriptive Statistics for Experimental and Reading Span Measures in Experiment 2.

Measure	Main experiment (%)			Reading span test (%)	
	Accuracy	Changed	Dropped	Memory score	Processing score
Mean	86	16	31	48	68
SD	0.12	0.13	0.17	15.6	3.7
Range	64-100	0-39	3-64	23-75	60-74

sentences in Experiment 2. *Changed* represents the percentage of sentences in which the position of the PP was changed. Here, *Dropped* refers to the percentage of sentences in which part of the intervener was dropped. The reading span measures are similar to published results for this version of the reading span test. As shown by Table 4.35, both the experimental results and the reading span results show a large amount of individual variation.

Table 4.36 shows the pairwise correlations for the mean values of the 24 participants. As before, there is a positive correlation between memory score and processing score. Participants that were particularly good at recalling letters tended to be also particularly accurate at judging the plausibility of sentences. There is thus again no evidence that participants traded off one subtask of the reading span test against the other subtask.

Table 4.36: Correlations Between Experimental and Reading Span Measures in Experiment 2.

Measure	Accuracy	Changed	Dropped	Memory score
Memory score	0.41*	-0.46*	-0.41*	—
Processing score	0.11	-0.19	-0.25	0.71***

* $p<.05$, *** $p<.001$

As in Experiment 1, the data of the main experiment show positive correlations with the results of the memory score of the reading span test. There was no correlation between the data of the main experiment and the processing score of the reading span test. Participants who were good at recalling letters also performed well on the main experimental task and vice versa. This finding was to be expected since the method of Production from memory and recalling letters were the same as in Experiment 1, and both tasks reflected participants' individual working memory performance.

4.3.4 Discussion

The major finding of Experiment 2 is that participants dropped intervening material rather than change the syntactic position of the extraposed PP. With regard to position change of the PP, the results confirm the findings of Experiment 1. Contrary to expectations, PPs were mostly reproduced in the position of the target version. There were no statistically significant changes from either extraposed to adjacent position, or vice versa. Sentences

with an adverb and verb as intervening material were changed slightly more often than sentences with either a verb or a PP adverbial and verb as interveners. However, this difference did not reach significance.

While the position of the PP was hardly ever changed, a fair amount of intervening material was dropped in reproduction. When the intervening material consisted of an adverb and verb, material was dropped in 10% of the sentences with adjacent PPs and in 31% of sentences with extraposed PPs. When the intervening material increased to four words (a PP adverbial and verb), material was dropped in 25% of sentences with adjacent PPs and in 50% of sentences with extraposed PPs. The statistical analysis revealed significant effects for PP position, as well as for the contrasts between Intervener Lengths. Thus, significantly more material was dropped in sentences with extraposed PPs than in sentences with adjacent PPs. Furthermore, significantly more material was dropped in sentences with an adverb and verb intervening in comparison to sentences with only a verb intervening, and significantly more material was dropped in sentences with a PP adverbial and verb intervening in comparison to sentences with an adverb and verb intervening.

With regard to the predictions by the DLT, interpreting the results of a production experiment is not easy. The DLT makes predictions as to which structure might be the preferred one, or which might be the one easier to process. Production is a different matter, especially since participants did not change the position of the PP, but rather dropped material. However, in half of the sentences with extraposed PPs and a PP adverbial and verb as intervener, material was dropped, and in almost all of these cases it was dropped to 'verb only'. Both the EIC and DLT predict (slight) preferences for sentences with extraposed PPs when the intervening material consists of one verb. While participants did not change the position of the PP to accommodate such preferences, the results show that extraposed PPs were preferably reproduced over one verb only. With increasing intervening/clause-final material, it seems to have been easier for participants to reproduce sentences with adjacent PPs without dropping any of the clause-final material. Thus it seems that the EIC was more accurate in predicting an increasing preference for adjacent PPs as the intervening/clause-final material would increase.

Participants reproduced a number of erroneous sentences. Error rates increased as the amount of intervening material increased. More errors were made in sentences with the PP in adjacent position, with the error rate increasing to 25% in sentences with a PP adverbial and verb at the end. The statistical analysis showed that significantly more errors were made in sentences with an adjacent PP than in sentences with an extraposed PP. Participants also reproduced significantly more erroneous sentences when the intervening material consisted of an adverb and verb than when it consisted of only a verb.

While the grammatical function of the NP (subject or direct object) had no influence on the position of the PP, or the amount of material being dropped, it did have an effect on error rates. In adjacent position, more errors were made when the PP was part of a direct

object NP. In extraposed position, more errors were made when the PP was extraposed out of a subject NP. The interaction between position and grammatical function reached statistical significance.

4.4 Experiment 3: The Influence of Verbal Interveners on Extraposition

Experiment 3 investigates the influence of purely verbal material intervening between head noun and PP. The length of the intervener is manipulated by constructing sentences in which PPs are extraposed either over a verb particle, a full verb or an auxiliary and verb (a verb cluster).

As mentioned above, empirical findings have shown that extraposition is favoured over purely verbal material, preferably over one verb. Uszkoreit et al.'s (1998*a*) corpus study on RC extraposition in German showed that extraposition was most likely over purely verbal material and when the intervening material consisted of only 1-2 words (the mean length of intervening material in Uszkoreit's corpus study was 1.6 words). In another corpus study on RC extraposition in German, Bader (2014:S82) found that "extraposition is almost obligatory" when the intervening material consists of a verb. With regard to verb clusters intervening between a head and its dependent, he notes that "the length of the verbal complex has only very small effects on the rate of extraposition."

The notion that verbs are the most acceptable kind of intervening material is also supported by theoretical predictions, as for example by Hawkins's (1994) *Early Immediate Constituents* (EIC) theory, or Gibson's (2000) *Dependency Locality Theory* (DLT). The EIC predicts that "extraposition from NP... should be highly productive in the event that V alone intervenes, much less so when there is an additional intervening constituent." Hawkins (2004:144) makes no difference between verb and verb particle here, as he notes that in the case of RC extraposition in German, extraposition is "always preferred over non-extraposition... when only a one-word V or separable verbal particle intervenes." The DLT predicts that any additional new discourse referent intervening between the head and the dependent that has to be integrated into the structure will cause additional processing costs. As the DLT identifies finite verbs and nouns as discourse referents, this means that any additional nouns in the intervening material would increase processing difficulty.

Considering the length of the intervening material, the difference between extraposition over a verb particle or a full verb is not the number of words, but the number of syllables. All particles used in Experiment 3 consisted of one syllable, while full verbs consisted either of three or four syllables, as shown in (143).

(143)   a. Maria las ein Buch **vor**   von einem berühmten Schriftsteller.
           Maria read a   book PART by a   famous   author

      b. Maria hat ein Buch **vorgelesen** von einem berühmten Schriftsteller.
        Maria has a book read-to by a famous author

Particle verbs have a number of special features. They are stored as single lexical entries in the mental lexicon (Capelle et al., 2010), but within the syntactic structure they are expressed by multiple words (McIntyre, 2007), which can be separated by a number of other words within a sentence (Booij, 1990). The verb and its particle form a dependency. Many particle verbs can occur without a particle, resulting in possible garden-path scenarios during processing. Thus the verb can only be successfully interpreted once the particle has been processed. Likewise, the verb needs to stay activated in working memory so that its syntactic and semantic properties are still available when the particle is parsed. The encounter of a verb that can also be a particle verb triggers an expectation for a particle further along in the sentence and a possible verb-particle dependency (Piai et al., 2013). This expectation is also helped by the prosody of the verb stem (Isel et al., 2005). It is an open question whether the additional processing cost caused by the verb-particle dependency will have an effect on extraposition rates in the reproduction of sentences.

In a third condition, a verb cluster consisting of a verb and an auxiliary (either *haben* 'have' or *sein* 'be') is tested as intervening/clause-final material. Here it will be interesting to see if two verbs have a different effect in reproduction compared to one verb, and also if participants transform the sentence so that the auxiliary can be dropped, which would result in a shorter extraposition distance.

4.4.1 Method

Participants

Thirty-two 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.

Materials

Thirty-six sentences were created, each in six conditions according to the factors Position (extraposed vs. adjacent), and Kind of Verbal Intervener (verb particle vs. verb vs. verb+aux). All verb particles consisted of one syllable. The full verbs consisted of either three or four syllables. The auxiliary used was *haben* 'have' in thirty-five of the sentences. Once, the auxiliary used was *sein* 'be'. All sentences were main clauses, there were no subordinate or embedded clauses. In all sentences, the PP was part of a direct object NP, with a subject NP in sentence-initial position, followed by an auxiliary verb. Ten different prepositions were used in the experimental sentences: *für* 'for' (ten times), *mit* 'with' (seven times), *über* 'about', *von* 'of', *zwischen* 'between' (four times each), *aus* 'from', *in* 'in' (twice each), *an* 'at', *auf* 'on', and *bei* 'at' (once each). The length of the PP varied between two to seven words.[10] Table 4.37 presents a set of example sentences

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[10]The number of PPs and their respective lengths measured in words was as follows: two words (one PP), three words (six PPs), four words (fourteen PPs), five words (eleven PPs), six words (three PPs), seven

Table 4.37: A complete experimental stimulus from Experiment 3.

<u>Intervener: Verb particle</u>

Condition 1: PP position: adjacent

Anna	suchte	sich	ein	neues	Kleid	für	den	Abschlußball	aus.
Anna	picked	PRO.refl	a	new	dress	for	the	prom	out

Condition 2: PP position: extraposed

Anna	suchte	sich	ein	neues	Kleid	aus	für	den	Abschlußball.
Anna	picked	PRO.refl	a	new	dress	out	for	the	prom

'Anna picked out a new dress for the prom.'

<u>Intervener: Verb</u>

Condition 3: PP position: adjacent

Anna	hat	sich	ein	neues	Kleid	für	den	Abschlußball	ausgesucht.
Anna	has	PRO.refl	a	new	dress	for	the	prom	picked

Condition 4: PP position: extraposed

Anna	hat	sich	ein	neues	Kleid	ausgesucht	für	den	Abschlußball.
Anna	has	PRO.refl	a	new	dress	picked	for	the	prom

'Anna has picked a new dress for the prom.'

<u>Intervener: Verb and auxiliary</u>

Condition 5: PP position: adjacent

Anna	soll	sich	ein	neues	Kleid	für	den	Abschlußball
Anna	is supposed	PRO.refl	a	new	dress	for	the	prom

ausgesucht	haben
picked	have

Condition 6: PP position: extraposed

Anna	soll	sich	ein	neues	Kleid	ausgesucht	haben	für
Anna	is supposed	PRO.refl	a	new	dress	picked	have	for

den	Abschlußball.
the	prom

'Anna is supposed to have picked a new dress for the prom.'

in all six conditions; for the complete material, see the appendix (Appendix B.3).

In adjacent conditions, the PP is adjacent to the NP, and is followed by a verb particle (condition 1), a verb (condition 3) or a verb and auxiliary (condition 5). In extraposed conditions, the PP is found at the end of the sentence, with either the verb particle (condition 2), verb (condition 4), or verb and auxiliary (condition 6) intervening. All sentences were grammatical sentences of Standard German. All test sentences, as well as filler sentences, were read by a female native speaker of German and digitally recorded in a sound-proof cabin.

From the experimental sentences, six stimulus lists were generated which contained an equal number of sentences within each condition but each sentence only in one of its six versions. The experimental sentences within these lists were randomized for each participant individually. The thirty-six stimulus sentences in each list were interspersed in lists of forty-two filler sentences. There were two different sets of filler sentences.

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words (one PP). It should be noted that the PP that consisted of two words counted eight syllables, and was therefore very similar to PPs with three or four words.

Table 4.38: A sample set of filler sentences from Experiment 3.

Finite auxiliary in first position, lexical NP (a.) or pronoun (b.) as direct object

a. Max hat gesagt, dass Maria einen Kollegen **hat** besuchen wollen.
   Max has said   that Maria a   colleague has visit   want
   'Max has said that Maria has wanted to visit a colleague.'

b. Max hat gesagt, dass Maria ihn besuchen **hat** wollen.
   Max has said   that Maria him visit   has want
   'Max has said that Maria has wanted to visit him.'

Finite auxiliary in second position, lexical NP (a.) or pronoun (b.) as direct object

a. Max hat gesagt, dass Maria einen Kollegen besuchen **hat** wollen.
   Max has said   that Maria a   colleague visit   has want
   'Max has said that Maria has wanted to visit colleague.'

b. Max hat gesagt, dass Maria ihn **hat** besuchen wollen.
   Max has said   that Maria him has visit   want
   'Max has said that Maria has wanted to visit him.'

Twenty-four filler sentences were experimental items in a study about verb clusters. A sample set of filler sentences of this kind is shown in Table 4.38. Another eighteen filler sentences were made up especially and had no other use than to serve as distractors. All filler sentences were grammatical.

Procedure

The same reading span task and production experiment procedures were used as in Experiments 1 and 2 (see Section 4.2.1).

4.4.2   Predictions

Predictions made by the EIC

The predictions made by the EIC are based on the local complexity metric of the EIC, which calculates the IC-to-word ratios for the NP and VP by dividing the number of immediate constituents (ICs) by the number of words necessary in order to recognize the last IC. The length of the PP was not specifically investigated in Experiment 3 and varied from two to seven words. In ⅔ of the sentences, however, the PPs were either four or five words long.[11]

Table 4.39 shows the IC-to-word ratios for a sample sentence from Experiment 3, with the intervening material consisting of a verb particle and the length of the PP measuring four words.[12] In the example sentence, the VP consists of two ICs, namely the direct

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[11]For the remaining ⅓ of sentences, PP lengths were as follows: two words (twice), three words (six times), six words (three times), and seven words (once).

[12]The complete sentence is *Maria las ein Buch von einem berühmten Schriftsteller vor.* 'Maria read a book by a famous author (to someone)'. In order too save space, only the relevant parts of the sentence are shown in the table.

Table 4.39:   IC-to-word ratios for a sample sentence from Experiment 3, intervening material (IM): Verb particle.

Adjacent PP, IM: Verb particle									
...	ein	Buch	von	einem	berühmten	Schriftsteller	vor	**IC/word**	
VP	1	2	3	4	5	6	7	2/7	=28.57%
NP	1	2	3					3/3	=100%
Total IC-to-word ratio								**5/10**	
Mean percentage									**64.29%**

Extraposed PP, IM: Verb particle								
...	ein	Buch	vor	von	einem	berühmten	Schriftsteller	
VP	1	2	3					2/3	=66.66%
NP	1	2	3	4				3/4	=75%
Total IC-to-word ratio								**5/7**
Mean percentage								**70.83%**

object NP (*ein Buch von einem berühmten Schriftsteller* 'a book by a famous author'), and the verb particle *vor* from the verb *vorlesen* 'to read (to someone/out loud)'. The NP consists of three ICs, the indefinite determiner *ein* 'a', the noun *Buch* 'book', and the PP *von einem berühmten Schriftsteller* 'by a famous author'. The PP can be recognized at the point of parsing the preposition *mit* 'with'.

In the adjacent version, seven words have to be processed until both ICs of the VP can be recognized, resulting in a ratio of 2/7 (=28.57%) for the VP. The three ICs of the NP can

Table 4.40:   IC-to-word ratios for a sample sentence from Experiment 3, intervening material (IM): Verb.

Adjacent PP, IM: Verb									
...	ein	Buch	von	einem	berühmten	Schriftsteller	vorgelesen	**IC/word**	
VP	1	2	3	4	5	6	7	2/7	=28.57%
NP	1	2	3					3/3	=100%
Total IC-to-word ratio								**5/10**	
Mean percentage									**64.29%**

Extraposed PP, IM: Verb								
...	ein	Buch	vorgelesen	von	einem	berühmten	Schriftsteller	
VP	1	2	3					2/3	=66.66%
NP	1	2	3	4				3/4	=75%
Total IC-to-word ratio								**5/7**
Mean percentage								**70.83%**

Table 4.41:   IC-to-word ratios for a sample sentence from Experiment 3, intervening material (IM): Verb and auxiliary.

				Adjacent PP, IM: Verb and auxiliary						
...	ein	Buch	von	einem	berühmten	Schriftst.	vorgelesen	haben	**IC/word**	
VP	1	2	3	4	5	6	7		2/7	=28.57%
NP	1	2	3						3/3	=100%
Total IC-to-word ratio									**5/10**	
Mean percentage										**64.29%**

			Extraposed PP, IM: Verb and auxiliary						
...	ein	Buch	vorgelesen	haben	von	einem	berühmten	Schriftst.	
VP	1	2	3						2/3	=66.66%
NP	1	2	3	4	5				3/5	=60%
Total IC-to-word ratio									**5/8**	
Mean percentage										**63.33%**

be recognized after three words, making the ratio 3/3 (= 100%). In the extraposed version, the two ICs of the VP can be processed after only three words, resulting in a ratio of 2/3 (= 66.66%) for the VP. With one word intervening between the noun and preposition, four words have to be processed in order to process the three ICs of the NP, resulting in a ratio of 3/4 (= 75%) for the NP. As before, the preferred structure is the one with the maximal overall minimization of phrasal combination domains (PCDs). The mean PCDs of the sentence are 64.29% in the adjacent version and 70.83% in the extraposed version. Thus, the EIC predicts a better efficiency for extraposed PPs when the intervening material is a verb particle.

In conditions three and four, the intervening material changes from a verb particle to a verb. While the number of syllables increases, the number of words does not. Thus, the predictions of the EIC, which measures length in number of words, are the same as for an intervening verb particle, as shown in Table 4.40.

When the intervening material increases to two words, a verb cluster consisting of a verb and auxiliary, it only makes a difference for the extraposed versions, as the number of words until the NP can be recognized increases. Due to this increase, the percentage for the efficiency of the extraposed version drops from 70.83% to 63.33%, as shown in Table 4.41. As the verb cluster represents one constituent, which can be recognized as soon as the first verb is parsed, the numbers do not change for the constituent recognition domains (CRDs) of the VPs in both the adjacent and extraposed versions. The VP can still be recognized when the verb *vorgelesen* is parsed. The additional word *haben* does not enter into the calculation. Therefore, when the PP is adjacent to the head noun, there is no additional material to be counted. It is only the NP of the extraposed version that is influenced by the additional word. However, when the intervening material consisted of

Table 4.42: Mean percentages of the efficiency of the test sentences in Experiment 3 as predicted by the EIC.

Length of the intervening material	Adjacent PPs	Extraposed PPs
Verb particle	64.11%	71.22%
Verb	64.11%	71.22%
Verb and auxiliary	64.11%	63.75%

either a verb particle or a verb, the predictions of the EIC were better for the extraposed versions, so that the decrease in the percentages of efficiency for the extraposed version brings both the adjacent and extraposed version to about the same efficiency level. For sentences with a two-word verb cluster intervening, the EIC thus predicts that both versions should be efficient in equal measure.

Table 4.42 shows the mean percentages of the efficiency of the test sentences in Experiment 3 as predicted by the EIC. The percentages differ slightly from those in the tables above, as the different lengths of the PPs as well as the specific make up of the NP (det noun, mass/plural noun, det adj noun) across all conditions have been incorporated.

In summary, the EIC predicts that sentences with the PP in extraposed position are more efficient than sentences with the PP in adjacent position when the intervening material consists of either a verb particle or a verb. When the intervening material increases to a verb and auxiliary, the efficiency of both sentence versions should be about the same.

Predictions made by the DLT

The total processing costs (discourse processing and structural integration) for a test sentence of Experiment 3 as predicted by the DLT are shown in Table 4.43. In the first condition the intervening material consists of a verb particle. The total processing cost at the verb *las* 'read' are 1 EUs in both the adjacent and the extraposed version. The verb particle *vor* has some special characteristics with regard to the calculation. It is not a discourse referent, thus the preposition in the extraposed version has no additional integration cost, resulting in 0 EUs at that point. In the adjacent version the processing cost at the verb particle is 1 EUs. Thus there is a slight preference for the extraposed version in this condition.

When the intervening material consists of a verb, the processing costs peak at 2 EUs at the clause-final verb in the adjacent version. At the point of the preposition *von* the processing cost is 0 EUs in the adjacent versions and 1 EUs in the extraposed version. The costs at the other words in the sentences are the same for both versions. Thus there is a slight preference to the extraposed version in this condition as well.

When the intervening material consists of a verb and an auxiliary, the total processing cost at the auxiliary *haben* 'have' in both versions is 0 EU, as it is no discourse referent. In the adjacent version, the processing cost peaks at 2 EUs at the verb *vorgelesen* 'read-to',

Table 4.43: Total processing costs (DR and IC) for a test sentence of Experiment 3 as predicted by the DLT.

Maria. . .

Adjacent PP, IM: Verb particle

	las	ein	Buch	von	einem	berühmten	Schriftsteller	vor
Total	1	0	1	0	0	0	1	1

Extraposed PP, IM: Verb particle

	las	ein	Buch	vor	von	einem	berühmten	Schriftsteller
Total	1	0	1	0	0	0	0	1

Maria hat. . .

Adjacent PP, IM: Verb

	ein	Buch	von	einem	berühmten	Schriftsteller	vorgelesen
Total	0	1	0	0	0	1	2

Extraposed PP, IM: Verb

	ein	Buch	vorgelesen	von	einem	berühmten	Schriftsteller
Total	0	1	1	1	0	0	1

Maria soll. . .

Adjacent PP, IM: Verb + auxiliary

	ein	Buch	von	einem	berühmten	Schriftsteller	vorgelesen	haben
Total	0	1	0	0	0	1	2	0

Extraposed PP, IM: Verb + auxiliary

	ein	Buch	vorgelesen	haben	von	einem	berühmten	Schriftsteller
Total	0	1	1	0	1	0	0	1

while in the extraposed version the processing cost at the verb is 1 EU. At the point of the preposition *von* the processing cost is 0 EUs in the adjacent versions and 1 EUs in the extraposed version. The costs at the other words in the sentences are the same for both versions. Thus in all conditions there is a slight preference for the extraposed version.

The storage costs (SC) for a test sentence of Experiment 3 as predicted by the DLT are shown in Table 4.44. In the conditions with a verb particle or verb intervening, there is no difference in storage costs between adjacent and extraposed versions. When a verb and an auxiliary intervene, the storage cost is 1 MU higher in the adjacent version than in the extraposed version at each word of the PP. Thus, in this condition there is a preference for the extraposed version.

In summary, the DLT predicts a slight preference for the extraposed version when the intervening material is a verb particle or a verb. When an auxiliary and verb are intervening the DLT predicts a more pronounced preference for the extraposed version.

The predictions of the EIC and DLT differ only slightly for the three different

Table 4.44: Storage costs (SC) for a test sentence of Experiment 3 as predicted by the DLT.

Maria...

Adjacent PP, IM: Verb particle

	las	ein	Buch	von	einem	berühmten	Schriftsteller	vor
SC	0	1	0	1	1	1	0	0

Extraposed PP, IM: Verb particle

	las	ein	Buch	vor	von	einem	berühmten	Schriftsteller
SC	0	1	0	0	1	1	1	0

Maria hat...

Adjacent PP, IM: Verb

	ein	Buch	von	einem	berühmten	Schriftsteller	vorgelesen
SC	1	0	1	1	1	0	0

Extraposed PP, IM: Verb

	ein	Buch	vorgelesen	von	einem	berühmten	Schriftsteller
SC	1	0	0	1	1	1	0

Maria soll...

Adjacent PP, IM: Verb + auxiliary

	ein	Buch	von	einem	berühmten	Schriftsteller	vorgelesen	haben
SC	2	1	2	2	2	1	1	0

Extraposed PP, IM: Verb + auxiliary

	ein	Buch	vorgelesen	haben	von	einem	berühmten	Schriftsteller
SC	2	1	1	0	1	1	1	0

conditions. With a verb particle or verb intervening, both theories predict a preference for the extraposed version. When the intervening material consists of a verb and an auxiliary, the EIC predicts both sentence versions to be similarly efficient, while the DLT predicts a preference for the extraposed version. Overall, the preferences for the different conditions should not differ all that much from one another.

Incorporating the results of Experiments 1 and 2

After analysing the results of Experiments 1 and 2, the expectations with regard to the position of the PP in reproduction have changed. While for both experiments the prediction was that adjacent (canonical) structures would be reproduced in their adjacent target position, the expectation that extraposed (non-canonical) structures would be reproduced in adjacent (canonical) position was not confirmed. In both experiments, the majority of sentences were reproduced with the PP in target position. The results of Experiment 2 have an even bigger import on Experiment 3, as both experiments investigate the influence of the intervening material. The length of the intervening

material in Experiment 2 had no influence on the change of position in reproduction. Participants rather dropped intervening material than change the syntactic position of the PP. In 31% of sentences with the intervening material consisting of two words (adverb and verb) the adverb was dropped.

Both the EIC and DLT predict a preference for the extraposed version over verb particles and verbs. However, in neither of the previous experiments did participants change the position from adjacent to extraposed in any significant number. It is an open question whether the length of the verb particle (one syllable) or the increased processing cost of structures with verb particles due to the additional dependency between the verb and its particle have an influence on extraposition in reproduction. Thus, based on the results of the two previous experiments, and taking into account the predictions made by the EIC and DLT, the following hypotheses are formulated:

Hypotheses

  i. The majority of PPs (both adjacent and extraposed) will be reproduced in their target position.

 ii. The theoretical preference for extraposition in sentences with a verb particle or verb intervening will result either in an increase of adjacent PPs changed to extraposed position, or, more likely, to a high number of extraposed PPs being reproduced in their target position.

iii. When the intervening material consists of two words (verb and auxiliary), participants will rather drop intervening material in sentences with extraposed PPs than change the syntactic position.

4.4.3   Results

One participant had to be excluded because s/he showed an above-average tendency to produce PPs in adjacent position (94% of PPs were reproduced in adjacent position). Thus the data of thirty-one participants was included in the statistical analysis.

Change of Position of the PP

Table 4.45: Percentages of sentences recalled with the position of the PP changed.

Intervening Material	Adjacent	Extraposed
Verb Particle	0	15
Verb	1	8
Auxiliary + Verb	1	8

Table 4.45 shows the percentages of sentences recalled with the position of the

PP changed, either from adjacent to extraposed position, or vice versa.[13]   Adjacent PPs were almost always reproduced in the original sentence position. Extraposed PPs were sometimes changed to adjacent position, especially when the intervening material consisted of a verb particle (15%).

Table 4.46: Mixed logit model fitted by maximum likelihood for Changing Position of the PP in Experiment 3.

	Estimate	Std. Error	z value	p	
(Intercept)	-5.4328	0.7158	-7.590	<.001	***
Position	2.7630	0.9075	3.045	0.00233	**
Intervener 1: Verb Particle vs. Verb	-0.4820	0.7989	-0.603	0.54632	
Intervener 2: Verb vs. Aux+Verb	0.3803	0.7197	0.528	0.59724	
Position × Intervener 1	-1.0910	1.5918	-0.685	0.49312	
Position × Intervener 2	-0.8091	1.4150	-0.572	0.56749	

** p<.01, *** p<.001
Formula: $changed \sim position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 + (position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 || subject) + (position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 || sentence)$

A mixed logit model with participants and items included as random effects and Position, Intervener Lengths, and interaction of Position and Intervener Lengths as fixed effects showed a significant main effect of Position, as shown in Table 4.46. There were no effects for Intervener Lengths, and there was no interaction of Position and Intervener Lengths.

Since there was hardly any change of position when the PP was in adjacent position, the influence of the intervener on sentences with extraposed PPs only was analysed. Therefore, a mixed logit model was fit with participants and items included as random effects and Intervener Lengths as fixed effects. The model showed a significant main effect of Intervener Length 1 (Verb Particle vs. Verb), as shown in Table 4.47. There was

Table 4.47: Mixed logit model fitted by maximum likelihood for Changing Position of extraposed PPs in Experiment 3, with Intervener Lengths as fixed effects.

	Estimate	Std. Error	z value	p	
(Intercept)	-4.01199	0.71549	-5.607	<.001	***
Intervener 1: Verb Particle vs. Verb	-1.02887	0.50841	-2.024	0.043	*
Intervener 2: Verb vs. Aux+Verb	0.01054	0.53464	0.020	0.984	

* p<.05, *** p<.001
Formula: $changed \sim Intervener1 + Intervener2 + (Intervener1 + Intervener2 || subject) + (Intervener1 + Intervener2 || sentence)$

---

[13]For computational reasons, the 0% of changed sentences with an adjacent PP and a verb particle were changed to 1% in the statistical model.

no effect of Intervener Length 2 (Verb vs. Aux+Verb).

Material dropped in reproduction

Table 4.48: Percentages of sentences recalled with material of the Intervener dropped.

Intervener length in original sentence	Adjacent	Extraposed
Verb particle	0	0
Verb	0	0
Auxiliary and verb	2	8

Table 4.48 shows the percentages of sentences recalled with material of the Intervener having been dropped. The results show that very little material is dropped. No verb particles and no verbs were dropped, neither in sentences with an adjacent PP nor in sentences with an extraposed PP. When the intervening material consisted of an auxiliary and a verb, material was dropped in 2% of sentences with an adjacent PP and in 8% of sentences with an extraposed PP.

A mixed logit model with participants and items included as random effects and Position, Intervener Lengths, and interaction of Position and Intervener Lengths as fixed effects showed a significant main effect for Intervener Length Verb vs. Verb+Auxiliary, as shown in Table 4.49.[14] There was no effect for Position, and there were no interactions of Position and Intervener Lengths.

Error rates

When sentences were incomplete, ungrammatical, or not reproduced at all, they were coded as *error*. As before, the method of *Production from Memory* was straining for working memory, and a number of errors were made. Table 4.50 shows the percentages of sentences coded as *error*. More errors were made when the PP was in adjacent position.

Table 4.49: Mixed logit model fitted by maximum likelihood for Dropping Material of the Intervener in Experiment 3.

	Estimate	Std. Error	z value	p	
(Intercept)	-4.9836	0.5635	-8.844	$<.001$	***
Position	0.6992	0.6581	1.062	0.2881	
Contrast 1	0.3584	0.8090	0.443	0.6577	
Contrast 2	1.2759	0.6147	2.076	0.0379	*
Position $\times$ Contrast 1	-0.6260	1.6213	-0.386	0.6994	
Position $\times$ Contrast 2	1.7579	1.2402	1.417	0.1564	

* p<.05, *** p<.001

Formula: $dropped \sim position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 + (position||subject) + (position||sentence)$

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[14]For computational reasons, the 0% of sentences with dropped material in the conditions with either a verb particle or verb intervening were changed to 1% in the statistical model.

Table 4.50: Percentages of sentences coded as *error*.

Intervener length	Adjacent	Extraposed
Verb particle	14	8
Verb	12	8
Auxiliary and verb	15	7

A mixed logit model over the percentages of erroneous sentences with participants and items included as random effects and Position, Intervener Lengths, and interaction of Position and Intervener Lengths as fixed effects showed a significant main effect for Position, as shown in Table 4.51. There were no effects for Intervener Lengths, and there was no interaction of Position and Intervener Lengths.

Table 4.51: Mixed logit model fitted by maximum likelihood for Error in Experiment 3.

	Estimate	Std. Error	z value	p	
(Intercept)	-3.45656	0.43336	-7.976	<.001	***
Position	-0.91325	0.28566	-3.197	0.00139	**
Contrast 1: Verb Particle vs. Verb	-0.10527	0.40411	-0.260	0.79448	
Contrast 2: Verb vs. Aux+Verb	0.14286	0.30338	0.471	0.63770	
Position × Contrast 1	0.01579	0.59972	0.026	0.97900	
Position × Contrast 2	-0.31891	0.59888	-0.533	0.59437	

** p<.01, *** p<.001

Formula: $error \sim position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 + (position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 || subject) + (position + Intervener1 + Intervener2 + position : Intervener1 + position : Intervener2 || sentence)$

Relation to reading span

Table 4.52: Descriptive Statistics for Experimental and Reading Span Measures in Experiment 3.

	Main experiment (%)			Reading span test (%)	
Measure	Accuracy	Changed	Dropped	Memory score	Processing score
Mean	90	15	12	47	67
SD	0.13	0.17	0.14	15.8	4.4
Range	50-100	0-56	0-56	12-74	58-73

Table 4.52 shows descriptive statistics for the main experiment and the reading span test of Experiment 3. As before, *Accuracy* represents the percentage of correctly recalled sentences in Experiment 2. *Changed* represents the percentage of sentences in which the position of the PP was changed, and *Dropped* refers to the percentage of sentences in which part of the intervener was dropped. As shown by Table 4.52, both the experimental results and the reading span results show a large amount of individual variation.

Table 4.53 shows the pairwise correlations for the mean values of the 31 participants. The data of the main experiment show positive correlations with the results of the processing score of the reading span test. There were also correlations with the memory score, albeit not all of them reached significance.

Table 4.53: Correlations Between Experimental and Reading Span Measures in Experiment 3.

Measure	Accuracy	Changed	Dropped	Memory score
Memory score	0.33	-0.34	-0.35*	—
Processing score	0.47**	-0.45**	-0.49**	0.13

* p<.05, ** p<.01

4.4.4 Discussion

The major finding of Experiment 3 is that participants changed the position of the PP from extraposed to adjacent significantly more often than from adjacent to extraposed. This finding is slightly different to the findings of the first two experiments, in which no statistically significant effect of position change was found. In Experiment 1, 5% of extraposed PPs were reproduced in adjacent position, in Experiment 3, 10% of extraposed PPs were reproduced in adjacent position.

The finding is contrary to the predictions of both the EIC and DLT, which both predicted that there should be a preference for extraposition when the intervener is one word in length and of verbal material. The expectation that a verb particle as intervening material might result in an increase of position change from adjacent to extraposed, or, at least, in a high number of extraposed PPs being reproduced in their target position, was not confirmed. The results show that rather the opposite is the case. Adjacent PPs were reproduced in target position, confirming the expectations. The intervener only had a statistically significant effect on the change of position in the case of extraposed PPs. Significantly more extraposed PPs were changed to adjacent position when the intervening material was a verb particle.

As expected, participants dropped significantly more material when the intervener consisted of a verb and auxiliary. However, the position of the PP had no influence on material being dropped, and the amount of dropped material was far from the amount that was dropped in Experiment 2. While in 31% of sentences with an extraposed PP and a two-word intervener (adverb and verb) material was dropped in Experiment 2, only in 8% of sentences with an extraposed PP and a two-word intervener (verb and auxiliary) material was dropped in Experiment 3. Dropping here means that an auxiliary was dropped, because the sentence was changed from reported speech, e.g. *soll gekauft haben* 'is supposed to have bought', to present perfect, e.g. *hat gekauft* 'has bought'. In this example, instead of *gekauft haben*, only *gekauft* remained as the intervener in the

reproduced sentence.

The statistical analysis showed that significantly more errors were made in sentences with an adjacent PP than in sentences with an extraposed PP. The type of intervening material had no influence on the production of erroneous sentences.

4.5 Experiment 4: Extraposition of Prepositional Phrases vs. Relative Clauses

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. Experiment 4 investigates possible differences between PP and RC extraposition in German, using the method of Production from memory.

In a corpus study on RC extraposition in German, Uszkoreit et al. (1998*a*) found that the preferred distance of extraposition is 1-2 words (the mean distance of extraposition in the corpus was 1.6 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 clearly had more influence than the length of the relative clause.

Francis (2010) conducted a corpus study on RC extraposition in English. She found that extraposition was strongly preferred when the intervening VP consisted of only one or two words or when the RC was four times longer than the VP. When the RC was the same length or shorter than the VP, extraposition occurred hardly at all (in 2% of the cases). When the extraposition distance was one word, extraposition took place in 90% of the cases, when the distance was between two to four words, extraposition rates decreased to 32%, and if the distance was bigger than eleven words, extraposition did not take place at all.

Bader (2014) conducted a corpus study and two production experiments on German RC extraposition. In the corpus study, 2000 sentences with RCs in either adjacent or extraposed position were analysed. Similar to the findings of Uszkoreit et al. (1998*b*), extraposition rates decreased when the extraposition distance increased. Bader (2014) found that extraposition distance was a much more important factor in the decision to extrapose than the length of the RC. Extraposition was especially common over verbal material. With only verbal material intervening, extraposition took place in about 90% of the cases.

The two production experiments conducted by Bader (2014) used the method of *Production from Memory*. Participants read a main clause on a computer screen. An example sentence is shown in (113), here repeated for convenience as (144). Then followed a visual prompt like *Max said that*, after which participants had to repeat the main clause in form of an embedded clause.

(144)   a. Gratulieren wollte Max dem Lehrer, der gestern   zu Besuch war
              Congratulate wanted Max the   teacher who yesterday to visit   was
              'Max wanted to congratulate the teacher who came to visit yesterday.'

        b. Gedichte vorlesen wollte Max dem Lehrer, der gestern   zu Besuch war
              Poems   read to   wanted Max the   teacher who yesterday to visit   was
              'Max wanted to read poems to the teacher who came to visit yesterday.'

        c. Einige Gedichte vorlesen wollte Max dem Lehrer, der gestern   zu
              Some   poems   read to   wanted Max the   teacher who yesterday to
              Besuch war
              visit   was
              'Max wanted to read some poems to the teacher who came to visit yesterday.'

The intervening material varied in number of words, as well as in number of discourse referents: In (144a), there is only verbal material (*gratulieren wollte*) intervening, equaling one discourse referent. In (144b), there is a bare NP object, and in (144c) an NP object containing a determiner. The latter two both have the same number of discourse referents (*Gedichte* and *vorlesen*), but differ in the number of words. Bader (2014) found that extraposition was common over verbal material, but extraposition rates declined rapidly when a new discourse referent (in this case a noun) was introduced into the intervening material.

Strunk (2014) also conducted a corpus study on RC extraposition in German, fitting a binary logistic regression model to the corpus data. He tested the influence of 33 factors on RC extraposition. Applying a log-likelihood ratio test, he found 15 factors which yielded at least a marginally significant result. The two factors with the strongest influence on extraposition were the length of the RC and the distance between the head noun and extraposed RC. An intervening DP or adverbial influence extraposition rates, as well as a number of features of the antecedent NP. Thus, the definiteness and grammatical function of the NP play a role, just as its position in the topological field. Additionally, cataphoric antecedents raise the expectation for a post-modifying RC and facilitate extraposition.

All of the corpus studies and production experiments mentioned above agree that RC extraposition is most likely over purely verbal material, and preferably over only one word. Given this precondition, RC extraposition is quite common and could also be elicited in a production experiment using the same method as Experiment 4. Taking into account the findings of these previous studies, the intervening material in Experiment 4 consisted solely of a verb particle. The findings of Experiment 3 showed that PPs extraposed over a verb particle in the target sentence show a tendency to be reproduced in the adjacent position. An open question is if RCs extraposed over a verb particle will likewise have a tendency to be reproduced in adjacent position, or if RC extraposition over such a short distance is more faithfully reproduced.

4.5.1 Method

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.

Materials

Twenty-four sentences of the material used in Experiment 3 were adapted to fit the prerequisites of Experiment 4. Each sentence came in four conditions according to the factors Position (extraposed vs. adjacent), and Clause Type (prepositional phrase vs. relative clause). In all sentences, the PP was part of a direct object NP, with a subject NP in sentence-initial position, followed by a finite verb. The PPs and RCs of each item were matched in length, measured in syllables.[15] Eight different prepositions were used in the experimental sentences: *für* 'for' (six times), *mit* 'with', *von* 'of' (four times each), *über* 'about', *zwischen* 'between' (three times each), *aus* 'from' (twice), *auf* 'on', and *bei* 'at' (once each). In all conditions, the intervening material consisted of a verb particle. Table 4.54 presents a set of example sentences in all six conditions; for the complete material, see the appendix (Appendix B.4).

In adjacent conditions, the PP/RC is adjacent to the NP, and is followed by a verb particle (conditions 1 and 2). In extraposed conditions, the PP/RC is found at the end of the sentence, with the verb particle intervening (conditions 3 and 4). All sentences were grammatical sentences of Standard German. All test sentences, as well as filler sentences, were read by the author and digitally recorded in a sound-proof cabin.

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 for each participant individually. The twenty-four stimulus sentences in each list were interspersed in lists of forty-two filler sentences. There were two different sets of filler sentences. Twenty-four filler sentences were experimental items in a study about SO/OS word order and shallow comprehension. A sample set of filler sentences of this kind is shown in Table 4.55. Another eighteen filler sentences were made up especially and had no other use than to serve as distractors. All filler sentences were grammatical.

Procedure

The same reading span task and production experiment procedures were used as in Experiments 1, 2 and 3 (see Section 4.2.1).

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[15]The number of items and their respective length measured in syllables was as follows: seven syllables (one item), eight syllables (three items), nine syllables, ten syllables (four items each), eleven syllables (six items), twelve syllables (five items), twenty-one syllables (one item).

Table 4.54: A complete experimental stimulus from Experiment 4.

Clause Type: PP

Condition 1: PP position: adjacent

Anna	suchte	sich	ein	Kleid	für	den	Abschlußball	nächste	Woche	aus.
Anna	picked	PRO.refl	a	dress	for	the	prom	next	week	out

Condition 2: PP position: extraposed

Anna	suchte	sich	ein	Kleid	aus	für	den	Abschlußball	nächste	Woche.
Anna	picked	PRO.refl	a	dress	out	for	the	prom	next	week

'Anna picked out a dress for the prom next week.'

Clause Type: RC

Condition 3: RC position: adjacent

Anna	suchte	sich	ein	Kleid,	das	sie	beim	Abschlußball	tragen
Anna	picked	PRO.refl	a	dress	that	she	at the	prom	wear

wird,	aus.
will	out

Condition 4: RC position: extraposed

Anna	suchte	sich	ein	Kleid	aus,	das	sie	beim	Abschlußball
Anna	picked	PRO.refl	a	dress	out	that	she	at the	prom

tragen	wird.
wear	will

'Anna picked out a dress that she will wear at the prom.'

4.5.2 Predictions

The material over which PPs and RCs are extraposed in Experiment 4 is a verb particle. The only other experiment in which extraposition took place over a verb particle was Experiment 3. While for Experiment 3 the expectation was that PPs would be reproduced in their target position, following the results of Experiments 1 and 2, the results of Experiment 3 showed that extraposed PPs were significantly more often reproduced in adjacent position than vice versa. Although the intervener had no influence on position change, a higher number of extraposed PPs were reproduced in adjacent position when the intervening material consisted of a verb particle.

Previous studies on RC extraposition in both German and English have shown that RC extraposition over verbal material, preferably consisting of one word, is common. It is an open question if extraposed RCs in the target sentence will be reproduced in the target position, or if extraposed RCs will tend to be reproduced in adjacent position, similar to extraposed PPs in Experiment 3. The canonical position for an RC is adjacent to its head noun, thus the assumption that canonical structures are reproduced in their canonical form and non-canonical structures tend to be reproduced as canonical structures is also taken as starting point for the extraposition of RCs in Experiment 4.

Applying this assumption, which was the initial assumption for PP extraposition in Experiments 1 and 2, and taking into account the findings of Experiment 3, the following assumptions are made:

Table 4.55: A sample set of filler sentences from Experiment 4.

SO word order

a. Der   Koch hat den   Braten ruiniert.
   The.NOM chef has the.ACC roast   ruined
   'The chef has ruined the roast.'

b. Der   Braten hat den   Koch ruiniert.
   The.NOM roast   has the.ACC chef ruined.
   'The rost has ruined the chef.'

OS word order

a. Den   Braten hat der   Koch ruiniert.
   The.ACC roast   has the.NOM chef ruined
   'The chef has ruined the roast.'

b. Den   Koch hat der   Braten ruiniert.
   The.ACC chef has the.NOM roast   ruined
   'The roast has ruined the chef.'

When extraposition takes place over a verb particle...

i. PPs and RCs in adjacent (canonical) position to their NP will also be reproduced in adjacent position.

ii. PPs and RCs in extraposed (non-canonical) position to their NP will tend to be reproduced in adjacent (canonical) position.

Predictions made by the EIC

The IC-to-word ratios for the VP and NP are calculated following the local complexity metric of the EIC. The number of ICs (immediate constituents) are divided by the number of words it takes until the last IC can be recognized. The IC-to-word ratios for a sentence with either an adjacent or extraposed PP are shown in Table 4.56.[16] In the example sentence taken from Experiment 4, the VP consists of two ICs, namely the direct object NP (*ein Buch von einem völlig unbekannten Schriftsteller* 'a book by a completely unknown author'), and the verb particle *vor* from the particle verb *vorlesen* 'read-to (someone/outloud)'. The NP consists of three ICs, the indefinite determiner *ein* 'a', the noun *Buch* 'book', and the PP *von einem völlig unbekannten Schriftsteller* 'by a completely unknown author'. The PP can be recognized at the point of parsing the preposition *von* 'by'.

In the adjacent version, eight words have to be processed until both ICs of the VP can be recognized, resulting in a ratio of 2/8 (=25%) for the VP. The three ICs of the NP can be recognized after three words, making the ratio 3/3 (= 100%). In the version

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[16]The IC-to-word ratios calculated and shown in Tables 4.56 and 4.57 are for PPs of length 5 words and for RCs of length 6 words. In the experimental material, PP lengths varied between 3 to 7 words, and RC lengths varied from 4 to 7 words. The PPs and RCs of each item were matched in length, measured in syllables. The EIC, however, measures length in number of words.

Table 4.56: IC-to-word ratios for a sample sentence from Experiment 4, clause type: PP.

	ein	Buch	von	einem	völlig	unbekannten	Schriftst.	vor	**IC/word**	
						Adjacent PP				
VP	1	2	3	4	5	6	7	8	2/8	=25%
NP	1	2	3						3/3	=100%
Total IC-to-word ratio									**5/11**	
Mean percentage										**62.5%**

	ein	Buch	vor	von	einem	völlig	unbekannten	Schriftst.		
					Extraposed PP					
VP	1	2	3						2/3	=66.66%
NP	1	2	3	4					3/4	=75%
Total IC-to-word ratio									**5/7**	
Mean percentage										**70.83%**

with the extraposed PP, the two ICs of the VP can be processed after only three words, resulting in a ratio of 2/3 (= 66.66%) 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 62.5% in the adjacent version and 70.83% in the extraposed version. Thus, the EIC predicts a preference of roughly 8% for the extraposed version.

Table 4.57 shows the IC-to-word ratios for a sentence with either an adjacent or extraposed RC. The VP consists of two ICs, namely the direct object NP (*ein Buch, das von einem unbekannten Schriftsteller war* 'a book which was by an unknown authorâĂŸ), and the verb particle *vor* from the particle verb *vorlesen* 'read-to (someone/outloud)'. The NP consists of three ICs, the indefinite determiner *ein* 'a', the noun *Buch* 'book', and the RC following it (*das von einem unbekannten Schriftsteller war* 'which was by an unknown author'. The RC can be recognized at the point of parsing the relative pronoun *das* 'which' following the head. Thus the relative pronoun constructs the RC within the NP PCD. In the adjacent version, nine words have to be processed until both ICs of the VP can be recognized, resulting in a ratio of 2/9 (=22.22%) 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 RC, the two ICs of the VP can be processed after only three words, resulting in a ratio of 2/3 (= 66.66%) 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.[17] Compared to the adjacent sentence version, the ratio thus

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[17]Following Hawkins (1994, 2004), the RC in the extraposed version is assumed to be discontinuously attached to NP.

Table 4.57: IC-to-word ratios for a sample sentence from Experiment 4, clause type: RC.

Adjacent RC

...	ein	Buch	das	von	einem	unbekannten	Schriftst.	war	vor	**IC/word**	
VP	1	2	3	4	5	6	7	8	9	2/9	=22.22%
NP	1	2	3							3/3	=100%
Total IC-to-word ratio										**5/12**	
Mean percentage											**61.11%**

Extraposed RC

...	ein	Buch	vor	das	von	einem	unbekannten	Schriftst.	war		
VP	1	2	3							2/3	=66.66%
NP	1	2	3	4						3/4	=75%
Total IC-to-word ratio										**5/7**	
Mean percentage											**70.83%**

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 61.11% in the adjacent version and 70.83% in the extraposed version. There is only a slight drop of about 1% for the mean PCD of the adjacent RC compared to the adjacent PP. The mean PCDs of the extraposed PP and RC are actually the same. The EIC predicts a preference of roughly 9% for the extraposed version of the RC.

For convenience, Table 4.58 shows the mean percentages of the efficiency of the test sentences in Experiment 4 as predicted by the EIC. The percentages differ slightly from those in the tables above, as the different lengths of the PPs and RCs have been incorporated.[18]

Table 4.58: Mean percentages of the efficiency of the test sentences in Experiment 4 as predicted by the EIC.

Clause type	Adjacent	Extraposed
PP	62.38%	70.83%
RC	61.60%	70.83%

In summary, the EIC predicts that sentences with extraposed PPs or RCs in Experiment 4 always have a mean PCD of 70.83%. This percentage is relatively high, considering that a. the PCDs of all versions with adjacent PPs are lower, and b. extraposed constituents are supposed to be non-canonical structures and should not be preferred in general. It has

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[18]PP lengths in the experimental material: three words (once), four words (twice), five words (fifteen), six words (four), seven words (twice). RC lengths in the experimental material: four words (twice), five words (seven), six words (eleven), seven words (four).

to be noted that since the intervening material in Experiment 4 is always a verb particle even short PPs are slightly longer. The EIC favours constructions in which the longer constituent comes after the shorter one.

There is not much difference in the mean percentage of adjacent PPs and RCs, either. The mean percentages of efficiency for both clause types are about 62%. The EIC thus predicts about the same efficiency of adjacent PPs and RCs when the intervening/clause-final material consists of one word. For both clause types, the extraposed versions have a higher efficiency according to the EIC.

Predictions made by the DLT

Table 4.59 shows the total processing costs at each word of an example sentence of Experiment 4 with a PP that is five words long. The EUs associated with establishing a new discourse referent (DR) and structural integration (IC) are given as well.

Particle verbs are somewhat special with regard to the calculation of the processing costs according to the DLT. Since a discourse referent is an entity that is a referent for either a noun or an event, it is the part of a particle verb which carries tense that is a discourse referent. Thus, the verb (in the example sentence *las* 'read') is a discourse referent, while the particle (*vor* '-to') is not. Many particle verbs can occur without the particle. The particle verb in the example sentence is of such kind. While the example sentence means 'Maria read out loud a book by a completely unknown author', the same sentence without the particle at the end (*Maria las ein Buch von einem völlig unbekannten Schriftsteller*) translates simply to 'Maria read a book by a completely unknown author'. Thus, the particular particle verb leads to a garden-path scenario during processing. Furthermore, *lesen* 'to read' is an intransitive verb, meaning that *Maria las* 'Maria read' is a complete and grammatical sentence in German. This is of importance with regard to the calculation of storage cost, as at the point of *las* no further input is needed in order to form

Table 4.59: Discourse processing (DR) and structural integration (IC) costs for an example sentence from Experiment 4, Clause type: PP.

	Maria	las	ein	Buch	von	einem	völlig	unbekannten	Schriftsteller	vor
Adjacent PP										
DR	1	1	0	1	0	0	0	0	1	0
IC	0	0	0	0	0	0	0	0	0	1
Total	1	1	0	1	0	0	0	0	1	1

	Maria	las	ein	Buch	vor	von	einem	völlig	unbekannten	Schriftsteller
Extraposed PP										
DR	1	1	0	1	0	0	0	0	0	1
IC	0	0	0	0	0	0	0	0	0	0
Total	1	1	0	1	0	0	0	0	0	1

Table 4.60: Discourse processing (DR) and structural integration (IC) costs for an example sentence from Experiment 4, Clause type: RC.

	Maria	las	ein	Buch	das	von	einem	unbekannten	Schriftsteller	war	vor
					Adjacent RC						
DR	1	1	0	1	0	0	0	0	1	1	0
IC	0	0	0	0	0	0	0	0	0	2	2
Total	1	1	0	1	0	0	0	0	1	3	2

	Maria	las	ein	Buch	vor	das	von	einem	unbekannten	Schriftsteller	war
					Extraposed RC						
DR	1	1	0	1	0	0	0	0	0	1	1
IC	0	0	0	0	0	0	0	0	0	0	2
Total	1	1	0	1	0	0	0	0	0	1	3

a grammatical sentence. The same is true at the point of *Buch* 'book' and *Schriftsteller* 'author'.

The processing costs for the adjacent and extraposed version of the example sentence in Table 4.59 hardly differ from one another. The only difference in total processing cost occurs at the verb particle *vor*, which is 1 EUs in the adjacent version and at 0 EUs in the extraposed version. Since the particle has to be integrated over a discourse referent (*Schriftsteller*) in the adjacent version, an integration cost occurs. In the extraposed version, there is no integration cost at the particle, but at the same time there is no integration cost at the preposition *von* as only the verb particle, which is not a discourse referent, appears between the head noun and the PP, and thus no integration cost occurs. The total processing costs at all other words in the sentence are the same in both versions.

Table 4.60 shows the total processing costs at each word of an example sentence of Experiment 4 with a RC that is six words long. In both the adjacent and extraposed versions, the maximal discourse and structural integration cost occurs at the point of processing the verb *war* 'was'. At this point, the construction of the new discourse referent costs 1 EU. An empty category to be coindexed with the RC pronoun *das* is integrated as the subject of *war*. The attachment step is local, with no new discourse referents intervening, thus no further integration cost occurs. The subject-position empty category is coindexed with the preceding RC pronoun *das*. Two discourse referents were introduced in the intervening material (the NP *Schriftsteller* and the event referent *war*) leading to an integration cost of 2 EUs for this step. The total processing cost at the point of the verb *war* is thus 3 EUs.

Similar to the calculation for the sentences with PPs, the only difference for total processing costs between adjacent and extraposed versions occurs at the verb particle *vor*. In the adjacent version the cost is at 2 EUs at this point, while in the extraposed version no processing cost occurs. In the extraposed version the particle is integrated locally,

Table 4.61: Storage costs (SC) for example sentences from Experiment 4.

	Adjacent PP									
	Maria	las	ein	Buch	von	einem	völlig	unbekannten	Schriftsteller	vor
SC	1	0	1	0	1	1	2	1	0	0

	Extraposed PP									
	Maria	las	ein	Buch	vor	von	einem	völlig	unbekannten	Schriftsteller
SC	1	0	1	0	0	1	1	2	1	0

	Adjacent RC										
	Maria	las	ein	Buch	das	von	einem	unbekannten	Schriftsteller	war	vor
SC	1	0	1	0	2	2	2	2	1	0	0

	Extraposed RC										
	Maria	las	ein	Buch	vor	das	von	einem	unbekannten	Schriftsteller	war
SC	1	0	1	0	0	2	2	2	2	1	0

thus no integration cost occurs. In the adjacent version, integration takes place over two new discourse referents in the intervening material (*Schriftsteller* and *war*), resulting in an integration cost of 2 EUs.

Table 4.61 shows the storage costs at each word for a set of example sentences of Experiment 4. There is no difference in storage cost between adjacent and extraposed sentence versions with regard to either the PP or the RC. The adjacent and extraposed RCs have higher storage costs than the adjacent and extraposed PPs.

In summary, for the clause type PP, the DLT predicts a slight preference for sentences with the PP in extraposed position. For sentences with the clause type RC, the DLT predicts also a preference for the extraposed version, although slightly more pronounced than for PPs.

Both the EIC and DLT predict a preference for extraposed PPs as well as extraposed RCs. While the EIC predicts a preference of about 8-9% for the extraposed versions of both clause types, the DLT predicts a slight preference for the extraposed version for PPs, and a slightly more pronounced preference for the extraposed version for RCs. The hypotheses based on the predictions of the EIC and DLT are thus as follows:

Hypotheses

i. Target sentences with adjacent PPs/RCs will tend to be reproduced with PPs/RCs in extraposed position.

ii. The tendency to reproduce adjacent constituents in extraposed position will be stronger with regard to RCs.

The hypotheses are contrary to the findings of Experiments 1-3, at least with regard to PPs. Taking into account the results of Experiments 1-3, the expectation is that PPs will mostly be reproduced in target position, with a possible tendency of extraposed PPs to be reproduced in adjacent position.

4.5.3 Results

Change of Position

Table 4.62: Percentages of sentences recalled with the position of the PP/RC changed.

Constituent Type	Adjacent	Extraposed
PP	1	4
RC	6	1

Table 4.62 shows the percentages of sentences recalled with the position of the PP or RC changed, either from adjacent to extraposed position, or vice versa. In adjacent position, RCs were more often changed to extraposed position than PPs, while in extraposed position, PPs were more often changed to adjacent position than RCs.

A mixed logit model with participants and items included as random effects and Position, Constituent Type, and the interaction of Position and Constituent Type as fixed effects showed that the interaction between Position and Constituent Type was significant, as shown in Table 4.63. There were no effects for Position and Constituent Type.

Table 4.63: Mixed logit model fitted by maximum likelihood for Changing Position of the PP/RC in Experiment 4.

	Estimate	Std. Error	z value	p	
(Intercept)	-5.9016	1.5120	-3.903	<.001	***
Position	-0.4512	0.9123	-0.495	0.621	
Constituent Type	-0.1757	1.0427	-0.169	0.866	
Position × Constituent Type	4.7454	1.9519	2.431	0.015	*

* p<.05, *** p<.001
Formula: *changed ∼ type ∗ position + (type ∗ position||subject) + (type ∗ position||sentence)*

Error rates

Table 4.64: Percentages of sentences coded as *error*.

Constituent Type	Adjacent	Extraposed
PP	9	2
RC	10	5

When sentences were incomplete, ungrammatical, or not reproduced at all, they were coded as *error*. As before, the method of *Production from Memory* was straining for

working memory, and a number of errors were made. Table 4.64 shows the percentages of sentences coded as *error*. More errors were made when the PP was in adjacent position. In extraposed position, slightly more errors were made when the extraposed constituent was an RC.

A mixed logit model over the percentages of erroneous sentences with participants and items included as random effects and Position, Constituent Type, and interaction of Position and Constituent Type as fixed effects showed a significant main effect for Position, as shown in Table 4.65. There were no effects for Constituent Type, and there was no interaction of Position and Constituent Type.

Table 4.65: Mixed logit model fitted by maximum likelihood for Error in Experiment 4.

	Estimate	Std. Error	z value	p	
(Intercept)	-3.9597	0.6242	-6.343	<.001	***
Position	-1.2440	0.5621	-2.213	0.0269	*
Constituent Type	-0.5391	0.4708	-1.145	0.2522	
Position × Constituent Type	-0.9526	1.0060	-0.947	0.3437	

* p<.05, *** p<.001

Formula: $error \sim type * position + (type * position||subject) + (type * position||sentence)$

Relation to reading span

Table 4.66: Descriptive Statistics for Experimental and Reading Span Measures in Experiment 4.

	Main experiment		Reading span test	
Measure	Accuracy (%)	Changed (%)	Memory score (%)	Processing score (%)
Mean	93	10	52	68
SD	0.08	0.11	14.6	3.7
Range	71-100	0-33	8-72	58-74

Table 4.66 shows descriptive statistics for the main experiment and the reading span test of Experiment 4. *Accuracy* represents the percentage of correctly recalled sentences in Experiment 4. *Changed* represents the percentage of sentences in which the position of the PP was changed. As shown by Table 4.66, both the experimental results and the reading span results show a large amount of individual variation.

Table 4.67 shows the pairwise correlations for the mean accuracy and change of position values of the 24 participants. There was no positive correlation between memory score and processing score. Participants' performance at recalling letters and their performance at judging the plausibility of sentences varied widely.

The accuracy data of the main experiment show positive correlations with the results of the reading span test. As expected, participants who performed well on the reading

Table 4.67: Correlations Between Experimental and Reading Span Measures in Experiment 4.

Measure	Accuracy	Change	Memory score
Memory score	0.64***	-0.67***	—
Processing score	0.45*	-0.41*	0.33

* p<.05, *** p<.001

span task also performed well on the main experimental task and vice versa. The data for position change in the main experiment also show positive correlations with the results of both tasks of the reading span test. Table 4.67 reveals a particularly strong correlation between accuracy and change in the main experiment and the memory score of the reading span test. Therefore, it is possible that only the memory score is necessary for predicting the results of the main experiment.

This possibility was addressed by fitting a linear model including the two reading span scores to the accuracy data. The resulting model is shown in Table 4.68.

Table 4.68: Predicting Accuracy in Experiment 4 From the Memory and the Processing Score of the Reading Span Task.

Coefficients	Estimate	Std. Error	t value	$\Pr(> |t|)$	
(Intercept)	0.36499	.024932	1.464	0.15875	
Memory score	0.00308	0.00097	3.173	0.00479	**
Processing score	0.006	0.00382	1.570	0.13220	

** p<.01

Another linear model was fitted including the two reading span scores to the position change data. The resulting model is shown in Table 4.69. In both models only the estimated coefficient of the memory score is significantly different from zero, indicating that only the memory score has an effect on accuracy and position change.

Table 4.69: Predicting Position Change in Experiment 4 From the Memory and the Processing Score of the Reading Span Task.

Coefficients	Estimate	Std. Error	t value	$\Pr(> |t|)$	
(Intercept)	0.73782	0.31095	2.373	0.0278	*
Memory score	-0.00430	0.00121	-3.551	0.0020	**
Processing score	-0.00616	0.00477	-1.292	0.2110	

* p<.05, ** p<.01

4.5.4 Discussion

The major finding of Experiment 4 is that there is a statistically significant interaction between Constituent Type and Position. While extraposed PPs tend to be reproduced in adjacent position, there is a tendency for adjacent RCs to be reproduced in extraposed condition.

The expectations with regard to the PPs were confirmed. Although the majority of PPs are still reproduced in target position, there is a tendency for extraposed PPs to be reproduced in adjacent position. This finding is in line with the findings of Experiment 3, where extraposed PP were significantly more often reproduced in adjacent position than adjacent PPs in extraposed position. This finding is also in line with the assumption that non-canonical (extraposed) structures are reproduced as canonical (adjacent) structures.

The opposite tendency was found for RCs. While most sentences with RCs are still reproduced as in the target, there is a tendency for adjacent RCs to be reproduced in extraposed position. The expectation was that adjacent RCs are canonical and extraposed RCs are non-canonical structures, and therefore a tendency for extraposed RCs to be reproduced in adjacent position should be found. However, this finding is in line with findings in natural language corpora. Both Bader (2014) and Uszkoreit et al. (1998*b*) found that when only one verb was intervening, extraposition of RCs took place in 90% of the cases.

With regard to the efficiency of processing these structures, the EIC predicts a 8-9% better efficiency for extraposed RCs when the intervening material is one verb or verb particle. However, the same prediction is made for extraposed PPs. While the EIC's prediction is mirrored in the reproduction of RC extraposition, it is not in the reproduction of PP extraposition. The DLT likewise predicts a preference for extraposed RCs when the intervener consists of one verb. For extraposed PPs, the DLT also predicts a preference for the extraposed version, albeit a smaller one. It seems that the predictions of both theories are reflected in elicited production with regard to RCs, but not for PPs. The results of Experiment 4 show that there is a difference between PPs and RCs in reproduction.

Another finding of Experiment 4 is that, similar to the findings of Experiments 2 and 3, error rates were significantly higher for sentences with the PP or RC in adjacent position.

4.6 General Discussion

The major finding of the production experiments is that the majority of PPs are reproduced in their target position. With regard to canonicity, expectations were based on the assumption that PPs in adjacent position to their head noun represent the canonical structure, whereas PPs in extraposed position were assumed to be non-canonical. Thus this finding was expected for PPs in adjacent position, since canonical (adjacent) PPs were expected to be reproduced in canonical (adjacent) position. For PPs in extraposed (non-canonical) position, the expectation was that participants would tend to reproduce PPs in adjacent (canonical) position.

The results of a number of studies using the method of *Production from Memory* (see Chapter 4.1 for a detailed overview) showed that canonical structures are reproduced as in the original target sentence and non-canonical structures tend to be reproduced as canonical structures, e.g. passive is produced as active, but active is not produced as passive. The method has been used cross-linguistically (e.g., Tanaka et al., 2011 for Japanese), and for a number of different constructions, e.g. active/passive, dative alternation, particle movement, genitive, adverb preposing, clefts, subject/object reversal, and phrasal conjuncts. It should be noted that the method has never before been used to investigate extraposition of PPs. However, these previous findings suggested that a change of PP position from extraposed to adjacent would likely be observed in the production experiments in this thesis.

The method did not fail to reveal preferences in word ordering. Two findings showed that participants do change target sentences and reproduce them in their preferred word order. In Experiment 3, extraposed PPs were statistically more often changed to adjacent position than vice versa, and in the experiments that provided the filler items, less frequent constructions were changed to more frequent ones.

Extraposed PPs were mostly (90% - 97%) reproduced in extraposed position in all four production experiments. In Experiment 3, the change from extraposed to adjacent position reached statistical significance. Ironically, the expectation, based on previous studies on RC extraposition (see e.g., Uszkoreit et al., 1998*a* for a corpus study, and Bader, 2014 for production experiments) as well as theoretical predictions made by the EIC and DLT, was that extraposition is favoured over purely verbal material, especially when it only consists of one word. The intervening material in Experiment 3 consisted of either a verb particle, a verb, or an auxiliary and verb. While the intervener had no statistically significant influence on the change of PP position, the tendency to change extraposed to adjacent position was especially strong over verb particles. Thus, participants changed the position of the PP when it was least expected. It can only be speculated that verb particles are in some way too 'weak' to prevent a position change from extraposed to adjacent, possibly due to their being not as heavy and salient as a verb or other parts of speech.

Excursus: Verb Clusters in Delayed Sentence Recall

One of the experiments that provided filler items for the productions experiments in this thesis investigated the placement of the auxiliary in 4-verb clusters in German.

Verb clusters show a lot of variation across the West-Germanic languages and also much dialectal variation within each language. For German, variation is also found for non-dialect speakers. A series of experimental investigations of verb cluster formation (Bader & Schmid, 2009; Bader et al., 2009; Bader & Häussler, 2010) has shown that non-dialect speakers of German do not adhere strictly to the Standard German pattern. Native speakers of "Colloquial German" are more liberal than prescriptive grammars of

"Standard German" in a precisely defined way. Thus, in Standard German the auxiliary must always occur in the first position, as shown in (145a), while in Colloquial German the auxiliary must at least precede the modal verb. Hence, all versions shown in (145) are possible in Colloquial German.

(145) a. **AUX=1**

Ich weiß, dass das Dach vor   dem Sturm **hätte** erneuert werden müssen.
I   know that the roof before the storm had   repaired get   must

'I know that the roof ought to have gotten repaired before the storm.'

b. **AUX=2**

Ich weiß, dass das Dach vor   dem Sturm erneuert **hätte** werden müssen.
I   know that the roof before the storm repaired had   get   must

c. **AUX=3**

Ich weiß, dass das Dach vor   dem Sturm erneuert werden **hätte** müssen.
I   know that the roof before the storm repaired get   had   must

For the experiment, eighteen sentences like the one in (145) were constructed. The factor under investigation was the position of the auxiliary (AUX=1 vs AUX=2 vs AUX=3). Sometimes participants produced sentences with verb-projection raising. These sentences were coded as AUX=1/VPR. Errors and omissions were excluded from the analysis. The method used was *Production from Memory*. Table 4.70 shows the percentages of verb clusters reproduced with the auxiliary in first, second, or third position.

The results show that verb clusters with AUX=3 were reproduced rarely. Participants preferred to change the position of the auxiliary to AUX=1 in half of the sentences, and to AUX=2 in another third of the sentences. AUX=1 and AUX=2 both seem to be acceptable in Colloquial German. Participants produced clusters with AUX=2 even when given a cluster with AUX=1. Clusters with AUX=1 were produced most often, but clusters with AUX=2 were also produced in a substantial number of times.

Thus the same participants that changed verb clusters with the auxiliary in the less frequent third position into verb clusters with the auxiliary in the more common first and second positions, did not change the position of the extraposed PP into an adjacent position.

Table 4.70: Percentages of sentences recalled with the auxiliary in first, second, or third position.

	Target sentence		
Response	AUX=1	AUX=2	AUX=3
AUX=1	64	56	51
AUX=1/VPR	5	4	7
AUX=2	26	38	35
AUX=3	5	2	7

Participants also changed the position of the auxiliary in an experiment with 3-verb clusters in which the prosody was manipulated by either having a full NP or pronoun within the sentence. Clusters with AUX=1 were mostly reproduced as AUX=1, while ⅔ of AUX=2 with a pronoun and ¾ of AUX=2 with a full NP in the sentence were reproduced as AUX=1.

In summary, in experiments that investigated the placement of auxiliaries in 3- and 4-verb clusters in German, participants did change less frequent word orders into more frequent ones in reproduction. The same participants did not change the position of PPs, neither from extraposed to adjacent position, nor vice versa. The length of the PP and the length of the intervening material did not prompt participants to change the position of the PP, either.

Extraposition of PPs and RCs in Delayed Sentence Recall

Experiment 4 investigated similarities and differences between PPs and RCs in elicited production using the method of Production from Memory. The PPs and RCs were matched for length, measured in syllables, and semantically they conveyed the same meaning.

The results showed that for the most part PPs and RCs were reproduced as in the original target sentences. The main difference was that extraposed PPs showed a tendency to be reproduced in adjacent position, and adjacent RCs showed a tendency to be reproduced in extraposed position. In the statistical analysis, the interaction between Position and Constituent Type reached statistical significance.

For PPs, this finding is in line with Experiment 1-3. In the first two experiments, there was a slight tendency for extraposed PPs to be changed to adjacent position, but those tendencies did not reach statistical significance, either. In Experiment 3, the change of position from extraposed to adjacent reached significance.

For RCs, there was no tendency at all to change position from extraposed to adjacent. On the contrary, adjacent RCs showed a tendency to be reproduced in extraposed position. This finding is in line with previous studies that conducted corpus studies on RC extraposition (Bader, 2014; Francis, 2010; Uszkoreit et al., 1998a). Although a change from adjacent to extraposed position was not observed before, the extraposition rate for RCs over one word, preferably a verb, reached 90% in the corpus studies.

In comparison, RCs seem to be more easily extraposed, while PPs show a tendency to be preferred in adjacent position even in reproduction.

How Sentences are Recalled from Memory

It seems that the method of Production from Memory reveals effects of extraposition on memory rather than on language production. The finding that the majority of PPs are reproduced in their target position shows that sentence recall is verbatim to a much larger degree than would be expected following the findings of Bock & Brewer (1974) and

subsequent studies using the method (e.g. McDonald et al., 1993; Tanaka et al., 2011). Lombardi & Potter (1992) claim that sentence recall is verbatim unless an intruding verb that is incompatible with the target structure prompts participants to change the syntactic structure to one compatible with the verb. Lombardi & Potter (1992) argue that sentence recall is often verbatim, because the syntactic structure and the lexical items of the sentence are still activated in working memory.

The findings of the production experiments in this thesis suggest that participants' first strategy in sentence recall is to attempt to reproduce a sentence as verbatim as possible. Participants succeeded at this whenever they reproduced complete and grammatical sentences, which featured a PP that was either adjacent or extraposed. In verbatim sentence recall primacy and recency effects were found. As to primacy effects, all of the sentences that were reproduced verbatim or near-verbatim included the beginning of the sentence. As participants could drop some words of the PP or the intervening material and still reproduce a grammatical sentence with an adjacent or extraposed PP, more can be said with regard to recency effects.

Recency effects were found for both constituent length and intervening material. In Experiment 1, long PPs (9-11 words) were shortened less often when they were recent (in extraposed position) than when they were non-recent (in adjacent position). In general, participants dropped significantly more material when the PP was 5-6 words long as opposed to 2-3 words, and they also dropped significantly more material when the PP was 9-11 words long as opposed to 5-6 words. Thus, as the length of the PP increased, the strain on working memory increased and more material was dropped. However, for PPs of length 9-11 words, participants dropped significantly more material when the PP was in adjacent position (non-recent) than when it was in extraposed position (recent).

This finding is also in line with the expectation that longer constituents are preferably uttered at the end of the sentence. Thus, longer PPs should be reproduced more often in extraposed position than in adjacent position. However, if it was the case that short PPs were absolutely preferred in adjacent position and long PPs in extraposed position, participants should have changed the position of PPs rather than drop material. With regard to change of position, PPs were almost always reproduced in target position. Overall, 1% of adjacent PPs were changed to extraposed position, and 5% of extraposed PPs were changed to adjacent position. This difference did not reach significance in the statistical analysis. Therefore, it is likely that the preference for longer PPs in extraposed position is at least partly due to recency effects rather than to considerations of weight.

Similarly, in Experiment 2, participants dropped intervening material (non-recent) rather than change the syntactic position of the extraposed PP (recent). PPs were mostly reproduced in the position of the target version. There were no statistically significant changes from either extraposed to adjacent position, or vice versa. When the intervening material consisted of two words (an adverb and verb), material was dropped in 10% of the sentences with adjacent PPs and in 31% of sentences with extraposed PPs. When

Table 4.71: Percentages of sentences recalled verbatim, or incomplete/with a different structure.

	Verbatim	Incomplete/Different structure
Experiment 1	93.6	6.4
Experiment 2	86.0	14.0
Experiment 3	89.7	10.3
Experiment 4	93.6	6.4

the intervening material increased to four words (a PP adverbial and verb), material was dropped in 25% of sentences with adjacent PPs and in 50% of sentences with extraposed PPs. Additionally, error rates increased as the amount of intervening material increased. This suggests that participants had increasing difficulty recalling an increasing amount of non-recent material.

Crucially, the quality of the intervening material is important with respect to how much intervening material is acceptable (or dropped). In Experiment 2, ⅓ of adverbs and ½ of PP adverbials including a lexical NP were shortened to "verb only." Apart from the difference in number of words, it also makes a difference what kind of part of speech is intervening. In Experiment 3, two-word interveners consisting of an auxiliary and verb were only shortened in 8% of the sentences, while in Experiment 2, two-word interveners consisting of an adverb and verb were shorted in 31% of the sentences. Thus, non-recent auxiliaries were less often dropped than non-recent adverbs.

While it is not possible to say how much of the effects found in the production experiments are due to recency effects and how much to other factors, such as length of the PP and the intervening material, working memory limitations and recency effects definitely played a role. It is possible that recency effects were more pronounced due to the modality of the presentation of the test items. In serial recall, it has been found that recency has a greater effect on stimuli that are presented auditorily rather than visually (Nairne, 1988, 1990).

When the strategy to reproduce sentences as verbatim as possible fails, participants reproduce sentences that are either incomplete or which no longer feature PPs in either adjacent or extraposed position. Table 4.71 shows that the vast majority of sentences were recalled verbatim. In the following, sentences that were reproduced either with parts missing or with a different structure will be looked at more closely, but it is important to remember that they represent a small percentage of recalled sentences.

While both primacy and recency effects could be observed in sentences that were recalled verbatim, sentences that were recalled incompletely allow a better look at the extent of primacy and recency effects. Table 4.72 shows the percentages of incomplete sentences recalled with either the start, the middle, the end or the whole sentence missing. There were hardly any instances in which the start of the sentence was not recalled, thus primacy effects were strong and much more pronounced than recency effects. The end

Table 4.72: Percentages of incomplete sentences recalled with either the start, the middle, the end or the whole sentence missing, and of sentences recalled with a different structure.

	Start	Middle	End	Whole sentence	Different structure
Experiment 1	3.6	21.8	50.9	5.5	18.2
Experiment 2	6.9	30.2	16.4	8.6	37.9
Experiment 3	2.5	21.9	26.9	11.8	36.9
Experiment 4	2.7	24.3	16.2	10.8	46.0

of the sentence was missing much more often than the start. However, recency effects showed up as well. In about ¼ of incomplete sentences it was the middle part of the sentence that was not recalled. Thus primacy and recency effects took place. When the sentences in which the start of the sentence was left out are added, recency effects showed in about 28% of incompletely recalled sentences.

The findings with regard to primacy and recency effects are in line with the serial-position effect which describes the tendency to recall first and last items best in serial recall. Figure 4.2 shows serial position curves for serial recall with a 0-, 10-, and 30-seconds delay from a study by Glanzer & Cunitz (1966). They found strong primacy effects. Recency effects diminished as the delay increased.

The tendency to recall the beginning and the end of a sentence best and the middle parts of a sentence worst, also indicates the sequence in which parts of sentences are recalled. The examples in (146) and (147) show sentences in which the sequence of the constituents has been changed. The beginning of the original sentence is still recalled first, then follows the end of the original sentence and finally the middle part.

In (146), the PP adverbial and auxiliary (*In der Oper hat* 'In the opera has') remain in first position, followed by the NP *eine russische Ballettgruppe* 'a Russian ballet group', which takes the place of the NP *eine Ballerina...von einer russischen Ballettgruppe*
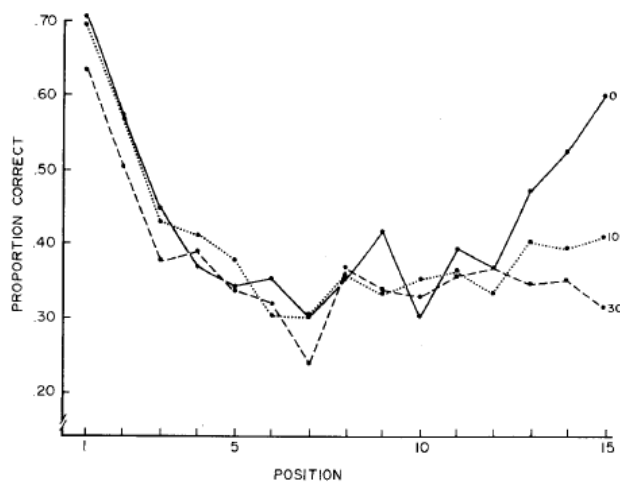
Figure 4.2: Serial position curves for 0-, 10-, and 30-seconds delay (Glanzer & Cunitz, 1966:358).

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'a ballerina...of a Russian ballet group'. Thus the dative object (*einer russischen Ballettgruppe*) from the end of the sentence is changed to the nominative subject of the sentence and placed in the middle. The adverb and verb from the middle of the original sentence are recalled last.

(146) **Original sentence**

    a. In der Oper hat eine Ballerina beeindruckend getanzt von einer russischen
       In the opera has a   ballerina impressively   danced of   a   russian
       Ballettgruppe.
       ballet-group

       'In the opera, a ballerina of a Russian ballet group has danced inpressively.'

    Recalled sentence

    b. In der Oper hat eine russische Ballettgruppe beeindruckend getanzt.
       In the opera has a   russian   ballet-group   impressively   danced
       'In the opera, a Russian ballet group has danced inpressively.'

In (147), the clause-final verb remains in last position in recall. As in (146), the beginning of the sentence consists of the first constituent and the auxiliary (*Die Direktorin hat* 'the headmistress has'). The PP *zur Vorbereitung aufs Abitur* left of the clause-final verb in the original sentence is recalled next, followed by the NP *ein neues Konzept* 'a new concept' which was placed in the middle of the original sentence. The PP *für den Unterricht in der Oberstufe* 'for the lessons in the sixth-form', which is part of the NP, is dropped.

(147) **Original sentence**

    a. Die Direktorin   hat ein neues Konzept für den Unterricht in der Oberstufe
       The headmistress has a   new   concept for the lessons   in the sixth-form
       zur   Vorbereitung aufs   Abitur   entwickelt.
       to-the preparation   for-the graduation developed

       'The headmistress has developed a new concept for the lessons in sixth form in preparation for graduation.'

    Recalled sentence

    b. Die Direktorin   hat zur   Vorbereitung aufs   Abitur   ein neues
       The headmistress has to-the preparation   for-the graduation a   new
       Konzept entwickelt.
       concept developed
       'The headmistress has developed a new concept in preparation for graduation.'

As illustrated in Table 4.72, participants changed the structure of the original sentence besides changing the position of the PP. Table 4.73 shows the percentages of sentences recalled with a different structure, or with the position of the PP changed. Participants changed the position of the PP to the same degree as they made other structural changes

Table 4.73: Percentages of sentences recalled with a different structure, or with the position of the PP changed.

	Different Structure	PP Position Changed
Experiment 1	1.3	2.8
Experiment 2	5.1	2.2
Experiment 3	3.5	5.9
Experiment 4	3.0	2.8

to the original sentences. It seems that participants did not (subconsciously) perceive the task as a choice of adjacent and extraposed structures, but rather as a challenge to recall sentences as verbatim as possible. Failures of verbatim sentence recall tell us more about how sentences are recalled from memory than about choices regarding PP positions.

Thus it appears that a theory about the choice between adjacent and extraposed PP position based on the results of sentence recall should rather be seen as a theory of working memory than a theory of choice.

If verbatim recall fails, it appears that participants' second strategy in sentence recall is to focus on "the important parts". The failure of verbatim recall thus allows a look at how sentences are recalled in different stages of "memory failure". In (148), primacy and recency effects still occur, but from the middle of the sentence only the fact that there was a *Schloss* 'lock' and that it was *sicher* 'safe' is recalled. Thus the middle of the sentence is indeed the place where syntactical structure decays first, and mainly meaning is recalled.

(148)   **Original sentence**

a. Juwelendiebe brachen den Tresor, der   das sicherste Schloss der   Welt
Jewel-thieves broke   the safe   which the safest   lock   of-the world
hat, auf.
has open

Recalled sentence

b. Der Juwelendieb brach gestern   das Sicherheitsschloss auf.
The jewel-thief   broke yesterday the safety-lock   open

In the example sentences in (149) - (151), only the PP is left out in (149). The PP is not necessary to make the sentence grammatical or plausible. In (150), not only is the PP left out, but also the sentence-initial PP adverbial. This makes the sentence ungrammatical, but it also illustrates which parts of the sentence have been "picked" as the most important. This is emphasized in (151), where the participant clearly states that the only thing s/he recalls is *ein Schuppen, der gebrannt hat* 'a shed that burned'.

(149) **Original sentence**

    a.   Auf einem Bauernhof hat ein Schuppen für Brennholz und Stroh
        At a   farm   has a   shed   for firewood and straw
        lichterloh gebrannt.
        blazingly burned

        Recalled sentence

    b.   Auf einem Bauernhof hat eine Scheune lichterloh gebrannt.
        At a   farm   has a   shed   blazingly burned

(150) **Original sentence**

    a.   Auf einem Bauernhof hat ein Schuppen für Brennholz und Stroh
        At a   farm   has a   shed   for firewood and straw
        gebrannt.
        burned

        Recalled sentence

    b. * Hat ein Schuppen gebrannt.
        Has a   shed   burned

(151) **Original sentence**

    a.   Auf einem Bauernhof hat ein Schuppen für Brennholz und Stroh in der
        At a   farm   has a   shed   for firewood and straw in the
        Nacht gebrannt.
        night burned

        Recalled sentence

    b. * Ein Schuppen, der gebrannt hat... (mehr ist mir nicht hängen geblieben.)
        A   shed   that burned has... (I cannot recall anything else.)

Thus parts that can be left out without making the sentence ungrammatical or implausible, such as PPs, adjectives, or adverbs, are left out first. What is recalled most faithfully are verbs, and nouns that are important to the meaning to the sentence. Due to the strength of the primacy effect, the beginning of a sentences is also recalled often. In the example sentences in (152) and (153), the noun and verb are recalled first, and then anything else that can be recalled is added.

(152) **Original sentence**

    a.   Ein Tierwärter hat ein Aquarium in einem Nebenraum gereinigt für
        A keeper   has an aquarium in a   side-room cleaned for
        Fische und Schildkröten.
        fish   and turtles

        Recalled sentence

    b. * Ein Aquarium wurde gereinigt mit... nein, es   waren Frösche und
        An aquarium was   cleaned with... no there were frogs   and
        Schildkröten drin.
        turtles   inside

(153) **Original sentence**

    a.   Das Hotel richtete das Zimmer, das die Gäste aus Japan gebucht
        The hotel prepared the room   that the guests from Japan booked
        hatten, her.
        had   PART

Recalled sentence

b. ?* Das Zimmer richteten…, das die Gäste aus Japan gebucht
   The room prepared… that the guests from Japan booked had
   hatten, richteten sie her.
   prepared they PART

The recalled sentence in (154) is ungrammatical, but illustrates how the sentence is recalled from memory. First of all, primacy and recency effects occur. The verb in the sentence is a particle verb. In the original sentence the particle is separated from the verb. In recall, verb and particle are united. Then follows the preposition *zwischen*, thus it is correctly recalled that there was a PP in the sentence and that this was the head of it. Instead of recalling the rest of the PP next, the NP *einen Zusammenhang* is recalled. It is possible that at that point a direct object for the recalled verb seemed 'more important' in order to produce a grammatical and plausible sentence. The content of the PP is then recalled with another preposition (*von*) and as a part of the NP.

(154)   **Original sentence**

a. Die Ärzte wiesen einen Zusammenhang nach zwischen
   The doctors proved a connection PART between
   Alkoholkonsum und Leberversagen.
   alcohol-consumption and liver-failure

   Recalled sentence

b. * Die Ärzte wiesen nach zwischen einen Zusammenhang von
   The doctors proved PART between a connection of
   Alkoholkonsum und Leberversagen.
   alcohol-consumption and liver-failure

It also seems to be the case that articles and auxiliaries are not memorized verbatim, but rather that they are derived from their nouns and verbs.

In an experiment that provided filler items for the production experiments in this thesis, sentences with either Subject-Object (SO) or Object-Subject (OS) word order had to be recalled (see Table 4.55). It was expected that sentences with non-canonical OS word order would be recalled with canonical SO word order. But instead of changing the position of constituents, participants rather changed articles to arrive at a SO word order, as shown in (155). It is possible that the tendency to recall a canonical word order was stronger than the verbatim memory of the articles.

(155)   **Original sentence**

a. Den Koch hat der Braten ruiniert.
   The.ACC chef has the.NOM roast ruined

   'The roast has ruined the chef.'

   Recalled sentence

b. Der Koch hat den Braten ruiniert.
   The.NOM chef has the.ACC roast ruined

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'The chef has ruined the roast.'

In Experiment 3, auxiliaries were only dropped in 8% of sentences with a two-word intervener, whereas in Experiment 2, adverbs were dropped in 31% of sentences with a two-word intervener. In the case of the auxiliaries, they could only be left out if the structure of the sentence had been changed from indirect speech to present perfect. Thus the correct recall of auxiliaries depended on a choice made earlier in the sentence. In German, sentences with present perfect tense are most frequent that sentences with indirect speech. Thus a sentence like *Anna soll ein neues Kleid für den Abschlussball gekauft haben* 'Anna is supposed to have bought a new dress for the prom' can be changed to *Anna hat ein neues Kleid für den Abschlussball gekauft* 'Anna has bought a new dress for the prom' due to frequency of the structure.

In another experiment providing filler items for this thesis, the position of the auxiliary in 3- and 4-verb clusters in German was investigated (see *Excursus: Verb Clusters in Delayed Sentence Recall* above). In the experiment, auxiliaries were mostly recalled in the more common first position. The structure of a sentence of this kind requires an auxiliary at some point in the sentence. There are only three different auxiliaries in German, and the sentence context leaves rarely much choice as to which auxiliary has to be used. There is therefore no need to memorize an auxiliary in the verbatim sense.

Chapter 5

The Acceptability of Extraposition of Prepositional Phrases out of NP

5.1 Introduction

Chapter 5 focuses on the acceptability of extraposition of prepositional phrases out of NP in German. Two different experimental methods are employed to gather acceptability judgements from participants: magnitude estimation and Likert scales.

Experiment 5 (Chapter 5.2) tests the same material as Experiment 2 (Chapter 4.3), using the method of magnitude estimation. As Experiment 2, Experiment 5 investigates the influence of the length of the intervening material between head noun and PP (measured in words) on extraposition rates, but this time participants rated the acceptability of sentences rather than reproduce them. Testing the same experimental material by using two different methods that look at both production and acceptability is meant to give a more complete insight and understanding into the phenomenon of extraposition.

Experiment 6 (Chapter 5.3) uses a questionnaire to obtain participants' acceptability judgements on a Likert scale. It investigates whether the acceptability of extraposition is influenced by the definiteness of the NP out of which is extraposed. In English, it has been found that extraposition out of definite NPs is less acceptable than out of indefinite NPs (Guéron, 1980). Walker (2013) concluded that in RC extraposition in English, there is a soft constraint on definiteness. Experiment 6 investigates if a similar (soft) constraint on definiteness can be found for PP extraposition in German.

Experiment 7 (Chapter 5.4) is concerned with the influence of weight of the extraposed PP on the acceptability of extraposition. The question asked is what defines weight. Three different measures of weight within the literature on Heavy NP Shift (HNPS) are identified by Wasow (1997b): i. number of words dominated (Hawkins, 1990), ii. number of nodes dominated (Hawkins, 1994), iii. number of phrasal nodes (i.e., maximal projections) dominated (Rickford et al., 1995). Experiment 7 tests if weight is defined by number of phrasal nodes. If indeed "heavier" constituents are preferred at the end of

utterances (Behagel, 1930; Quirk et al., 1972; Arnold et al., 2000), a PP that includes an RC (and thus has more phrasal nodes) should receive higher ratings than a simple PP.

The comparison of results with regard to predictions made by theories that are primarily concerned with sentence comprehension, such as the *Dependency Locality Theory* (DLT) by Gibson (2000), is more straightforward as results are more easily adapted to the theories' approach of establishing processing costs. At the same time, it becomes clear that acceptability and production are really two sides of the same coin. Some studies on language comprehension taking an expectation-based approach (Hale, 2001; Levy, 2008; Gennari & MacDonald, 2009) claim that some structures are more difficult to comprehend, because they occur less frequently in the language input. This leads to the question why speakers produce these structures less frequently. One possible explanation is that speakers prefer to produce structures that are simpler and which consume less resources rather than structures that are more complex and which are therefore more costly to produce (Scontras et al., 2015). A more specific answer is given by MacDonald et al. (2016:517), who conclude that "the motivations behind speakers' implicit choices of sentence structure (and thus structure frequency) largely stem from the nature of lexical retrieval and semantic interference between words during utterance planning."

Thus, investigating the same linguistic phenomenon both from a production and an acceptability point of view is the only way to be able to recognize aspects that are specific to either production or acceptability, and to be able to see differences between the two as well as things they have in common.

5.2 Experiment 5: The Influence of the Length of the Intervening Material on Acceptability

Experiment 5 tested the same material as Experiment 2, using the method of *Magnitude Estimation*. The first point of interest is to see what differences between production and acceptability can be found when the same test sentences are used. Most previous studies on extraposition tested acceptability rather than production, thus a comparison to previous findings is easier and more straightforward.

Hawkins (2004:106) points out that the predictions for efficiency made by the *Early Immediate Constituents* proposal (EIC) apply not only to comprehension, but also to production. Thus, "the quantification procedure [of the local complexity metric of the EIC] is also most plausible from the speaker's perspective." However, the mean percentages of efficiency for specific sentence structures are not as easily compared to participants' handling of test sentences and their reproductions. A comparison of the EIC's predictions to the mean ratings of sentences in a magnitude estimation procedure should therefore be easier, especially since production data of the same material can be consulted.

The *Dependency Locality Theory* (DLT) by Gibson (2000:95) is first and foremost a "theory of resource use in sentence comprehension." Therefore the predictions made by the DLT should have a bigger import on the results of an acceptability experiment than on the results of an elicited production experiment. However, Temperley (2007) tested the DLT predictions with regard to the occurrence of specific structures in a natural language corpus. He found that the theory's predictions were in line with the number of occurrences of most of the structures he investigated, suggesting that the predictions made by the DLT are also relevant for production. The DLT makes predictions as to which structures are easier processed. The number of occurrences of specific structures in a corpus are more easily compared to such predictions than the results of an experiment using the method of Production from Memory. The method of magnitude estimation should therefore make an easier comparison possible.

Konieczny (2000) conducted an acceptability study on RC extraposition using the same method as Experiment 5: magnitude estimation. He found that adjacent RCs were always rated higher than their extraposed counterparts. This finding was contrary to the predictions of the EIC and the DLT. It will be interesting to see if participants' ratings in Experiment 5 repeat Konieczny's (2000) findings, or if they mirror the predictions by the EIC or DLT.

Using the same material in Experiments 2 and 5, and the comparison of results between these two experiments is therefore meant to give a more complete insight into the phenomenon of extraposition in German.

5.2.1   Method

Participants

Sixty-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.

Materials

The same thirty-six test sentences in six conditions were used as in Experiment 2. A set of example sentences is shown in Table 4.1; for the complete material, see the appendix (Appendix B.2). A list of 125 filler sentences representing a variety of grammatical and ungrammatical sentence structures were combined with the experimental items.

Procedure

The method used was that of *Magnitude Estimation* (ME), which is a graded acceptability task. The procedure used in the experiment closely followed the method described in Bard et al. (1996), Sorace (2000) and Keller (2000). The software used was the same as in Bader & Häussler (2010) and was provided by the authors.

In each experimental session there were three phases. At the beginning of each phase, participants read an instruction which explained the procedure with the help of an example. If participants had any questions they could ask a research assistant who was always close by.

The first phase served to introduce the method to participants. In this phase they were not judging linguistic phenomena but the lengths of lines shown on the computer screen. They were given a reference line and had to assign a numerical value to it. Participants were then asked to assign numerical values to subsequent lines appearing on the screen. The idea is that these lines are judged relative to the reference line, thus a subsequent line that is twice the length of the reference line should be assigned a numerical value that is twice the value of the reference line's value. A subsequent line that is one third in length of the reference line should be assigned a value that is one third the value of the reference line's value, and so forth.

In the second phase, participants judged the acceptability of training sentences. They were given a reference sentence and had to assign a numerical value to it. As the following training sentences appeared on the computer screen participants had to judge them by giving them numerical values relative to the reference sentence.

In the final phase, after reading the instructions participants pressed a key to start the experiment. They were given the reference sentence shown in (156). In order to be able to compare results with prior work using the method of ME if necessary, the reference sentence was the same as the one used in the study by Bader & Häussler (2010) and very similar to the one used by Keller (2000).

(156) Ich glaube, dass den   Bericht der   Chef in seinem Büro gelesen hat.
       I   believe that the.ACC report   the.NOM boss in his   office read   has
       "I believe that the boss read the report in his office."

Then they judged the experimental sentences of Experiment 5 and the filler sentences one by one, relative to their judgement of the reference sentence. The reference sentence as well as their numerical assignment to it remained visible on the screen throughout the experiment. Judgements and judgement times were recorded automatically.

5.2.2 Predictions

Since the material of Experiment 5 is the same as the material used in Experiment 2, the predictions of the *Early Immediate Constituents* proposal (EIC) by Hawkins (1994, 2004) and of the *Dependency Locality Theory* (DLT) by Gibson (2000) are the same as in Experiment 2 (see Chapter 4.3.2).

In summary, both the EIC and DLT predict a preference for the extraposed version when one verb is intervening, although the DLT only predicts a slight preference. With an adverb and verb intervening, the DLT still predicts a slight preference for the extraposed version, while the EIC now predicts a slight preference for the adjacent version. The two

theories truly diverge from one another when the intervening material consists of a PP adverbial and a verb. While the EIC predicts a much better efficiency for the adjacent version, the DLT predicts a pronounced preference for the extraposed version.

In Experiment 2, participants dropped intervening material during reproduction rather than change the syntactic position of the extraposed PP. Since dropping material is not possible with the magnitude estimation procedure, the expectation is that participants will divert to rating sentences with extraposed PPs lower than sentences with adjacent PPs. The acceptability of extraposed PPs should decrease as the amount of intervening material increases.

Thus, while the DLT predicts an increasing preference for extraposition, the EIC predicts a decreasing preference for extraposition, with only extraposition over a verb being actually preferred over the adjacent version. The results of Experiment 2 and the acceptability judgement study on RC extraposition by Konieczny (2000) suggest that sentences with adjacent PPs will be rated consistently higher than sentences with extraposed PPs. The hypotheses therefore disregard the predictions of the DLT and follow expectations based on the study by Konieczny (2000), Experiment 2, and in part on the predictions of the EIC:

Hypotheses

i. Sentences with the PP in adjacent position will be rated higher than sentences with the PP in extraposed position.

ii. As the length of the intervening material increases, the tendency to rate sentences with the PP in adjacent position higher than sentences with the PP in extraposed position will increase.

5.2.3 Results

All of the data were analysed using the R statistics software, Version 3.2.1 (R Core Team, 2015).

Preprocessing. Every rating of the raw output of the magnitude estimation procedure was normalized by dividing it by the value assigned to the reference sentence to put all judgements on the same scale. To ensure that the data will be approximately normally distributed, these normalized values were log-transformed. Finally, a z-transformation by subject was performed in order to reduce individual differences. The same procedure was used in Hofmeister et al. (2013). The mean z-transformed log ratios are shown in Table 5.1.

Analysis. To test for significant effects, the data were analysed by means of mixed-effect modelling using the lme4 package (Bates et al., 2015). The experimental factors of Position and Intervener Lengths and all interactions between them were entered as fixed effects into the model, including *Grammatical Function* (subject NP vs. direct object NP). In addition, random effects were included for items and participants.

Table 5.1: Mean z-transformed log ratios in Experiments 5.

	Adjacent	Extraposed
Verb	0.419	-0.212
Adverb + Verb	0.295	-0.564
PP Adverbial + Verb	0.336	-0.436

The linear mixed model shows significant main effects of Position, Contrast 1 (Verb vs. PP Adverbial+Verb), Contrast 2 (Adverb+Verb vs. PP Adverbial+Verb), and Grammatical Function, as shown in Table 5.2. Contrast 1 is the contrast between Verb vs. PP Adverbial+Verb, because the difference between the mean z-transformed log ratios of these two conditions is smaller than the difference between the mean z-transformed log ratios of Verb vs. Adverb+Verb. Contrast 2 is the contrast between the mean z-transformed log ratios of Adverb+Verb vs. PP Adverbial+Verb.

The interaction between Position and Contrast 1 almost reaches a t-value of 2 (t-value: 1.918). In a second linear mixed model defining Contrast 1 as the contrast between Verb vs. Adverb+Verb rather than Verb vs. PP Adverbial+Verb, the interaction between Position and Contrast 1 is significant with a t-value of 3.002.

Table 5.2: Linear mixed model fit by maximum likelihood for Experiment 5.

	Estimate	Std. Error	t value
(Intercept)	-0.027	0.040	-0.688
Position	0.754	0.062	**12.254**
Contrast 1: Verb vs. PP Adverbial+Verb	-0.154	0.030	**-5.057**
Contrast 2: Adverb+Verb vs. PP Adverbial+Verb	0.084	0.034	**2.484**
Grammatical Function	-0.169	0.071	**-2.370**
Position × Contrast 1	0.140	0.073	1.918
Position × Contrast 2	-0.090	0.076	-1.187
Position × Grammatical Function	0.106	0.114	0.929
Contrast 1 × Grammatical Function	-0.001	0.061	-0.008
Contrast 2 × Grammatical Function	-0.022	0.066	-0.324
Position × Contrast 1 × Grammatical Function	0.269	0.144	1.872
Position × Contrast 2 × Grammatical Function	0.216	0.155	1.394

Formula: $log_z \sim position + intervener1 + intervener2 + position : intervener1 + position : intervener2 + subobj + subobj : position + subobj : intervener1 + subobj : intervener2 + subobj : position : intervener1 + subobj : position : intervener2 + ((1|subject) + (0 + position|subject) + (0 + intervener1|subject) + (0 + intervener2|subject) + (0 + subobj|subject) + (0 + position : intervener1|subject) + (0 + position : intervener2|subject) + (0 + position : subobj|subject) + (0 + intervener1 : subobj|subject) + (0 + intervener2 : subobj|subject) + (0 + position : intervener1 : subobj|subject) + (0 + position : intervener2 : subobj|subject)) + ((1|sentence) + (0 + position|sentence) + (0 + intervener1|sentence) + (0 + intervener2|sentence) + (0 + position : intervener1|sentence) + (0 + position : intervener2|sentence))$
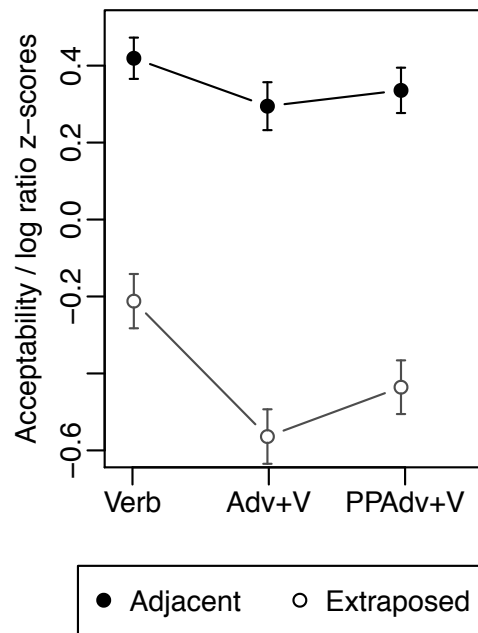
Figure 5.1: Z-transformed log ratios of magnitude estimation judgments by condition for Experiment 5. Error bars represent 95% confidence intervals.

5.2.4 Discussion

The results of Experiment 5 reveal three major findings. First, sentences with adjacent PPs were rated significantly higher than sentences with extraposed PPs. This finding confirms the influence of Position on acceptability, and supports the idea that adjacent PPs represent the canonical structure, while extraposed PPs seem to represent the non-canonical structure, at least with regard to acceptability.

Secondly, sentences with a PP adverbial+verb as intervening/clause-final material were rated significantly lower than sentences with only a verb intervening/in clause-final position. Interestingly, sentences with an adverb+verb intervening/in clause-final position were rated significantly lower than sentences with a PP adverbial+verb as intervening/clause-final material, as can be seen in Figure 5.1. A second statistical model revealed that sentences with an adverb+verb intervening/in clause-final position were also rated significantly lower than sentences with a verb intervening/in clause-final position (t-value: -7.381). The interaction between Position and the Contrast between verb and adverb+verb reached significance.

Thus, the expectation that ratings would decrease as the length of the intervening material increases was not entirely confirmed. Sentences with an adverb and verb (2 words) were actually rated lower than sentences with a PP adverbial and verb (4 words). This holds true for both extraposed and adjacent sentence versions. As expected, sentences with a verb (1 word) intervening received the highest ratings.

Both the EIC and DLT failed to predict the general preference for adjacent PPs. The EIC did predict a slight preference for adjacent PPs with an adverb+verb intervening, and a pronounced preference for adjacent PPs with a PP adverbial+verb intervening. The latter prediction proved to be correct, while the preference for adjacent PPs when an

adverb+verb is intervening was even more pronounced in the ratings than in the EIC's predictions. The DLT predicted an increasing preference for the extraposed sentence versions as the intervening material increases. Thus, the results of the rating experiment were quite contrary to the DLT's predictions.

This is in line with findings of Konieczny (2000) who conducted an acceptability judgement task on RC extraposition, and who also used the method of magnitude estimation. He found that adjacent RCs were consistently rated higher than extraposed RCs. With regard to the predictions of the EIC, Konieczny (2000:639) states that "although EIC predicts a preference of adjacent RCs, at least those RCs extraposed across only one word should have been judged more acceptable than their adjacent counterparts. This has not been the case." He also notes that Gibson's (1998) *syntactic prediction locality theory* (SPLT), an earlier version of the DLT, is even less compatible with the findings than the EIC.

The results of Experiment 5 also repeat Konieczny's (2000) finding that extraposed constituents are rated worse if the extraposition distance increases. The results differ with regard to adjacent constituents. While adjacent RCs were rated lower when potential extraposition distances decreased, adjacent PPs were rated best when the potential extraposition distance was only one word.

Thirdly, sentences in which the PP was part of a subject NP were rated significantly lower than sentences in which the PP was part of a direct object NP. The grammatical function of the NP had a bigger influence on sentences with extraposed PPs, however, the interaction between Position and Grammatical Function did not reach significance.

It is unclear why ratings for subject NPs were lower. In sentences with subject NPs, a PP adverbial was in initial sentence position, followed by an auxiliary and then the subject NP out of which was extraposed. The distance between extraposed PP and NP was the same in both sentences with subject and object NPs. In sentences with a direct object NP, a subject NP was in initial position, followed by an auxiliary and the object NP out of which was extraposed.

It is possible that sentences that included a subject and an object NP provided more of a context, and were thus rated higher, because they seemed more natural or plausible.

⅔ of the sentences with a subject NP featured a definite NP within the PP adverbial in initial position (e.g. *Auf dem Foto...* 'On the photograph...'), the other ⅓ featured mostly a temporal adverb, such as *Letzte Woche...* 'Last week...', or, in two instances, an indefinite NP (e.g. *Vor einem Hotel...* 'In front of a hotel...'). The analysis showed that the ratings for sentences with a temporal adverb/indefinite NP in initial subject position were lower than the ratings for sentences with definite NPs within the PP adverbial in initial subject position. The reasons for this remain unclear. However, it is possible that the the nature of the experimental material itself somehow caused these lower ratings.

5.3 Experiment 6: The Influence of the Definiteness of the NP on Acceptability

Experiment 6 investigates whether the acceptability of extraposition is influenced by 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. 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). Rochemont & Culicover (1990) give the examples in (157) and (158) for RC extraposition in English.

(157) a.   A man who is carrying a large package is here.

b.   The man who is carrying a large package is here.

(158) a.   A man is here who is carrying a large package.

b.   * The man is here who is carrying a large package.

Guéron (1980:665) gives the example in (159) 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.'

(159) 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 (160a) and that likewise there are indefinite NPs out of which extraposition is not acceptable, as shown in (160b).

(160) 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 (158b). In other cases, such as in the examples given by Ziv & Cole (1974:772), shown in (161) and (162), extraposition out of definite NPs is judged as having 'reduced acceptability.'

(161) 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.

(162) 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 (163). Rochemont & 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.

(163) a. The people who were angry at the movie have come.

    b. The people have come who were angry at the movie.

It is likely that the difference in judgements is due to the individual preferences of the researchers, since 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. Therefore, Walker (2013) conducted an acceptability judgement experiment on RC extraposition in English using the method of thermometer judgements (see 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 specifically are 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' 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 the analysis of a corpus study, he found that the definiteness of the NP out of which RCs are extraposed indeed influences the likelihood of extraposition. In the corpus, extraposition from definite NPs occurred significantly less often than from indefinite NPs.

Experiment 6 investigates if 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.

Table 5.3: A complete experimental stimulus from Experiment 6.

Indefinite NP

Condition 1: PP position: adjacent

Gestern	hat	eine	Trauerfeier		für	einen	verstorbenen	Politiker	stattgefunden.
Yesterday	has	a	funeral service		for	a	deceased	politician	taken place

Condition 2: PP position: extraposed

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.'

Definite NP

Condition 3: PP position: adjacent

Gestern	hat	die	Trauerfeier		für	den	verstorbenen	Politiker	stattgefunden.
Yesterday	has	the	funeral service		for	the	deceased	politician	taken place

Condition 4: PP position: extraposed

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.'

5.3.1 Method

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.

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' (twelve times), *von* 'of' (eight times) and *für* 'for' (four times). In all conditions, the intervening material consisted of one verb. Table 5.3 presents a set of example sentences in all four conditions; for the complete material, see the appendix (Appendix B.5).

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 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 for each participant individually. The twenty-four stimulus sentences in each list were interspersed in lists of sixty-four filler sentences. There were grammatical (eight) and ungrammatical (twenty-four) filler sentences. Thirty-two filler sentences were experimental items in a study about extraposition of center-embedded clauses.

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 (i.e., Hesse). 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 couldn't find any fault with it and 'totally unacceptable' if they couldn't 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. The instruction did not contain any example sentences. Participants then proceeded to mark their ratings for the eighty-eight sentences on the questionnaire. They needed about 15-20 minutes to complete the questionnaire.

5.3.2 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 (158b), repeated here as (164a) for convenience, an extraposed RC is judged as ungrammatical when extraposed out of a definite NP.

(164) a. * The man is here who is carrying a large package.

   b. Der Mann ist hier der ein großes Paket trägt.

The same sentence, translated to German in (164b), is not ungrammatical. Definite NPs tend to represent old information, and the sentence in (164b) 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. The need for
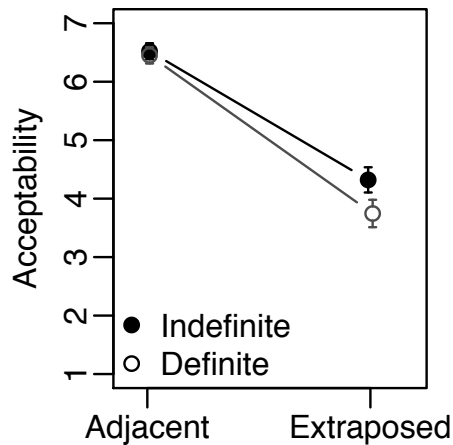
Figure 5.2: Mean acceptability ratings for Experiment 6. Error bars show 95% confidence intervals.

more context to make the definite version more felicitous might result in lower ratings for sentences with definite NPs.

Definite NPs could be rated lower than indefinite NPs in general, and, following the results of the previous experiments, extraposed PPs are likely to be rated lower than adjacent PPs. However, there is no obvious reason why extraposed PPs out of definite NPs should be less acceptable than extraposed PPs out of indefinite NPs or adjacent PPs out of definite NPs, other than the finding that extraposed RCs in English show a soft constraint on definiteness.

5.3.3 Results

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 *Definiteness*.

Figure 5.2 shows the mean acceptability ratings obtained in Experiment 6. The results of the corresponding statistical analysis are shown in Table 5.4. 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 versus 6.5; Tukey's test: t-ratio = 9.09, p < .0001, in sentences with definite NPs: 3.8 versus 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 versus 3.8; Tukey's test: t-ratio = 3.62, p = 0.0041). There was no significant acceptability difference between sentences with adjacent PPs with indefinite NPs and sentences with adjacent PPs with definite NPs (6.52 versus 6.45; Tukey's test: t-ratio = 0.445, p = 0.97).

5.3.4 Discussion

The main result of Experiment 6 is the finding that PP extraposition in German is less acceptable when the antecedent NP is definite. Sentences with extraposed PPs out of

Table 5.4: Linear mixed model fitted by maximum likelihood estimation for Experiment 6.

	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**
definiteness:position	-0.12604	0.05459	**-2.31**

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

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, 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 6, 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.[1] 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 6 were all extraposed from the same syntactic position (left to the infinite verb in the right bracket).

As expected, sentences with PPs in adjacent position were rated significantly higher than sentences with PPs in extraposed position. This finding mirrors the occurrence of adjacent and extraposed PPs in natural language corpora, and it is also in line with the findings of Uszkoreit et al. (1998*a*) and Konieczny (2000), who both conducted

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[1]Walker (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 6 were not verbs of appearance, the results are compared to Walker's results about non-appearance verbs.

Table 5.5: A complete experimental stimulus from the Filler Items of Experiment 6.

<div align="center">Comparative Clause</div>

Adjacent

Der	Kauf	von	mehr	Kleidern,	als	man	sich	leisten	kann,	ist	unvernünftig.
The	purchase	of	more	clothes	than	one	PRO.refl	afford	can	is	unreasonable

Extraposed

Der	Kauf	von	mehr	Kleidern,	ist	unvernünftig	als	man	sich	leisten	kann.
The	purchase	of	more	clothes	is	unreasonable	than	one	PRO.refl	afford	can

'The purchase of more clothes than one can afford is unreasonable.'

<div align="center">Relative Clause</div>

Adjacent

Der	Kauf	von	Kleidern,	die	viel	zu	teuer	sind,	ist	unvernünftig.
The	purchase	of	clothes	which	much	too	expensive	are	is	unreasonable

Extraposed

Der	Kauf	von	Kleidern	ist	unvernünftig,	die	viel	zu	teuer	sind.
The	purchase	of	clothes	is	unreasonable	which	much	too	expensive	are

'The purchase of clothes which are much too expensive is unreasonable.'

acceptability judgement tasks on RC extraposition in German, and who found that adjacent RCs were generally rated higher than extraposed RCs.

However, sentences with extraposed PPs were still rated rather good if compared to extraposed sentences in the filler items. The filler items came from an experiment on relative and comparative clauses in adjacent or extraposed position. A sample set of filler items is shown in Table 5.5. Another difference between the Filler Experiment and Experiment 6 is that the position of the head NP in the filler experiment is SpecCP, while in Experiment 6 the head NP appears in the middlefield.

Figure 5.3 shows the mean acceptability ratings of Experiment 6 and the Filler Experiment (Figure 5.2 is repeated as Figure 5.3a for convenience). Extraposed PPs in Experiment 6 were still rated somewhere in the middle of the scale (4.321 for sentences with indefinite NPs, 3.746 for sentences with definite NPs). In comparison, the extraposed comparative and relative clauses of the Filler Experiment were rated at the lower end of the scale (2.450 for relative clauses, 1.744 for comparative clauses).
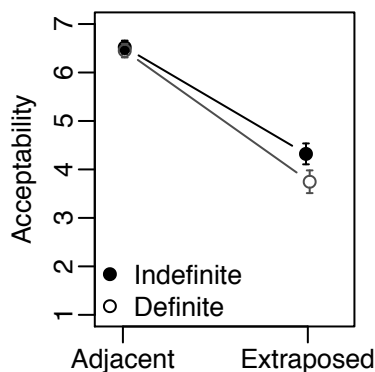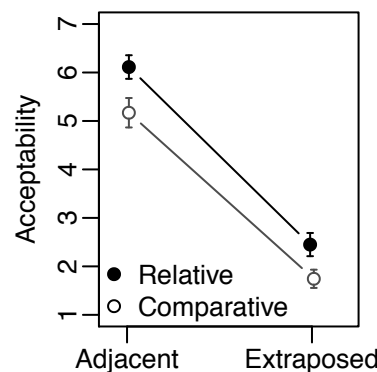
(a) Ratings for Experiment 6. (b) Ratings for Filler Experiment.

Figure 5.3: Comparison of mean acceptability ratings of Experiment 6 and the Filler Experiment.

5.4 Experiment 7: The Influence of the Inner Structure of the PP on Acceptability

Experiment 7 is concerned with the weight of the extraposed constituent and the question of how to define weight.

Within the literature, different measures of weight 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. Wasow (1997*b*:102) claims that "counting words, nodes, or phrasal nodes all work well."

A preliminary corpus survey conducted for this thesis found that about half of the extraposed PPs were followed by an RC. 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. If indeed heavier constituents are realized at the end of an utterance (see Quirk et al., 1972; Arnold et al., 2000), the acceptability of an extraposed PP that includes an RC should be higher than that of an extraposed PP without one. Experiment 7 thus asks if the inner structure of the extraposed constituent (PP only vs. PP+RC) influences its acceptability.

5.4.1 Method

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.

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 the length of six, seven or eight words respectively. The prepositions used were: *mit* 'with' (fourteen times), *für* 'for' (six times), *von* 'of' (three times) and *zwischen* 'between' (once). In all conditions, the intervening material consisted of one verb. Table 5.6 presents a set of example sentences in all four conditions; for the complete material, see the appendix (Appendix B.6). All sentences were grammatical sentences of German.

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 for each

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Table 5.6: A complete experimental stimulus from Experiment 7.

<u>PP only</u>

Condition 1: PP position: adjacent

Gestern	hat	eine	Trauerfeier	für	einen	jungen	und	sehr	beliebten
Yesterday	has	a	funeral service	for	a	young	and	very	popular

Politiker	stattgefunden.
politician	taken place

Condition 2: PP position: extraposed

Gestern	hat	eine	Trauerfeier	stattgefunden	für	einen	jungen	und	sehr
Yesterday	has	a	funeral service	taken place	for	a	young	and	very

beliebten	Politiker.
popular	politician

'Yesterday, a funeral service took place for a deceased politician.'

<u>PP + RC</u>

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
Yesterday	has	a	funeral service	taken place	for	a	politician	who	very

beliebt	war.
popular	was

'Yesterday, a funeral service took place for a politican who was very popular.'

participant individually. The twenty-four stimulus sentences in each list were interspersed in lists of fifty-six filler sentences. There were grammatical (five) and ungrammatical (twenty-one) filler sentences. Thirty filler sentences were experimental items in a study about the agreement of hybrid nouns and relative pronouns in German.

Procedure

The procedure was the same as in Experiment 6 (for a detailed description, see Section 5.3.1.)

5.4.2 Predictions

Following the findings of the previous experiments, sentences with adjacent PPs should be rated higher than sentences with extraposed PPs.

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.

Experiment 7 not only tests the definition of weight by Rickford et al. (1995), but also Wasow's (1997:102) conclusion that "counting words, nodes, or phrasal nodes all

Table 5.7: IC-to-word ratios for a sample sentence from Experiment 7.

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%**

Extraposed 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	=66.66%
NP	1	2	3	4							3/4	=75%
Total IC-to-word ratio											**5/7**	
Mean percentage												**70.83%**

work well". The sentences in the experimental material 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.

Predictions made by the EIC

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. As illustrated in Table 5.7, 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.[2]

Following the local complexity metric of the EIC, the number of ICs (immediate constituents) are divided by the number of words it takes until the last IC can be recognized. In the example sentence taken from Experiment 7, 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 beliebt war* 'a funeral for a young and very popular politician / a funeral for a politician who was very popular'), and the

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[2]The IC-to-word ratios calculated and shown in Table 5.7 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."

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 (= 66.66%) 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 70.83% in the extraposed version. Thus, the EIC predicts a preference of almost 11% for the extraposed version.

For convenience, Table 5.8 shows the mean percentages of the efficiency of the test sentences in Experiment 7 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, ⅓ of test items were of lengths 6 words, 7 words, and 8 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 if the PP includes an RC (an additional phrasal node) or not.

Table 5.8: Mean percentages of the IC-to-word ratios for Experiment 7.

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

Predictions made by the DLT

Table 5.9 shows the total processing costs at each word of an example sentence of Experiment 7 with a PP that is seven words long. The EUs associated with establishing a new discourse referent (DR) and structural integration (IC) are given as well. The processing 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 EUs in the adjacent version and 1 EUs 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 5.9: Discourse processing (DR) and structural integration (IC) costs for an example sentence from Experiment 7, 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
IC	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
IC	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 7 which features a PP including an RC are shown in Table 5.10. 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 EUs in the adjacent version and 1 EUs 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.

The storage costs (SC) for an example set of sentences from Experiment 7 are given in Table 5.11. The storage costs for the PP both with and without an RC are 1 MUs higher in the adjacent version than in the extraposed version.

Table 5.10: Discourse processing (DR) and structural integration (IC) costs for an example sentence from Experiment 7, constituent type: PP incl. 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
IC	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
IC	0	0	0	1	0	0	0	0	0	0
Total	0	1	1	1	0	1	0	0	0	1

Table 5.11: Storage costs (SC) for an example set of sentences from Experiment 7.

				Adjacent PP						
...	eine	Tr.f.	für	einen	jungen	und	sehr	beliebten	P.	stattg.
SC	2	1	2	2	2	3	3	2	1	0

				Extraposed 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

				Extraposed PP+RC						
...	eine	Tr.f.	stattg.	für	einen	P.	der	sehr	beliebt	war
SC	2	1	0	1	1	0	2	2	1	0

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.

5.4.3   Results
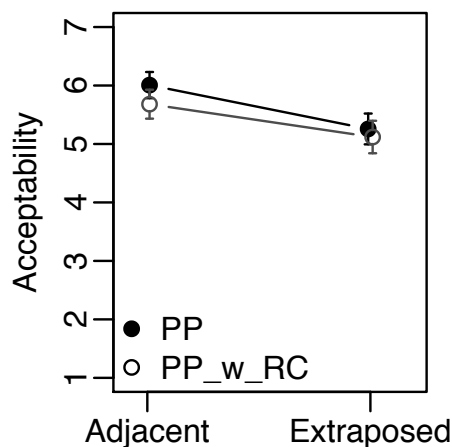
Figure 5.4: Mean acceptability ratings for Experiment 7. Error bars show 95% confidence intervals.

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*.

Table 5.12: Linear mixed model fitted by maximum likelihood estimation for Experiment 7.

	Estimate	Std. Error	t 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: $response \sim clausetype * position + (clausetype * position|subject) + (clausetype * position|sentence)$

Figure 5.4 shows the mean acceptability ratings obtained in Experiment 7. The results of the corresponding statistical analysis are shown in Table 5.12. 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 versus 5.3; Tukey's test: t-ratio = 3.72, p = 0.0035, in sentences with"PP+RC": 5.7 versus 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 versus 5.7; Tukey's test: t-ratio = 2.089, p = 0.1740, in sentences with extraposed PPs: 5.3 versus 5.1; Tukey's test: t-ratio = 0.876, p = 0.8174).

5.4.4 Discussion

The main result of Experiment 7 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'). Following the results of all other experiments in this thesis, this result was to be expected. It is contrary to the predictions of both the EIC and the 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". This is also illustrated by a comparison of the ratings for extraposed PPs to the filler items of Experiment 7. The filler items were provided by an experiment on hybrid nouns and relative pronouns. An example for a hybrid noun in German is *das Mädchen* 'the girl' where the article is neuter, but the person referred to is feminine. In the experiment, one factor was the position of the RC (adjacent vs. extraposed), and the second factor was the agreement of the article and the relative pronoun (neuter-neuter vs. neuter-feminine vs. feminine-feminine). A sample set of items is shown in Table 5.13.

The ratings for the filler items of Experiment 7 are shown in Table 5.14. A comparison to the ratings of Experiment 7 shows that extraposed PPs were rated higher than extraposed RCs in the filler items. This is especially true for conditions in which the

Table 5.13: Filler Items of Experiment 7 — Hybrid Nouns.

RC: adjacent

Condition 1: das - das

Lukas	schubst	**das**	Kind,	**das**	im	Haus	gegenüber	wohnt.
Lukas	pushes	the.NEUT	child	who.NEUT	in the	house	opposite	lives

Condition 2: das - die

Lukas	schubst	**das**	Kind,	**die**	im	Haus	gegenüber	wohnt.
Lukas	pushes	the.NEUT	child	who.FEM	in the	house	opposite	lives

Condition 3: die - die

Lukas	schubst	**die**	Nachbarstochter,	**die**	im	Haus	gegenüber	wohnt.
Lukas	pushes	the.FEM	neighbour's daughter	who.FEM	in the	house	opposite	lives

RC: extraposed

Condition 4: das - das

Lukas	soll	**das**	Kind	leider	immer wieder	schubsen,	**das**
Lukas	is said to	the.NEUT	child	unfortunately	time and again	push	who.NEUT

im	Haus	gegenüber	wohnt.
in the	house	opposite	lives

Condition 5: das - die

Lukas	soll	**das**	Kind	leider	immer wieder	schubsen,	**die**
Lukas	is said to	the.NEUT	child	unfortunately	time and again	push	who.FEM

im	Haus	gegenüber	wohnt.
in the	house	opposite	lives

Condition 6: die - die

Lukas	soll	**die**	Nachbarstochter	leider	immer wieder	schubsen,
Lukas	is said to	the.FEM	neighbour's daughter	unfortunately	time and again	push

die	im	Haus	gegenüber	wohnt.
who.FEM	in the	house	opposite	lives

article and the relative pronoun did not agree or were both feminine. The extraposed PPs are also rated slightly higher than extraposed RCs with an article and relative pronoun that are both neuter. Only sentences in which the RC was adjacent and the article and relative pronoun were in agreement were rated higher. These sentences were even rather higher than the adjacent PPs of Experiment 7.

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 (i.e. maximal projections) contained within an NP that defines the weight of that NP. From this followed the expectation that "heavier" constituents, i.e. 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,

Table 5.14: Mean ratings for Filler Items of Experiment 7 — Hybrid Nouns.

Position	das - das	das - die	die - die
Adjacent	6.194	3.383	6.300
Extraposed	5.071	3.142	4.783

which said that there would be no difference between PP only versus 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. This is also supported by the findings of Experiment 2, which showed that at the end of an utterance longer PPs (length measured in number of words) are preferred.

5.5 General Discussion

Testing the same material in elicited production and acceptability judgements

Experiment 2 (see Chapter 4.3) and Experiment 5 (see Chapter 5.2) tested the same experimental material, the former using the method of Production from Memory, the latter using the method of Magnitude Estimation. The factor under investigation was the length of the intervening material, which could either be a verb, an adverb and verb, or a PP adverbial and verb. The assumption was that sentences with adjacent PPs represent the canonical sentence structure, while sentences with extraposed PPs represent non-canonical sentence structure.

Following from this, and also from corpus data and acceptability judgement data from studies on RC extraposition (e.g. Uszkoreit et al., 1998*a*), the expectation was that in elicited production, extraposed PPs would be reproduced in adjacent position, and in the acceptability judgement task, sentences with extraposed PPs would receive lower ratings than sentences with adjacent PPs.

With regard to acceptability, these expectations were confirmed. Sentences with adjacent PPs were rated significantly higher than sentences with extraposed PPs. In the production experiment, the preference for adjacent PPs turned out to be not as obvious. Participants hardly changed the syntactic position of the PP. While sentences with extraposed PPs received lower ratings in acceptability, sentences with extraposed PPs were mostly reproduced with the PP in target position. A preference for adjacent PPs in reproduction, at least over an increasing amount of intervening material, revealed itself not by a change of position, but rather by dropping of intervening material. In sentences with extraposed PPs, a highly significant amount of material was dropped both when contrasting verb vs. adverb+verb, and when contrasting adverb+verb vs. PP adverbial+verb as intervening material.

Although the EIC predicted a preference for adjacent PPs when the intervening material consists of two or four words, over one word (a verb) extraposed PPs should have been preferred. But adjacent PPs over one word were rated much higher than their extraposed counterparts. While the EIC predicts a slight preference (69% vs. 67.69%) for adjacent PPs when the intervening material consists of two words, the ratings for adjacent PPs were much higher than for extraposed PPs when the intervening material consisted

of an adverb+verb. However, the EIC does correctly predict that adjacent PPs will be rated much higher than extraposed PPs when the intervener is a PP adverbial+verb. The predictions made by the DLT are even less compatible with the results of Experiment 5, as the DLT predicts a preference for extraposed PPs in all three conditions.

The findings of Experiment 5 are in line with findings of Konieczny (2000). In his study on RC extraposition (also using the method of magnitude estimation), Konieczny (2000) found that adjacent RCs were consistently rated higher than extraposed RCs. Likewise, the EIC predicted a preference for extraposed RCs over one intervening word, a prediction that did not find support in the results. While the other predictions of the EIC fit the findings, the predictions of the SPLT (an earlier version of the DLT) had also predicted a general preference for extraposed RCs, and were thus not compatible with Konieczny's (2000) findings.

Apart from the acceptability judgement experiment, Konieczny (2000) also conducted a self-paced reading experiment using the same material in order to compare off-line and on-line data. While the off-line data from the magnitude estimation experiment showed locality effects, the on-line data from the self-paced reading experiment did not. Konieczny (2000) notes that, while acceptability judgements are usually considered language processing data, they might actually reflect production preferences.   His argumentation is that his findings were predicted most accurately by the EIC when one did not consider the IC-to-word ratios but rather the *differences* between the IC-to-word ratios of the adjacent and extraposed versions (Konieczny refers to this as the *difference hypothesis*). From this, Konieczny follows that participants compared a given sentence version with the alternative version. They "have to generate this alternative first, which eventually involves *language production*" (Konieczny, 2000:644). He concludes that the similarity between his off-line data and corpus data, and the differences between his off-line data and on-line data "clearly indicate that locality-based processing cost is primarily a production phenomenon." Thus acceptability data should not be understood as processing data but rather production data.

For Experiment 5, no differences between the EIC IC-to-word ratios and the *differences* between the IC-to-word ratios of adjacent and extraposed versions were found. It has to be noted that Konieczny's experimental design included another factor and was thus a 2×3×3 design, whereas the experimental design of Experiment 5 was 2×3. It is possible that an added factor offered more opportunities for the *difference hypothesis* to make different predictions to the IC-to-word ratios. Be that as it may, even under the *difference hypothesis* the EIC does not make any more accurate predictions in Experiment 5, and thus there is no evidence that participants generated and compared alternative versions while giving their judgements. It will be interesting to test the materials in the acceptability judgement experiment of Experiment 5 in an on-line processing experiment, such as self-paced reading, and see if differences between the off-line and on-line data can be found.

As to the length of the intervening material, somewhat surprisingly, sentences with an adverb+verb (2 words) as intervening material were rated significantly lower than sentences with a PP adverbial+verb (4 words) intervening. While this is true for both adjacent and extraposed sentence versions, the effect was much more pronounced for extraposed versions (see Figure 5.1). In the production experiment, sentences with an adverb+verb as intervening material were changed slightly more often from extraposed to adjacent position than sentences with either a verb or a PP adverbial+verb as interveners, but this difference did not reach significance. However, in extraposed sentence versions significantly more errors were made when an adverb+verb were intervening than when only a verb was intervening. While the percentage of erroneous sentences with a PP extraposed over a PP adverbial+verb was slightly higher than over an adverb+verb, this contrast did not reach significance in the statistical analysis. The amount of material dropped was significant for both contrasts (Contrast 1: verb vs. adverb+verb, Contrast 2: adverb+verb vs. PP adverbial+verb), but slightly more significant for Contrast 1. It seems that participants had somewhat more difficulty in reproducing sentences with an adverb and verb intervening, especially considering that the expectation was that 2-word interveners should still be better for extraposition than 4-word interveners.

The method of Production from Memory, however, also reveals effects of extraposition on memory rather than only language production. The dropping of material represents, at least in part, recency effects. Participants dropped intervening material (non-recent) rather than change the syntactic position of the extraposed PP (recent). Recency effects were also found for constituent length. Long PPs were shortened less often when recent (extraposed) than when non-recent (adjacent). Thus, the dropping of adverbs in non-recent position is probably mostly due to recency effects, and there have to be other reasons for the low ratings of sentences with adverbs intervening.

The grammatical function of the NP out of which is extraposed had an influence on the acceptability of sentences. Sentences in which the PP was part of a subject NP were rated significantly lower than sentences in which the PP was part of a direct object NP. In the production experiment, the grammatical function of the NP only had an effect on error rates. For erroneous sentences there was an interaction between Position and Grammatical Function. In adjacent position, more errors were made when the PP was part of a direct object NP. In extraposed position, more errors were made when the PP was extraposed out of a subject NP. It is not clear why the error rate for sentences with adjacent PPs was higher in general, nor why there should be more errors out of an object NP. With regard to acceptability, adjacent PPs even received higher ratings when part of an object NP. As for extraposed sentences, more errors were made when the PP was extraposed out of a subject NP and acceptability ratings were lower for extraposed PPs out of subject NPs. As the intervening material increased, the ratings for PPs extraposed out of subject NP decreased. This is in line with the reproduction data. When the intervening material consisted of a PP adverbial and verb, the percentages for erroneous sentences were much

higher for extraposed PPs out of subject NP than for extraposed PPs out of object NPs. It remains an open question to what degree these findings are connected. Grammatical function had no influence on position change or dropping of material in reproduction, thus similar effects on error rates and acceptability ratings might only be coincidence.

In summary, acceptability judgements confirmed that PPs in adjacent position are more acceptable than PPs in extraposed position, and thus give support to the notion of adjacent PPs representing the canonical structure. In reproduction, a clear preference for adjacent PP position was not observed. Syntactic position of PPs was rarely changed. The dropping of intervening material in extraposed conditions is at least partly due to recency effects. However, recency effects aside, participants clearly preferred to reproduce extraposed PPs over 1 word (a verb), confirming that extraposition is most convenient when the extraposition distance is short. This is also confirmed in the acceptability ratings, with ratings being much lower for extraposed sentence versions over 2- or 4-word intervening material.

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

The results of Experiment 6 (see Chapter 5.3) 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 (159) 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 is 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 6 and those used by Walker (2013). One of the obvious differences was that the experimental design of Experiment 6 did not include *verb class* as a factor and none of the verbs used were verbs of appearance. More importantly, the sentences in Experiment 6 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 (165), taken from Walker (2013:156):

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

In PP extraposition, sentences can easily become ungrammatical if the definiteness status of the antecedent NP and the NP within the PP do not agree, as shown in (166). The grammaticality of these sentences does not depend on the position of the PP. The sentence shown in (166a) is ungrammatical, no matter if the PP is in adjacent or extraposed position.

(166)   a.   * Gestern hat ein Mann mit der tiefen Stimme angerufen.

           b.   ?? Gestern hat der Mann mit einer tiefen Stimme angerufen.

The only way in which (166b) 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. 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 6, 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 grammaticality and agreement in definiteness status illustrates that things are not as straightforward. Context and discourse status play an important role in making sentences acceptable or even grammatical. While the example sentence in (166a) is ungrammatical, the sentences in (167) are acceptable, within a certain context.

(167)   a.   Gestern hat eine Trauerfeier für den verstorbenen Politiker stattgefunden.

           b.   Gestern hat die Trauerfeier für einen verstorbenen Politiker stattgefunden.

The sentence in (167a) is perfectly fine, as long as *der verstorbene Politiker* 'the deceased 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 (167a) 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, verging on ungrammatical. 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 (see 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'.[3]

(168)   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 (168a) 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

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

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 (168b), 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 6 do not qualify as "referent-establishing". It is possible that some sentences, like the one in (167b), might benefit from an explanatory element in the modifying PP (such as *für einen verstorbenen Politiker* 'for a deceased 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 focussed constituent, which requires prior knowledge of the definite entity within it to make it sound completely natural and acceptable.

Definition of weight: number of words versus number of phrasal nodes

Experiment 7 (see Chapter 5.4) 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 this was found in Experiment 2, in which longer PPs were preferred at the end of utterances, with length being measured in number of words.

Wasow (1997*b*) identified a number of different measures of weight within the literature, mostly with regard to Heavy NP Shift (HNPS). 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 and student's exam and final papers. They identified three types of NP 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*b*:91) found that number of words, nodes, and phrasal nodes "are all extremely good predictors of constituent ordering in the three constructions [he] 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).[4] He investigated the influence of weight on the ordering of postverbal PPs in Russian.[5] 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."

It should be noted that all three studies discussed above are corpus studies, and thus looked at the influence of weight from the speaker's perspective, while Experiment 7 was an acceptability judgement task. Placing longer and more complex phrases at the end of utterances has advantages for processing, as illustrated by Hawkins's (1994) EIC. Input can be parsed more efficiently when shorter/less complex constituents come first. However, as Wasow (1997*b*) 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.

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[4]The corpus used was the Russian National Corpus (RNC).

[5]Apart 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.

Chapter 6

Conclusion

In this thesis extraposition of PPs out of NPs in German was investigated from a psycholinguistic perspective. Four elicited production experiments and three acceptability experiments were presented, which tested the influence of a number of factors on extraposition rates.

Experiment 1 tested whether the length of the PP has an influence on extraposition rates in production. Experiment 2 tested whether the length of the material intervening between the head noun and the PP has an influence on extraposition rates. In both experiments, length was measured in number of words. Experiment 3 was concerned with the make-up of the intervening material. In a number of corpus studies, RC extraposition preferably took place over purely verbal material. Experiment 3 thus tested whether PP extraposition was more likely over verbal material as well, and whether the length of the verbal material has an influence on extraposition rates. The majority of previous studies on extraposition focussed on RC extraposition. To the best of my knowledge, no previous studies investigated elicited production of PPs extraposed out of NP in German. Therefore, Experiment 4 investigated similarities and differences between PP and RC extraposition in elicited production in German.

The method used for all four production experiments was *Production from Memory*. A number of constructions (e.g., active/passive, dative alternation, and particle movement) have been investigated using this method and it has been applied cross-linguistically (e.g. for English, German, and Japanese). It has been found that participants are able to remember the semantic content of the input they are given, but the syntactic structure decays rapidly in working memory. In order to reproduce the target sentence, participants therefore have to regenerate the syntactic structure of the sentence (Bock & Brewer, 1974; Bock & Warren, 1985; Potter & Lombardi, 1990; Lombardi & Potter, 1992; McDonald et al., 1993; Tanaka et al., 2011).

In order to give a more complete insight into the phenomenon of extraposition, three acceptability judgement experiments were conducted. Experiment 5 tested the influence of the length of the intervening material on the acceptability of extraposition. The same material as in Experiment 2 was used, in order to facilitate comparisons between elicited

production of extraposed structures and the acceptability of extraposition. Experiment 6 tested whether a soft constraint for definiteness of the NP out of which is extraposed can be found in PP extraposition in German. Previous studies have suggested that such a soft constraint exists for RC extraposition in English and German. Finally, Experiment 7 tested whether the weight of a constituent is defined by the number of phrasal nodes within, and if extraposed constituents which are heavier in terms of number of phrasal nodes will receive higher acceptability ratings than constituents which are lighter with regard to number of phrasal nodes.

The aim of this thesis was to find answers to a number of research questions which were posed in Chapter 3.5. In the following, the answers that have been found are summarized.

6.1 Concerning the Length of the Extraposed Constituent

A number of studies have suggested that longer constituents are preferably realized at the end of utterances (e.g., Behagel, 1909, 1930; Quirk et al., 1972) and that this preference is due to the fact that longer and more complex constituents are harder to plan and, therefore, harder to produce (Arnold et al., 2000; Wasow, 2002). Studies which have found that constituent weight has an influence on word ordering are plentiful, also cross-linguistically (Siewierska, 1993; Wasow, 1997*a*; Stallings et al., 1998; Konieczny, 2000; Matthews & Yeung, 2001; Yamashita & Chang, 2001; Arnold et al., 2004; Hawkins, 2004; Lohse et al., 2004; Cheung, 2006; Stallings & MacDonald, 2011).

With regard to RC extraposition in production, a number of corpus studies (Uszkoreit et al., 1998*a*; Francis, 2010; Francis & Michaelis, 2014; Bader, 2014; Strunk, 2014) and an elicited production experiment (Bader, 2014) have found evidence for the assumption that RCs that are much longer than the intervening material are preferred in extraposed position. Francis & Michaelis (2014) suggest that the RC be at least five times longer than the VP.

This thesis thus investigated whether the preference for long constituents at the end of an utterance can also be found for extraposed PPs in elicited production.

How does the length of the extraposed PP influence extraposition rates? Are longer PPs reproduced in extraposed position?

In Experiment 1, three different lengths of PPs were tested: short (2-3 words), medium (5-6 words), and long (9-11 words). The influence of the length of the PP did not show itself by a change of syntactic position, but by the amount of dropped material. In sentences in which the PP was in extraposed position, participants dropped less material. More specifically, when the PP was 9-11 words long participants dropped significantly more material when the PP was in adjacent position than when it was in extraposed position.

As the length of the PP increased, the amount of dropped material increased as well. Participants dropped significantly more material when the PP was of medium length than when it was short. When the PP was long, significantly more material was dropped than in conditions in which the PP was of medium length. The fact that participants dropped increasingly more material as the sentences increased in length is also due to working memory. Furthermore, the method of *Production from Memory* also revealed recency effects with regard to constituent length. Long PPs were shortened less often when they were recent (extraposed) than when they were non-recent (adjacent).

Thus, the main result is that especially in the case of long PPs (9-11 words) significantly more material was reproduced when the PP was in extraposed position.

Does the number of phrasal nodes define the weight of a constituent? Does the number of phrasal nodes within an extraposed constituent influence its acceptability?

In Experiments 1-3 and 5 the "weight" of a constituent was measured in number of words. In Experiment 4, it was measured in number of syllables. But there are other definitions of weight proposed in the literature. An alternative to "length" measurements (such as words or syllables) is the syntactic complexity of a constituent. Rickford et al. (1995), for example, measure the weight of a constituent by the number of phrasal nodes contained within it. Thus in Experiment 7, the weight of the PPs was measured in number of phrasal nodes (the PPs were matched in length, measured in number of words).

In a corpus survey for this thesis, it was found that about 50% of extraposed PPs include an RC. If indeed the number of phrasal nodes defines the weight of a constituent, an extraposed PP which includes an RC should be heavier than a "simple" extraposed PP. As mentioned above, "heavier" constituents are preferred at the end of utterances. From this follows that a PP which includes an RC should be more acceptable in extraposed position than its lighter "PP only" version.

The results of the acceptability judgement experiment showed that the number of phrasal nodes had no influence on the acceptability of extraposition. While sentences with adjacent PPs were rated significantly higher than sentences with extraposed PPs, the type of PP made no difference.

Assuming that "heavier" constituents are indeed more acceptable at the end of utterances, the findings suggest that number of phrasal nodes is not a reliable indicator for constituent weight. The PPs were matched in length, measured in number of words. The fact that there was no difference in length between "PP only" and "PP+RC" conditions is in line with the finding that there was no difference in ratings between the two conditions, either.

6.2 Concerning the Length and Make-up of the Intervening Material

The distance between the head noun and the PP is another crucial factor with regard to extraposition rates. Hawkins's (1994:203) *Early Immediate Constituents* proposal predicts that "extraposition from NP...should be highly productive in the event that V alone intervenes, much less so when there is an additional intervening constituent." In Gibson's (2000) *Dependency Locality Theory*, each new discourse referent that intervenes between head and dependent will increase the integration cost, and thus increase processing complexity.

A number of corpus studies on RC extraposition (Marillier, 1993; Uszkoreit et al., 1998*b*; Korthals, 2001; Francis, 2010; Bader, 2014; Strunk, 2014) have found that extraposition is preferred over 1-2 words and over purely verbal material. As the amount of intervening material increases, extraposition rates decrease rapidly.

Experiment 2 thus tested whether the length of the intervening material, measured in words, has an influence on extraposition rates in elicited production. The intervening material differed between a verb (1 word), an adverb and verb (2 words), and a PP adverbial and verb (4 words).

Experiment 3 investigated the influence on purely verbal material on extraposition rates in elicited reproduction. The length of the verbal material differed between a verb particle, a verb, and an auxiliary and verb.

How does the length of the intervening material influence extraposition rates in elicited production?

Similar to the findings in Experiment 1, participants dropped intervening material rather than change the syntactic position of the PP. As the amount of intervening material increased, the amount of dropped material increased as well. Significantly more material was dropped in sentences with extraposed PPs. When the intervening material consisted of an adverb and verb, material was dropped in 10% of sentences with adjacent PPs and in 31% of sentences with an extraposed PP. When the intervening material consisted of a PP adverbial and verb, material was dropped in 25% of sentences with an adjacent PP and in 50% of sentences with an extraposed PP. In the majority of cases, the result of dropping material was that only a verb intervened between head noun and PP.

Thus, the length and type of the intervening material was important with respect to how much intervening material is acceptable. ⅓ of adverbs and ½ of PP adverbials including a lexical NP were shortened to "verb only".

Again similar to Experiment 1, the fact that participants dropped intervening material (non-recent) rather than change the syntactic position of the extraposed PP (recent) indicates that there were recency effects with regard to the intervening material in Experiment 2.

Is the extraposition behaviour in elicited production different when the intervening material consists of purely verbal material? Does the length of the verb cluster influence extraposition rates?

When the intervening material consisted of purely verbal material, participants changed the syntactic position of the PP rather than drop material. Thus participants' behaviour in Experiment 3 was converse to that in Experiment 2. Participants changed the position of the PP from extraposed to adjacent position significantly more often than from adjacent to extraposed position.

This finding was contrary to the expectation that extraposition was favoured over verbal material. While in Experiment 2 there was no statistically significant change of position when the intervening material consisted of a verb, adverb and verb, or PP adverbial and verb, in Experiment 3, participants did change the syntactic position of the PP over verbal material. Even then, the expectation would have been that a change take place from adjacent to extraposed position, but not vice versa.

The tendency to change position was especially strong over verb particles, although the differences between intervener lengths did not reach statistical significance. Still, the expectation was that especially over the shortest verbal material, verb particles, extraposition would be preferred. It has to be noted, however, that the majority of PPs were still reproduced in their target position.

Significantly more intervening material was dropped when the intervener consisted of two words (an auxiliary and verb). However, the position of the PP did not play a role here. Material was dropped both in sentences with adjacent PPs and in sentences with extraposed PPs.

Compared to a two-word intervener that consisted of an adverb and verb, much less material was dropped when a two-word verb cluster intervened. When the intervener consisted of an adverb and verb, material was dropped in 31% of sentences with an extraposed PP. When the intervening material consisted of an auxiliary and verb, material was dropped in 8% of sentences with an extraposed PP.

6.3 Concerning the Acceptability of Extraposition

Are sentences with adjacent PPs more acceptable than sentences with extraposed PPs?

Sentences with adjacent PPs were consistently rated higher than sentences with extraposed PPs in all three acceptability judgement experiments. This finding is in line with findings by Uszkoreit et al. (1998*a*) and Konieczny (2000) who also found that sentences with adjacent RCs were always rated higher than sentences with extraposed RCs.

Even in conditions for which the EIC predicted a preference for the extraposed version or for which the DLT predicted lower processing costs for the extraposed version,

participants rated sentences with adjacent PPs higher than sentences with extraposed PPs. This is true for the findings of the present thesis as well as for the findings by Konieczny (2000).

However, sentences with extraposed PPs were still rated rather good in all three experiments when compared to sentences that served as filler items. Center-embedded clauses that were extraposed received lower ratings than extraposed PPs, and extraposed RCs (from an experiment on hybrid nouns and relative pronouns) were rated lower than extraposed PPs as well.

How does the length of the intervening material influence the acceptability of extraposition?

Experiment 5 tested the same material as Experiment 2. This time the acceptability of the sentences was investigated using the method of magnitude estimation.

The results showed that, in general, sentences with adjacent PPs were rated significantly higher than sentences with extraposed PPs.

With regard to the length of the intervening material, sentences with an adverb and verb intervening were rated significantly lower than sentences with only a verb intervening. Likewise, sentences with a PP adverbial and verb intervening were rated significantly lower than sentences with only a verb intervening.

Interestingly, sentences with an adverb and verb (2 words) intervening were also rated significantly lower than sentences with a PP adverbial and verb (4 words) intervening. This was the case for sentences with both adjacent and extraposed PPs. Thus, the expectation that the acceptability of extraposition would decrease as the amount of intervening material increases was not fully confirmed. It can only be speculated that inherent properties of the adverbs influenced the quality of the test sentences and their ratings.

6.4 Further Aspects

What are the differences and similarities between PP and RC extraposition in elicited production?

While extraposition of PPs out of NP in German language production had not previously been investigated, there are a number of corpus studies (Marillier, 1993; Uszkoreit et al., 1998*a*; Korthals, 2001; Bader, 2014; Strunk, 2014) as well as an elicited production experiment (Bader, 2014) on RC extraposition in German.

All of the corpus studies found that extraposition was most likely if the intervening material consisted of only one or two words, and if those were purely verbal. Furthermore, the length of the extraposed RC should be at least four times longer than that of the intervening VP. Similarly, in the elicited production experiment, Bader (2014) found that extraposition was common over verbal material, but that extraposition rates declined

rapidly once a new discourse referent, e.g. a noun, was introduced into the intervening material.

In order to facilitate extraposition, the intervening material in Experiment 4 consisted of a verb particle. There was a statistically significant interaction between constituent type (PP vs. RC) and position. While the majority of sentences were reproduced with the PPs and RCs in target position, there was a tendency for extraposed PPs to be reproduced in adjacent position, and for adjacent RCs to be reproduced in extraposed position.

Thus, the findings support the expectations raised by corpus studies on RC extraposition. Over short verbal material, there is a tendency to extrapose RCs. Conversely, extraposed PPs show a tendency to be reproduced in adjacent position. This is in line with the findings of Experiment 3, in which extraposed PPs were significantly often changed from extraposed to adjacent position over verbal material.

Does a soft constraint exist for definiteness of the NP out of which is extraposed, similar to the one found for RC extraposition in English and German?

In RC extraposition in English and German it has been found that extraposition out of definite NPs was not as acceptable as extraposition out of indefinite NPs. In an acceptability judgement experiment, Walker (2013) found that RCs extraposed out of indefinite NPs received higher ratings than RCs extraposed out of definite NPs.

In a corpus study on RC extraposition in German, Strunk (2014) found that the definiteness of the NP was a statistically significant factor, and that extraposition was less likely when the NP out of which was extraposed was definite than when the NP was indefinite.

The results of Experiment 6 showed that sentences with indefinite NPs were rated significantly higher than sentences with definite NPs when the PP was in extraposed position. For sentences with adjacent PPs, ratings were the same for both indefinite and definite NPs. These findings suggest that there is also a soft constraint for definiteness with regard to PP extraposition out of NP in German.

6.5 Effects of Working Memory on Sentence Recall

Are extraposed (non-canonical) PPs changed to adjacent (canonical) position in elicited reproduction?

The method of *Production from Memory* was chosen to be able to give participants a "free choice" with respect to producing adjacent or extraposed PPs. Studies concerned with sentence memory (Lombardi & Potter, 1992; Potter & Lombardi, 1998) have found that only the meaning of a sentence is well remembered and that the surface structure of a sentence decays rather rapidly.

The method has been used to investigate, amongst others, active/passive constructions (Bock & Irwin, 1980; Bock & Warren, 1985; Bock, 1986;McDonald et al., 1993; Tanaka

et al., 2011). The results of these studies showed that active sentences were almost always reproduced as active sentences, but that passive sentences were often reproduced as active sentences. It is assumed that non-canonical (e.g. passive) structures are reproduced as canonical (e.g. active) structures in *Production from Memory*.

With regard to the subject of this thesis, it is assumed that PPs adjacent to their head NP are in canonical position, while extraposed PPs are in non-canonical position (Baltin, 2006). Following from the findings of the studies mentioned above, the expectation thus was that adjacent PPs would be reproduced in target position, while the position of extraposed PPs would be changed to adjacent position in reproduction.

The results of the four production experiments showed that sentences were mostly (90%-97%) reproduced with the PPs in target position. Only in Experiment 3, PPs were significantly often changed from extraposed to adjacent position. However, the expectation was that a large percentage of extraposed PPs would be changed to adjacent position, but even in Experiment 3, only 10% of extraposed PPs were changed to adjacent position.

Thus, the expectation that extraposed (non-canonical) PPs would regularly be reproduced in adjacent (canonical) position, was not confirmed.

It has to be noted that the word order was changed from non-canonical to canonical in filler items used in the production experiments. The experiments supplying the filler items dealt with word order within verb clusters in German (see Section 4.6). Thus the method succeeded in giving participants a free choice in word ordering, and participants did make use of it.

How are sentences recalled from working memory?

The expectation was that sentence structures would be changed in recall, more specifically that extraposed PPs would be changed to adjacent position, and possibly vice versa. The results showed that in Experiments 1-4, 90% of sentences were recalled verbatim. This percentage was much higher than expected, following previous studies using the same method (e.g. Bock & Brewer, 1974; McDonald et al., 1993; Tanaka et al., 2011).

Strong primacy and less pronounced recency effects were found which were in line with the serial-position effect found in Glanzer & Cunitz (1966). They also found strong primacy effects in serial recall, but recency effects diminished as the delay increased from 0 to 30 seconds.

When looking at sentences with a changed structure, it was found that primacy and recency effects also influenced the sequence in which sentences were recalled. Participants sometimes recalled the end of sentences before the middle part.

If verbatim recall failed, participants focussed on recalling 'important parts'. Thus constituents that were not needed to produce a grammatical and complete sentences were left out first (e.g. PPs, adjectives and adverbs). When looking at incompletely recalled

sentences, participants recalled verbs and nouns most faithfully, even if the rest of the sentence could no longer be recalled. In cases were more material could be recalled, nouns and verbs were often recalled first, and other parts, such as PPs, were added at the end.

Recalled sentences that were ungrammatical illustrated effects of working memory on sentence recall best. For example, particle verbs that were separated in the original sentence were united in recall, or instead of following a preposition with the rest of the PP, a direct object NP was recalled in order to satisfy the verb's need of an argument.

The data also suggest that articles and auxiliaries are not memorized verbatim, as they can be derived from nouns and verbs in the recall of sentences.

6.6 Open Questions for Future Work

The first issue is one of method rather than construction. It is difficult to find an experimental method that will allow the investigation of extraposition in language production without the participants noticing one's intent, but which will give them a free choice of their word ordering. This is presumably one of the reasons why extraposition of PPs in language production has never been investigated in an experimental setting before. Almost all studies have relied on corpus surveys to investigate the production side of the phenomenon.

The method used in this study, *Production from Memory*, worked well, but it leaves open questions as to how much of the reproduction choices were influenced by recency effects and individual working memory limitations in general.

Another possible method used in previous studies on HNPS (Stallings et al., 1998; Stallings & MacDonald, 2011) is a constrained production paradigm, in which participants are presented with phrases on a computer screen (at the top, middle and bottom of the screen, in a randomized order). They have to construct a grammatical sentence from these phrases and produce the sentence after a delay. The two main differences to *Production from Memory* are the modality of the presentation of the test sentences and that no definite word order of the sentence is given beforehand. However, the task still relies heavily on working memory and can be seen as a variant of sentence recall.

It has to be seen if a method can be found that allows testing extraposition by way of an experimental design that does not put a strain on working memory as it does with recall tasks.

Once more ways of investigating PP extraposition in language production are found, a better insight into how prosody influences extraposition of PPs out of NP would also be possible. It seems quite certain that prosody plays an important role in extraposition of PPs, however investigating that role in language production has hardly gone beyond having participants read test sentences out loud. It would be desirable to test the influence of prosody on extraposition in subtler ways.

For the sake of completeness, the *comprehension* of PP extraposition out of NP in German should also be investigated to allow a better comparison with results of production experiments as well as with the large number of comprehension studies on RC extraposition in German and other languages. It might turn out that PP extraposition behaves differently to RC extraposition in comprehension. After all, some tendencies for differences between the two in elicited production were already found in this thesis.

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Appendix A

Supplementary Notes

A.1   Differences between Prepositions

In a preliminary corpus study using the deWaC Corpus (Baroni et al., 2009), the "Top 5" prepositions appearing in extraposed PPs were *für* 'for', *mit* 'with', *über* 'about', *zwischen* 'between' and *auf* 'to'.

It would have been possible that certain prepositions facilitate extraposition and that others might hinder extraposition in some way. However, no peculiarities of specific prepositions were found. While *von* received the lowest ratings in Experiments 5 and 6, it received the second highest ratings in Experiment 7, even higher than *mit*, which received the highest ratings in Experiment 5. Sentences with the preposition *mit* had the least errors in elicited production, and there were no differences between sentences with *von* and *für* in the production experiments. In the acceptability ratings, *für* received high ratings as well.

In Experiments 3 and 4, a larger variety of prepositions appeared in the test sentences (10 in Experiment 3, and 8 in Experiment 4). None of the prepositions showed any distinctive features with regard to extraposition behaviour.

In summary, across all experiments in this thesis, no noticeable peculiarities of any specific preposition were observed.

A.1.1   Acceptability Ratings: Experiments 5-7

Experiment 5: Magnitude Estimation

In Experiment 5, acceptability ratings were given using the method of magnitude estimation. The three prepositions used were *mit*, *für* and *von*. Each of the prepositions was used in ⅓ of the sentences. Overall, each preposition was used in 972 sentences (81 participants rated 36 sentences each).

Table A.1 shows the mean z-transformed log ratios for each preposition. *Mit* received the highest ratings, *für* received lower ratings, but still above zero. The preposition *von* received the lowest ratings.

Table A.2 shows the mean z-transformed log ratios for Preposition and Position. *Von*

received lower ratings than the other two prepositions for adjacent sentences as well, but the bigger difference is found for extraposed sentences.

Table A.3 shows the mean z-transformed log ratios for Preposition, Position and Intervener.

Table A.1: Mean z-transformed log ratios for Preposition in Experiments 5.

Preposition	log_z
mit	0.059
für	0.007
von	-0.148

Table A.2: Mean z-transformed log ratios for Preposition and Position in Experiments 5.

Preposition	Position	log_z
mit	adjacent	0.396
mit	extraposed	-0.277
für	adjacent	0.377
für	extraposed	-0.362
von	adjacent	0.277
von	extraposed	-0.573

Table A.3: Mean z-transformed log ratios for Preposition, Position and Intervener in Experiments 5.

Preposition	Position	Intervener	log_z
mit	adjacent	verb	0.440
mit	extraposed	verb	-0.097
mit	adjacent	adverb+verb	0.362
mit	extraposed	adverb+verb	-0.422
mit	adjacent	PP adverbial+verb	0.385
mit	extraposed	PP adverbial+verb	-0.313
für	adjacent	verb	0.529
für	extraposed	verb	-0.181
für	adjacent	adverb+verb	0.259
für	extraposed	adverb+verb	-0.517
für	adjacent	PP adverbial+verb	0.343
für	extraposed	PP adverbial+verb	-0.388
von	adjacent	verb	0.288
von	extraposed	verb	-0.359
von	adjacent	adverb+verb	0.264
von	extraposed	adverb+verb	-0.753
von	adjacent	PP adverbial+verb	0.280
von	extraposed	PP adverbial+verb	-0.607

Experiment 6: Likert Scale

In Experiment 6, ratings were given on a Likert scale from 1 ('totally unacceptable') to 7 ("totally acceptable"). The three prepositions used were *mit*, *für* and *von*. *Mit* was used in ½ of the sentences (480 sentences), *von* was used in ⅓ of the sentences (320), *für* was used in ⅙ of the sentences (160) (40 participants rated 24 sentences each).

Table A.4 shows the mean ratings for each of the prepositions. *Für* received the highest ratings, *mit* the seconds highest, and *von* the lowest. All three prepositions received mean ratings over 5.0.

Table A.5 shows the mean ratings for Preposition, Position and Definiteness. *Für* received the highest ratings in all conditions. Especially with a definite antecedent, *für* is still rated rather high, also for sentences with extraposed PPs. *Mit* received high ratings for sentences with adjacent PPs, but extraposed PPs with a definite antecedent are rated lowest when the preposition is *mit*. Sentences with *von* are rated lower than sentences with other preposition, except for the condition with a definite NP and extraposed PP.

Table A.4: Mean ratings for Preposition in Experiments 6.

Preposition	Mean Rating
mit	5.215
für	5.888
von	5.013

Table A.5: Mean ratings for Preposition, Position and Definiteness in Experiments 6.

Preposition	Position	Definiteness	Mean Rating
mit	adjacent	indefinite	6.54
mit	extraposed	indefinite	4.391
mit	adjacent	definite	6.458
mit	extraposed	definite	3.467
für	adjacent	indefinite	6.875
für	extraposed	indefinite	4.850
für	adjacent	definite	6.925
für	extraposed	definite	4.900
von	adjacent	indefinite	6.313
von	extraposed	indefinite	3.950
von	adjacent	definite	6.200
von	extraposed	definite	3.588

Experiment 7: Likert Scale

Experiment 7 used the same method as Experiment 6. Ratings were given on a Likert scale from 1 ('totally unacceptable") to 7 ("totally acceptable"). There were four prepositions used: *mit*, *für*, *von* and *zwischen*. Overall, 576 sentences were rated (24

participants rated 24 sentences each). *Mit* was used in 336 sentences, *für* was used in 144 sentences, *von* was used in 72 sentences, and *zwischen* was used in 24 sentences.

Table A.6 shows the mean ratings for each of the prepositions. *Für* received the highest ratings. Contrary to Experiment 6, *von* received the second highest ratings, followed by *mit*. *Zwischen* received the lowest ratings. All four prepositions received mean ratings of 5.0 or higher.

Table A.7 shows the mean ratings for Preposition, Position and Clause Type.

Table A.6: Mean ratings for Preposition in Experiments 7.

Preposition	Mean Rating
mit	5.444
für	5.748
von	5.569
zwischen	5.00

Table A.7: Mean ratings for Preposition, Position and Clause Type in Experiments 7.

Preposition	Position	Clause Type	Mean Rating
mit	adjacent	PP	5.988
mit	extraposed	PP	5.310
mit	adjacent	PP+RC	5.512
mit	extraposed	PP+RC	4.964
für	adjacent	PP	6.139
für	extraposed	PP	5.333
für	adjacent	PP+RC	6.111
für	extraposed	PP+RC	5.400
von	adjacent	PP	5.722
von	extraposed	PP	5.389
von	adjacent	PP+RC	5.611
von	extraposed	PP+RC	5.556
zwischen	adjacent	PP	6.333
zwischen	extraposed	PP	3.667
zwischen	adjacent	PP+RC	5.667
zwischen	extraposed	PP+RC	4.333

A.1.2 Production: Experiments 1-4

Differences between prepositions are easier to spot when sentences are rated numerically. Therefore, only some general observations can be given with regard to differences between prepositions in the elicited production experiments.

Experiments 1 and 2

In Experiments 1 and 2, the three prepositions used were *mit*, *für* and *von*. Each of the prepositions was used in ⅓ of the sentences. Overall, each preposition was used in 288 sentences (24 participants rated 36 sentences each).

The only difference observed was that the least errors were made in sentences with the preposition *mit* 'with'. Some more errors were made in sentences with the prepositions *für* 'for' and *von* 'of'. Those differences did not reach any statistical significance.

Experiments 3 and 4

Since no real differences between the prepositions were found in Experiments 1 and 2, a wider range of prepositions were used in Experiments 3 and 4.

The following prepositions were used in Experiment 3 (the numbers given in brackets represent the number of sentences the preposition appeared in):

an '(participate) in' (31), *auf* '(allude) to' (31), *aus* 'from' (62), *bei* 'at' (31), *für* 'for' (310), *in* 'in' (62), *mit* 'with' (217), *über* 'about' (124), *von* 'of' (124), *zwischen* 'between' (124)

The following prepositions were used in Experiment 4 (the numbers given in brackets represent the number of sentences the preposition appeared in):

auf '(allude) to' (24), *aus* 'from' (48), *bei* 'at' (24), *für* 'for' (120), *mit* 'with' (120), *über* 'about' (72), *von* 'of' (96), *zwischen* 'between' (72)

Across these larger numbers of different prepositions no peculiarities were observed.

Appendix B

Experimental Stimuli

B.1 Stimuli Experiment 1

In the following, all thirty-six test sentences used in Experiment 1 are given. Each condition comes in a version with an adjacent PP (conditions a, c, and e) and one with an extraposed PP (conditions b, d and f). Furthermore, the conditions differ with regard to the length of the PP: short PPs with 2-3 words (a and b), medium length PPs with 5-6 words (c and d), and long PPs with 9-11 words (e and f).

(1) a. Ich habe eine Liste mit Informationen angelegt.
         I   have a   list   with information   created

     b. Ich habe eine Liste angelegt mit   Informationen.
         I   have a   list   created   with information
         'I created a list with information.'

     c. Ich habe eine Liste mit Informationen über jedes einzelne   Vereinsmitglied
         I   have a   list   with information   about each individual club-member
         angelegt.
         created

     d. Ich habe eine Liste mit Informationen angelegt über   jedes einzelne
         I   have a   list   with information   created about each individual
         Vereinsmitglied.
         club-member
         'I created a list with information about each individual club member.'

     e. Ich habe eine Liste mit Informationen über jedes einzelne   Vereinsmitglied der
         I   have a   list   with information   about each individual club-member   of-the
         Turngemeinschaft in Frankfurt angelegt.
         sports-club   in frankfurt created

     f. Ich habe eine Liste mit Informationen angelegt über   jedes einzelne
         I   have a   list   with information   created about each individual
         Vereinsmitglied der   Turngemeinschaft in Frankfurt.
         club-member   of-the sports-club   in frankfurt
         'I created a list with information about each individual club member
         in Frankfurt.'

(2) a. Wir haben ein Baugrundstück mit   einem Schuppen erworben.
         We have a   building-site   with a   shed   purchased

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b. Wir haben ein Baugrundstück erworben mit einem Schuppen.
We have a   building-site   purchased with a   shed
'We have purchased a building site with a shed.'

c. Wir haben ein Baugrundstück mit einem Holzschuppen und einer Gartenhütte
We have a   building-site   with a   woodshed   and a   garden-hut
erworben.
purchased

d. Wir haben ein Baugrundstück erworben mit einem Holzschuppen und einer
We have a   building-site   purchased with a   woodshed   and a
Gartenhütte.
garden-hut
'We have purchased a building site with a woodshed and a garden hut.'

e. Wir haben ein Baugrundstück mit einem Holzschuppen, einer Gartenhütte und einer
We have a   building-site   with a   woodshed,   a   garden-hut and a
kleinen Pferdekoppel erworben.
small   paddock   purchased

f. Wir haben ein Baugrundstück erworben mit einem Holzschuppen, einer
We have a   building-site   purchased with a   woodshed,   a
Gartenhütte und einer kleinen Pferdekoppel.
garden-hut and a   small   paddock
'We have purchased a building site with a woodshed, a garden hut and a small
paddock.'

(3) a. Ich habe meinem Bruder ein Buch mit Gedichten geschenkt.
I   have my   brother a   book with poems   given

b. Ich habe meinem Bruder ein Buch geschenkt mit Gedichten.
I   have my   brother a   book given   with poems
'I have given my brother a book of poems.'

c. Ich habe meinem Bruder ein Buch mit Gedichten und Kurzgeschichten aus
I   have my   brother a   book with poems   und short-stories   from
Norwegen geschenkt.
Norway   given

d. Ich habe meinem Bruder ein Buch geschenkt mit Gedichten und Kurzgeschichten
I   have my   brother a   book given   with poems   und short-stories
aus Norwegen.
from Norway
'I have given my brother a book of poems and short stories from Norway.'

e. Ich habe meinem Bruder ein Buch mit Gedichten und Kurzgeschichten aus
I   have my   brother a   book with poems   and short-stories   from
Norwegen in altnordischer Sprache   geschenkt.
Norway   in old-norse   language given

f. Ich habe meinem Bruder ein Buch geschenkt mit Gedichten und Kurzgeschichten
I   have my   brother a   book given   with poems   and short-stories
aus Norwegen in altnordischer Sprache.
from Norway   in old-norse   language
'I have given my brother a book of poems and short stories in Old Norse from Norway.'

(4) a. Wir haben ein Paket   mit Essen zusammengestellt.
We have a   package with food put-together

b. Wir haben ein Paket   zusammengestellt mit Essen.
   We have a   package put-together   with food
   'We have put together a package of food.'

c. Wir haben ein Paket   mit Essen und warmer Kleidung zusammengestellt.
   We have a   package with food and warm   clothing put-together

d. Wir haben ein Paket   zusammengestellt mit Essen und warmer Kleidung.
   We have a   package put-together   with food and warm   clothing
   'We have put together a package of food and warm clothing.'

e. Wir haben ein Paket   mit Essen, warmer Kleidung und Spielsachen für die Kinder
   We have a   package with food, warm   clothing and toys   for the kids
   zusammengestellt.
   put-together

f. Wir haben ein Paket   zusammengestellt mit Essen, warmer Kleidung und
   We have a   package put-together   with food, warm   clothing and
   Spielsachen für die Kinder.
   toys   for the kids
   'We have put together a package of food, warm clothing and toys for the kids.'

(5) a. Gestern   habe ich ein Plakat mit einer Friedenstaube gesehen.
        Yesterday have I   a   poster with a   peace-dove   seen

     b. Gestern   habe ich ein Plakat gesehen mit einer Friedenstaube.
        Yesterday have I   a   poster seen   with a   peace-dove
        'Yesterday, I saw a poster with a peace dove.'

     c. Gestern   habe ich ein Plakat mit einer Friedenstaube über dem Erdball gesehen.
        Yesterday have I   a   poster with a   peace-dove   above the globe seen

     d. Gestern   habe ich ein Plakat gesehen mit einer Friedenstaube über dem Erdball.
        Yesterday have I   a   poster seen   with a   peace-dove   above the globe
        'Yesterday, I saw a poster with a peace dove over the Earth.'

     e. Gestern   habe ich ein Plakat mit einer Friedenstaube über dem Erdball und
        Yesterday have I   a   poster with a   peace-dove   above the globe and
        einem Spendenaufruf für Flüchtlinge gesehen.
        a   aid-appeal   for refugees   seen

     f. Gestern   habe ich ein Plakat gesehen mit einer Friedenstaube über dem Erdball
        Yesterday have I   a   poster seen   with a   peace-dove   above the globe
        und einem Spendenaufruf für Flüchtlinge.
        and a   aid-appeal   for refugees
        'Yesterday, I saw a poster with a peace dove above the Earth and a call for donations
        for refugees.'

(6) a. Ein Bekannter   hat ein Haus mit Garten gekauft.
        A   acquaintance has a   house with garden bought

     b. Ein Bekannter   hat ein Haus gekauft mit Garten.
        A   acquaintance has a   house bought with garden
        'An acquaintance has bought a house with garden.'

     c. Ein Bekannter   hat ein Haus mit Dachterrasse und einem großen Garten gekauft.
        A   acquaintance has a   house with roof-terrace and a   big   garden bought

    d. Ein Bekannter   hat ein Haus gekauft mit Dachterrasse und einem großen Garten.
      A   acquaintance has a   house bought with roof-terrace and a   big   garden
      'An acquaintance has bought a house with a roof terrace and a big garden.'

    e. Ein Bekannter   hat ein Haus mit einer Dachterrasse, einem großen Garten und
      A   acquaintance has a   house with a   roof-terrace, a   big   garden and
      einem eigenen Bootsanleger gekauft.
      a   own   boat-dock   bought

    f. Ein Bekannter   hat ein Haus gekauft mit einer Dachterrasse, einem großen
      A   acquaintance has a   house bought with a   roof-terrace, a   big
      Garten und einem eigenen Bootsanleger.
      garden and a   own   boat-dock
      'An acquaintance has bought a house with a roof terrace, a big garden and its own boat dock.'

(7)   a. In der Kirche sind Tafeln mit Geburtsdaten angebracht.
      In the church are   plaques with dates-of-birth installed

    b. In der Kirche sind Tafeln angebracht mit Geburtsdaten.
      In the church are   plaques installed   with dates-of-birth
      'In the church, plaques with dates of birth are installed.'

    c. In der Kirche sind Tafeln mit Geburtsdaten und einem Text angebracht.
      In the church are   plaques with dates-of-birth and a   text installed

    d. In der Kirche sind Tafeln angebracht mit Geburtsdaten und einem Text.
      In the church are   plaques installed   with dates-of-birth and a   text
      'In the church, plaques with dates of birth and a text are installed.'

    e. In der Kirche sind Tafeln mit den Geburtsdaten und einem Text über das
      In the church are   plaques with the dates-of-birth and a   text about the
      Lebenswerk jedes   Bischofs angebracht.
      lifework   of-each bishop   installed

    f. In der Kirche sind Tafeln angebracht mit den Geburtsdaten und einem Text über
      In the church are   plaques installed   with the dates-of-birth and a   text about
      das Lebenswerk jedes   Bischofs.
      the lifework   of-each bishop
      'In the church, plaques with the date of birth and a text about the life's work of each bishop are installed.'

(8)   a. Auf dem Foto   ist ein Mädchen mit Zöpfen abgebildet.
      On the picture is a   girl   with braids shown

    b. Auf dem Foto   ist ein Mädchen abgebildet mit Zöpfen.
      On the picture is a   girl   shown   with braids
      'The picture shows a girl with braids.'

    c. Auf dem Foto   ist ein Mädchen mit Sommersprossen und langen blonden Zöpfen
      On the picture is a   girl   with freckles   and long   blond   braids
      abgebildet.
      shown

    d. Auf dem Foto   ist ein Mädchen abgebildet mit Sommersprossen und langen
      On the picture is a   girl   shown   with freckles   and long
      blonden Zöpfen.
      blond   braids

'The picture shows a girl with freckles and long blond braids.'

e. Auf dem Foto   ist ein Mädchen mit Sommersprossen, langen blonden Zöpfen und
On the picture is a   girl   with freckles,   long blond   braids and
einem kleinen Hund im   Arm abgebildet.
a   small   dog   in-the arm shown

f. Auf dem Foto   ist ein Mädchen abgebildet mit Sommersprossen, langen blonden
On the picture is a   girl   shown   with freckles,   long blond
Zöpfen und einem kleinen Hund im   Arm.
braids and a   small   dog   in-the arm

'The picture shows a girl with freckles, long blond braids and a small dog in her arms.'

(9)   a. Gestern   ist eine Familie mit Kindern angekommen.
Yesterday is a   family with children arrived

b. Gestern   ist eine Familie angekommen mit Kindern.
Yesterday is a   family arrived   with children

'Yesterday, a family with children arrived.'

c. Gestern   ist eine Familie mit zwei Kindern und einem Hund angekommen.
Yesterday is a   family with two children and a   dog   arrived

d. Gestern   ist eine Familie mit   zwei Kindern und   einem Hund angekommen.
Yesterday is a   family arrived with two   children and   a   dog

'Yesterday, a family with two children and a dog arrived.'

e. Gestern   ist eine Familie mit zwei kleinen Kindern, einer gebrechlichen
Yesterday is a   family with two small   children, a   frail
Großmutter   und einem Hund angekommen.
grandmother and a   dog   arrived

f. Gestern   ist eine Familie angekommen mit zwei kleinen Kindern, einer
Yesterday is a   family arrived   with two small   children, a
gebrechlichen Großmutter   und einem Hund.
frail   grandmother and a   dog

'Yesterday, a family with two small children, a frail grandmother and a dog arrived.'

(10)   a. Auf dem Tisch hat ein Korb   mit Wein gestanden.
On the table has a   basket with wine stood

b. Auf dem Tisch hat ein Korb   gestanden mit Wein.
On the table has a   basket stood   with wine

'On the table stood a basket with wine.'

c. Auf dem Tisch hat ein Korb   mit Rotwein und französischem Käse   gestanden.
On the table has a   basket with red-wine and french   cheese stood

d. Auf dem Tisch hat ein Korb   gestanden mit Rotwein und französischem Käse.
On the table has a   basket stood   with red-wine and french   cheese

'On the table stood a basket with red wine and french cheese.'

e. Auf dem Tisch hat ein Korb   mit einer Flasche Rotwein, französischem Käse
On the table has a   basket with a   bottle red-wine, french   cheese
und frischem Baguette gestanden.
and fresh   baguette stood

f. Auf dem Tisch hat ein Korb   gestanden mit   einer Flasche Rotwein, französischem
On the table has a   basket stood   with a   bottle   red-wine, french
Käse   und frischem Baguette.
cheese and fresh   baguette

'On the table stood a basket with a bottle of red wine, french cheese and fresh

baguette.'

(11) a. In Hamburg hat ein Freizeitpark   mit zehn Achterbahnen eröffnet.
In Hamburg has a   amusement-park with ten   roller-coasters opened

b. In Hamburg hat ein Freizeitpark   eröffnet mit   zehn Achterbahnen.
In Hamburg has a   amusement-park opened with ten   roller-coasters

'In Hamburg, an amusement park with ten roller coasters has opened.'

c. In Hamburg hat ein Freizeitpark   mit zehn Achterbahnen und einer
In Hamburg has a   amusement-park with ten   roller-coasters and a
Unterwasserwelt   eröffnet.
under-water-world opened

d. In Hamburg hat ein Freizeitpark   eröffnet mit   zehn Achterbahnen und einer
In Hamburg has a   amusement-park opened with ten   roller-coasters and a
Unterwasserwelt.
under-water-world

'In Hamburg, an amusement park with ten roller coasters and a seaworld has opened.'

e. In Hamburg hat ein Freizeitpark   mit zehn Achterbahnen und einer
In Hamburg has a   amusement-park with ten   roller-coasters and a
Unterwasserwelt   für besonders gefährdete Meerestiere   eröffnet.
under-water-world for especially endangered marine-animals opened

f. In Hamburg hat ein Freizeitpark   eröffnet mit zehn   Achterbahnen und
In Hamburg has a   amusement-park with   ten roller-coasters and   a
einer   Unterwasserwelt für   besonders gefährdete
under-water-world for   especially endangered marine-animals
Meerestiere.
opened

'In Hamburg, an amusement park with ten roller coasters and a seaworld for especially

endangered marine animals has opened.'

(12) a. Am   Bahnhof wurde ein Rucksack mit   Dokumenten gefunden.
At-the station   was   a   rucksack with documents   found

b. Am   Bahnhof wurde ein Rucksack gefunden mit   Dokumenten.
At-the station   was   a   rucksack found   with documents

'At the station, a rucksack with documents was found.'

c. Am   Bahnhof wurde ein Rucksack mit   einer Pistole und geheimen Dokumenten
At-the station   was   a   rucksack with a   pistol and secret   documents
gefunden.
found

d. Am   Bahnhof wurde ein Rucksack gefunden mit   einer Pistole und geheimen
At-the station   was   a   rucksack found   with a   pistol and secret
Dokumenten.
documents

'At the station, a rucksack with a pistol and secret documents was found.'

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e. Am   Bahnhof wurde ein Rucksack mit einer Pistole und geheimen Dokumenten
At-the station   was   a   rucksack with a   pistol and secret   documents
über die Aufenthaltsorte von Agenten gefunden.
about the locations   of agents   found

f. Am   Bahnhof wurde ein Rucksack gefunden mit einer Pistole und geheimen
At-the station   was   a   rucksack found   with a   pistol and secret
Dokumenten über die Aufenthaltsorte von Agenten.
documents   about the locations   of agents

'At the station, a rucksack with a pistol and secret documents giving the locations of agents was found.'

(13) a. Der Verein   hat Geld   für Turngeräte   gesammelt.
The sports-club has money for gym-equipment collected

b. Der Verein   hat Geld   gesammelt für Turngeräte.
The sports-club has money collected   for gym-equipment

'The sports club collected money for gym equipment.'

c. Der Verein   hat Geld   für neue Turngeräte   und ein Trampolin gesammelt.
The sports-club has money for new gym-equipment and a   trampoline collected

d. Der Verein   hat Geld   gesammelt für neue Turngeräte   und ein Trampolin.
The sports-club has money collected   for new gym-equipment and a   trampoline

'The sports club collected money for new gym equipment and a trampoline.'

e. Der Verein   hat Geld   für neue Turngeräte,   ein großes Trampolin und
The sports-club has money for new gym-equipment, a   big   trampoline and
einen eigenen Tennisplatz gesammelt.
a   own   tennis-court collected

f. Der Verein   hat Geld   gesammelt für neue Turngeräte,   ein großes
The sports-club has money collected   for new gym-equipment, a   big
Trampolin und einen eigenen Tennisplatz.
trampoline and a   own   tennis-court

'The sports club collected money for new gym equipment, a big trampoline and its own tennis court.'

(14) a. Unser Bürgermeister hat gute Arbeit für die Stadt geleistet.
Our   mayor   has good work for the city   done

b. Unser Bürgermeister hat gute Arbeit geleistet für die Stadt.
Our   mayor   has good work done   for the city

'Our mayer has done a good job for the city.'

c. Unser Bürgermeister hat gute Arbeit für den Kreis   und seine Kommunen
Our   mayor   has good work for the district and its   communities
geleistet.
done

d. Unser Bürgermeister hat gute Arbeit geleistet für den Kreis   und seine Kommunen.
Our   mayor   has good work done   for the district and its   communities

'Our mayer has done a good job for the district and its communities.'

e. Unser Bürgermeister hat gute Arbeit für den Kreis,   seine Kommunen und jede
Our   mayor   has good work for the district, its   communities and each
einzelne Gemeinde geleistet.
individual township done

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f. Unser Bürgermeister hat gute Arbeit geleistet für den Kreis, seine Kommunen
   Our mayor has good work done for the district, its communities
   und jede einzelne Gemeinde.
   and each individual township
   'Our mayer has done a good job for the district, its communities and each individual township.'

(15) a. Ein Mann hat einen Gutschein für eine Reise gewonnen.
      A man has a gift-coupon for a trip won

   b. Ein Mann hat einen Gutschein gewonnen für eine Reise.
      A man has a gift-coupon won for a trip
      'A man has won a gift coupon for a trip.'

   c. Ein Mann hat einen Gutschein für eine Rundreise durch Italien gewonnen.
      A man has a gift-coupon for a tour through Italy won

   d. Ein Mann hat einen Gutschein gewonnen für eine Rundreise durch Italien.
      A man has a gift-coupon won for a tour through Italy
      'A man has won a gift coupon for a tour through Italy.'

   e. Ein Mann hat einen Gutschein für ein Kofferset und eine zweiwöchige Rundreise
      A man has a gift-coupon for a case-set and a two-week tour
      durch Italien gewonnen.
      through Italy won

   f. Ein Mann hat einen Gutschein gewonnen für ein Kofferset und eine zweiwöchige
      A man has a gift-coupon won for a case-set and a two-week
      Rundreise durch Italien.
      tour through Italy
      'A man has won a gift coupon for a case set and a two-week tour through Italy.'

(16) a. Eine Studentin hat Freikarten für einen Film verteilt.
      A student has free-tickets for a film distributed

   b. Eine Studentin hat Freikarten verteilt für einen Film.
      A student has free-tickets distributed for a film
      'A (female) student distributed free tickets for a film.'

   c. Eine Studentin hat Freikarten für einen neuen französischen Film verteilt.
      A student has free-tickets for a new French film distributed

   d. Eine Studentin hat Freikarten verteilt für einen neuen französischen Film.
      A student has free-tickets distributed for a new French film
      'A (female) student distributed free tickets for a new French film.'

   e. Eine Studentin hat Freikarten für einen neuen französischen Film über die
      A student has free-tickets for a new French film about the
      Widerstandsbewegung im Zweiten Weltkrieg verteilt.
      resistance-movement in-the second world-war distributed

   f. Eine Studentin hat Freikarten verteilt für einen neuen französischen Film über
      A student has free-tickets distributed for a new French film about
      die Widerstandsbewegung im Zweiten Weltkrieg.
      the resistance-movement in-the second world-war
      'A (female) student distributed free tickets for a new French film about the Resistance movement in World War II.'

(17) a. Die Direktorin   hat ein neues Konzept für den Unterricht entwickelt.
          The headmistress has a   new   concept for the lessons   developed

      b. Die Direktorin   hat ein neues Konzept entwickelt für den Unterricht.
          The headmistress has a   new   concept developed for the lessons
          'The headmistress has developed a new concept for the lessons.'

      c. Die Direktorin   hat ein neues Konzept für den Unterricht in der Oberstufe
          The headmistress has a   new   concept for the lessons   in the sixth-form
          entwickelt.
          developed

      d. Die Direktorin   hat ein neues Konzept entwickelt für den Unterricht in der
          The headmistress has a   new   concept developed for the lessons   in the
          Oberstufe.
          sixth-form
          'The headmistress has developed a new concept for the lessons in sixth form.'

      e. Die Direktorin   hat ein neues Konzept für den Unterricht in der Oberstufe zur
          The headmistress has a   new   concept for the lessons   in the sixth-form to-the
          Vorbereitung aufs   Abitur   entwickelt.
          preparation   for-the graduation developed

      f. Die Direktorin   hat ein neues Konzept entwickelt für den Unterricht in der
          The headmistress has a   new   concept developed for the lessons   in the
          Oberstufe zur   Vorbereitung aufs   Abitur.
          sixth-form to-the preparation   for-the graduation
          'The headmistress has developed a new concept for the lessons in sixth form in
          preparation for graduation.'

(18) a. Eine Frau   hat Geschenke für ihre Kinder   gekauft.
          A   woman has presents   for her children bought

      b. Eine Frau   hat Geschenke gekauft für ihre Kinder.
          A   woman has presents   bought for her children
          'A woman has bought presents for her children.'

      c. Eine Frau   hat Geschenke für ihren Mann   und ihre Kinder gekauft.
          A   woman has presents   for her   husband and her children bought

      d. Eine Frau   hat Geschenke gekauft für ihren Mann   und ihre Kinder.
          A   woman has presents   bought for her   husband and her children
          'A woman has bought presents for her husband and her children.'

      e. Eine Frau   hat Geschenke für ihren Mann,   ihre Kinder   und mehrere Nichten,
          A   woman has presents   for her   husband, her children and several   nieces,
          Neffen   und Patenkinder gekauft.
          nephews and godchildren bought

      f. Eine Frau   hat Geschenke gekauft für ihren Mann,   ihre Kinder   und mehrere
          A   woman has presents   fbought or her   husband, her children and several
          Nichten, Neffen   und Patenkinder.
          nieces,   nephews and godchildren
          'A woman has bought presents for her husband, her children and several of her nieces,
          nephews and godchildren.'

(19) a. In der Kindheit   werden die Grundlagen für unsere Entwicklung geschaffen.
          In the childhood are   the foundations for our   development created

b. In der Kindheit werden die Grundlagen geschaffen für unsere Entwicklung.
   In the childhood are   the foundations created   for our   development
   'During childhood, the foundations of our development are created.'

c. In der Kindheit werden die Grundlagen für unsere spätere   gesundheitliche
   In the childhood are   the foundations for our   subsequent health
   Entwicklung geschaffen.
   development created

d. In der Kindheit werden die Grundlagen geschaffen für unsere spätere
   In the childhood are   the foundations created   for our   subsequent
   gesundheitliche Entwicklung.
   health   development
   'During childhood, the foundations of our subsequent health development are created.'

e. In der Kindheit werden die Grundlagen für unsere gesundheitliche Entwicklung
   In the childhood are   the foundations for our   health   development
   sowie   unsere geistige   und soziale Kompetenz geschaffen.
   as-well-as our   intellectual and social   competences created

f. In der Kindheit werden die Grundlagen geschaffen für unsere gesundheitliche
   In the childhood are   the foundations created   for our   health
   Entwicklung sowie   unsere geistige   und soziale Kompetenz.
   development as-well-as our   intellectual and social   competences
   'During childhood, the foundations of our health development as well as our
   intellectual and social competences are created.'

(20) a. An der Uni werden Kurse für Jugendliche   angeboten.
         At the uni are   classes for young-people offered

      b. An der Uni werden Kurse angeboten für Jugendliche.
         At the uni are   classes offered   for young-people
         'At the university, they offer classes for young people.'

      c. An der Uni werden Kurse für besonders begabte Kinder   und Jugendliche
         At the uni are   classes for especially gifted   children and young-people
         angeboten.
         offered

      d. An der Uni werden Kurse angeboten für besonders begabte Kinder   und
         At the uni are   classes offered   for especially gifted   children and
         Jugendliche.
         young-people
         'At the university, they offer classes for especially gifted children and young people.'

      e. An der Uni werden Kurse für besonders begabte Kinder   und Jugendliche
         At the uni are   classes for especially gifted   children and young-people
         sowie   deren Eltern angeboten.
         as-well-as their parents offered

      f. An der Uni werden Kurse angeboten für besonders begabte Kinder   und
         At the uni are   classes offered   for especially gifted   children and
         Jugendliche   sowie   deren Eltern.
         young-people as-well-as their parents
         'At the university, they offer classes for especially gifted children and young people as
         well as their parents.'

(21)   a. Gestern   hat ein Geschäft für Bio-Produkte   eröffnet.
             Yesterday has a   shop   for organic-products opened

        b. Gestern   hat ein Geschäft eröffnet für Bio-Produkte.
             Yesterday has a   shop   opened for organic-products

            'Yesterday, a shop opened that offers organic food.'

        c. Gestern   hat ein Geschäft für Bio-Produkte   von regionalen Lieferanten
             Yesterday has a   shop   for organic-products from regional   suppliers
             eröffnet.
             opened

        d. Gestern   hat ein Geschäft eröffnet für Bio-Produkte   von regionalen
             Yesterday has a   shop   opened for organic-products from regional
             Lieferanten.
             suppliers

            'Yesterday, a shop opened that offers organic food from regional suppliers.'

        e. Gestern   hat ein Geschäft für Bio-Produkte   von regionalen Lieferanten und
             Yesterday has a   shop   for organic-products from regional   suppliers   and
             Öko-Kleidung aus   spezieller Baumwolle eröffnet.
             eco-clothing   from special   cotton   opened

        f. Gestern   hat ein Geschäft eröffnet für Bio-Produkte   von regionalen
             Yesterday has a   shop   opened for organic-products from regional
             Lieferanten und Öko-Kleidung aus   spezieller Baumwolle.
             suppliers   and eco-clothing   from special   cotton

            'Yesterday, a shop opened that offers organic food from regional suppliers as well as

            eco-clothing made of special cotton.'

(22)   a. Am   Wochenende hat ein Wettbewerb für Autoren stattgefunden.
             At-the weekend   has a   competition for authors taken-place

        b. Am   Wochenende hat ein Wettbewerb stattgefunden für Autoren.
             At-the weekend   has a   competition taken-place   for authors

            'Last weekend, a competition for writers took place.'

        c. Am   Wochenende hat ein Wettbewerb für Autoren von Kurzgeschichten und
             At-the weekend   has a   competition for authors of   short-stories   and
             Romanen stattgefunden.
             novels   taken-place

        d. Am   Wochenende hat ein Wettbewerb stattgefunden für Autoren von
             At-the weekend   has a   competition taken-place   for authors of
             Kurzgeschichten und Romanen.
             short-stories   and novels

            'Last weekend, a competition for writers of short stories and novels took place.'

        e. Am   Wochenende hat ein Wettbewerb für Autoren von Kurzgeschichten und
             At-the weekend   has a   competition for authors of   short-stories   and
             Romanen über starke Frauen im   Mittelalter   stattgefunden.
             novels   about strong women in-the Middle-Ages taken-place

        f. Am   Wochenende hat ein Wettbewerb stattgefunden für Autoren von
             At-the weekend   has a   competition taken-place   for authors of
             Kurzgeschichten und Romanen über starke Frauen im   Mittelalter.
             short-stories   and novels   about strong women in-the Middle-Ages

'Last weekend, a competition for writers of short stories and novels about strong women in the Middle Ages took place.'

(23) a. Nebenan wurde ein Zentrum für Weiterbildung   gebaut.
           Nearby was   a   centre   for further-education built

       b. Nebenan wurde ein Zentrum für   Weiterbildung gebaut.
           Nearby was   a   centre   built for   further-education
          'Nearby, a centre for further education was built.'

       c. Nebenan wurde ein Zentrum für Weiterbildung   und Wissenstransfer   in
           Nearby was   a   centre   for further-education and transfer-of-knowledge in
           Naturwissenschaften gebaut.
           natural-sciences   built

       d. Nebenan wurde ein Zentrum gebaut für Weiterbildung   und Wissenstransfer
           Nearby was   a   centre   built   for further-education and transfer-of-knowledge
           in Naturwissenschaften.
           in natural-sciences
          'Nearby, a centre for further education and transfer of knowledge in natural sciences was built.'

       e. Nebenan wurde ein Zentrum für Weiterbildung   und Wissenstransfer   in
           Nearby was   a   centre   for further-education and transfer-of-knowledge in
           Naturwissenschaften und verwandten Gebieten gebaut.
           natural-sciences   and related   areas   built

       f. Nebenan wurde ein Zentrum gebaut für Weiterbildung   und Wissenstransfer
           Nearby was   a   centre   built   for further-education and transfer-of-knowledge
           in Naturwissenschaften und verwandten Gebieten.
           in natural-sciences   and related   areas
          'Nearby, a centre for further education and transfer of knowledge in natural sciences and related areas was built.'

(24) a. Gestern   wurde der Grundstein   für einen Büroturm   gelegt.
           Yesterday was   the foundation-stone for a   office-tower laid

       b. Gestern   wurde der Grundstein   gelegt für einen Büroturm.
           Yesterday was   the foundation-stone laid   for a   office-tower
          'Yesterday, the foundation stone for an office tower was laid.'

       c. Gestern   wurde der Grundstein   für einen Büroturm   mit einhundert
           Yesterday was   the foundation-stone for a   office-tower with one-hundred
           Stockwerken gelegt.
           floors   laid

       d. Gestern   wurde der Grundstein   gelegt für einen Büroturm   mit
           Yesterday was   the foundation-stone laid   for a   office-tower with
           einhundert   Stockwerken.
           one-hundred floors
          'Yesterday, the foundation stone for an office tower with one hundred floors was laid.'

       e. Gestern   wurde der Grundstein   für einen Büroturm   mit einhundert
           Yesterday was   the foundation-stone for a   office-tower with one-hundred
           Stockwerken und einer eigenen Solaranlage gelegt.
           floors   and a   own   solar-plant laid

f. Gestern   wurde der Grundstein   gelegt für einen Büroturm   mit
Yesterday was   the foundation-stone laid   for a   office-tower with
einhundert   Stockwerken und einer eigenen Solaranlage.
one-hundred floors   and a   own   solar-plant

'Yesterday, the foundation stone for an office tower with one hundred floors and with

its own solar plant was laid.'

(25)   a. Gestern   haben wir ein Rezept von   einem Koch nachgekocht.
Yesterday have   we a   recipe from a   chef cooked-ourself

b. Gestern   haben wir ein Rezept nachgekocht   von   einem Koch.
Yesterday have   we a   recipe cooked-ourself from a   chef

'Yesterday, we cooked a recipe from a chef ourself.'

c. Gestern   haben wir ein Rezept von   einem Koch aus   dem Fernsehen
Yesterday have   we a   recipe from a   chef from the   TV
nachgekocht.
cooked-ourself

d. Gestern   haben wir ein Rezept nachgekocht   von   einem Koch aus   dem
Yesterday have   we a   recipe cooked-ourself from a   chef   from the
Fernsehen.
TV

'Yesterday, we cooked a recipe from a TV chef ourself.'

e. Gestern   haben wir ein Rezept von   dem berühmten Koch aus   dem Fernsehen
Yesterday have   we a   recipe from the famous   chef from the   TV
mit   dem lustigen Bart   nachgekocht.
with the   funny   beard cooked-ourself

f. Gestern   haben wir ein Rezept nachgekocht   von   dem berühmten Koch aus
Yesterday have   we a   recipe cooked-ourself from the   famous   chef from
dem Fernsehen mit   dem lustigen Bart.
the TV   with the   funny   beard

'Yesterday, we cooked a recipe from the famous TV chef with the funny beard ourself.'

(26)   a. In Linguistik mussten wir mehrere Bücher von   Chomsky lesen.
In linguistics had-to   we several   books from Chomsky read

b. In Linguistik mussten wir mehrere Bücher lesen von   Chomsky.
In linguistics had-to   we several   books read from Chomsky

'In linguistics, we had to read several books by Chomsky.'

c. In Linguistik mussten wir mehrere Bücher von   Chomsky und anderen
In linguistics had-to   we several   books from Chomsky and other
Sprachwissenschaftlern lesen.
linguists   read

d. In Linguistik mussten wir mehrere Bücher lesen von   Chomsky und anderen
In linguistics had-to   we several   books read from Chomsky and other
Sprachwissenschaftlern.
linguists

'In linguistics, we had to read several books by Chomsky and other linguists.'

e. In Linguistik mussten wir mehrere Bücher von   Chomsky und anderen
In linguistics had-to   we several   books from Chomsky and other

Sprachwissenschaftlern über Sprachstörungen   und mögliche
linguists   about language-impairments and possible
Behandlungsmethoden lesen.
treatment-methods   read

   f. In Linguistik mussten wir mehrere Bücher lesen von Chomsky und anderen
     In linguistics had-to   we several   books   read from Chomsky and other
     Sprachwissenschaftlern über Sprachstörungen   und mögliche
     linguists   about language-impairments and possible
     Behandlungsmethoden.
     treatment-methods

     'In linguistics, we had to read several books by Chomsky and other linguists about

     language impairments and possible treatment methods.'

(27) a. Ein Mädchen hat ein Lied von den Beatles gesungen.
      A   girl   has a   song from the Beatles sung

     b. Ein Mädchen hat ein Lied gesungen von den Beatles.
      A   girl   has a   song sung   from the Beatles
      'A girl sang a song from the Beatles.'

     c. Ein Mädchen hat ein Lied von einer Band aus   den 70ern gesungen.
      A   girl   has a   song from a   band from the 70s   sung

     d. Ein Mädchen hat ein Lied gesungen von einer Band aus   den 70ern.
      A   girl   has a   song sung   from a   band from the 70s
      'A girl sang a song from a band from the 70s.'

     e. Ein Mädchen hat ein Lied von einer berühmten australischen Band aus   den 70er
      A   girl   has a   song from a   famous   australian   band from the 70s
      Jahren gesungen.
      years   sung

     f. Ein Mädchen hat ein Lied gesungen von einer berühmten australischen Band aus
      A   girl   has a   song sung   from a   famous   australian   band from
      den 70er Jahren.
      the 70s   years
      'A girl sang a song from a famous Australian band from the 70s.'

(28) a. Ein Stalljunge hat ein Pferd von einem Millionär gefüttert.
      A   stable-boy has a   horse from a   millionaire fed

     b. Ein Stalljunge hat ein Pferd gefüttert von einem Millionär.
      A   stable-boy has a   horse fed   from a   millionaire
      'A stable boy fed a horse from a millionaire.'

     c. Ein Stalljunge hat ein Pferd von einem arroganten englischen Millionär gefüttert.
      A   stable-boy has a   horse from a   arrogant   english   millionaire fed

     d. Ein Stalljunge hat ein Pferd gefüttert von einem arroganten englischen Millionär.
      A   stable-boy has a   horse fed   from a   arrogant   english   millionaire
      'A stable boy fed a horse from an arrogant English millionaire.'

     e. Ein Stalljunge hat ein Pferd von einem arroganten englischen Millionär mit einer
      A   stable-boy has a   horse from a   arrogant   english   millionaire with a
      eigenen Pferdezucht   gefüttert.
      own   horse-breeding fed

  f. Ein Stalljunge hat ein Pferd gefüttert von einem arroganten englischen Millionär
   A stable-boy has a horse fed from a arrogant english millionaire
   mit einer eigenen Pferdezucht.
   with a own horse-breeding
   'A stable boy fed a horse from an arrogant English millionaire who runs his own horse

   breeding farm.'

(29) a. Unsere Agentur hat schon Auftritte von Musikern vermittelt.
   Our agency has already appearances by musicians organized

  b. Unsere Agentur hat schon Auftritte vermittelt von Musikern.
   Our agency has already organized appearances by musicians
   'Our agency has already organized appearances by musicians.'

  c. Unsere Agentur hat schon Auftritte von Musikern, Schauspielern und
   Our agency has already appearances by musicians, actors   and
   bekannten Autoren vermittelt.
   known authors organized

  d. Unsere Agentur hat schon Auftritte vermittelt von Musikern, Schauspielern
   Our agency has already appearances organized by musicians, actors
   und bekannten Autoren.
   and known authors
   'Our agency has already organized appearances by musicians, actors and known

   authors.'

  e. Unsere Agentur hat schon Auftritte von Musikern, Schauspielern, bekannten
   Our agency has already appearances by musicians, actors,   known
   Autoren und Künstlern aller Art vermittelt.
   authors and artists of-all sorts organized

  f. Unsere Agentur hat schon Auftritte vermittelt von Musikern, Schauspielern,
   Our agency has already appearances organized by musicians, actors,
   bekannten Autoren und Künstlern aller Art.
   known authors and artists of-all sorts
   'Our agency has already organized appearances by musicians, actors, known authors

   and artists of all sorts.'

(30) a. Gestern haben wir die Kinder von nebenan gehütet.
   Yesterday have we the children from next-door looked-after

  b. Gestern haben wir die Kinder gehütet von nebenan.
   Yesterday have we the children looked-after from next-door
   'Yesterday, we looked after the children from next door.'

  c. Gestern haben wir die Kinder von den neuen Nachbarn von gegenüber
   Yesterday have we the children from the new neighbours from next-door
   gehütet.
   looked-after

  d. Gestern haben wir die Kinder gehütet von den neuen Nachbarn von
   Yesterday have we the children looked-after from the new neighbours from
   gegenüber.
   next-door
   'Yesterday, we looked after the children from the new neighbours from next door.'

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    e. Gestern   haben wir die Kinder von den neuen Nachbarn aus   der
        Yesterday have   we the children from the new   neighbours from the
        Eigentumswohnung im   vierten Stock gehütet.
        apartment   in-the fourth floor looked-after

    f. Gestern   haben wir die Kinder gehütet   von den neuen Nachbarn aus   der
       Yesterday have   we the children looked-after from the new   neighbours from the
       Eigentumswohnung im   vierten Stock.
       apartment   in-the fourth floor

       'Yesterday, we looked after the children from the new neighbours who own the apartment on the fourth floor.'

(31) a. In der Zeitung   war ein Bild   von einem Mörder   abgedruckt.
        In the newspaper was a   picture from a   murderer printed

    b. In der Zeitung   war ein Bild   abgedruckt von einem Mörder.
        In the newspaper was a   picture printed   from a   murderer

       'In the newspaper, they printed a picture of a murderer.'

    c. In der Zeitung   war ein Bild   von einem besonders   brutalen Mörder
        In the newspaper was a   picture from a   particularly brutal   murderer
        abgedruckt.
        printed

    d. In der Zeitung   war ein Bild   abgedruckt von einem besonders   brutalen
        In the newspaper was a   picture printed   from a   particularly brutal
        Mörder.
        murderer

       'In the newspaper, they printed a picture of a particularly brutal murderer.'

    e. In der Zeitung   war ein Bild   von einem besonders   brutalen Mörder   und
        In the newspaper was a   picture from a   particularly brutal   murderer and
        seinen möglichen Komplizen   abgedruckt.
        his   possible   accomplices printed

    f. In der Zeitung   war ein Bild   abgedruckt von einem besonders   brutalen
       In the newspaper was a   picture printed   from a   particularly brutal
       Mörder   und seinen möglichen Komplizen.
       murderer and his   possible   accomplices

       'In the newspaper, they printed a picture of a particularly brutal murderer and his possible accomplices.'

(32) a. Im   Polizeiprotokoll werden Aussagen von Zeugen   festgehalten.
        In-the police-report   are   statements of   witnesses recorded

    b. Im   Polizeiprotokoll werden Aussagen festgehalten von Zeugen.
        In-the police-report   are   statements recorded   of   witnesses

       'In the police report, statements of witnesses are recorded.'

    c. Im   Polizeiprotokoll werden Aussagen von allen Zeugen   und Verdächtigen
        In-the police-report   are   statements of   all   witnesses and suspects
        festgehalten.
        recorded

    d. Im   Polizeiprotokoll werden Aussagen festgehalten von allen Zeugen   und
        In-the police-report   are   statements recorded   of   all   witnesses and

Verdächtigen.
suspects

'In the police report, statements of all witnesses and suspects are recorded.'

e. Im   Polizeiprotokoll werden Aussagen von allen Zeugen,   möglichen
In-the police-report   are   statements of all   witnesses, possible
Verdächtigen und weiteren betroffenen Personen festgehalten.
suspects   and further   affected   persons recorded

f. Im   Polizeiprotokoll werden Aussagen festgehalten von allen Zeugen,
In-the police-report   are   statements recorded   of all   witnesses,
möglichen Verdächtigen und weiteren betroffenen Personen.
possible   suspects   and further affected   persons

'In the police report, statements of all witnesses, possible suspects and further affected

persons are recorded.'

(33) a. In der Truhe haben alte Briefe von Shakespeare gelegen.
In the chest have old letters of Shakespeare lain

b. In der Truhe haben alte Briefe gelegen von Shakespeare.
In the chest have old letters lain   of Shakespeare

'In the chest lay old letters of Shakespeare.'

c. In der Truhe haben alte Briefe von Shakespeare und seiner Geliebten gelegen.
In the chest have old letters of Shakespeare and his   mistress lain

d. In der Truhe haben alte Briefe gelegen von Shakespeare und seiner Geliebten.
In the chest have old letters lain   of Shakespeare and his   mistress

'In the chest lay old letters of Shakespeare and his mistress.'

e. In der Truhe haben alte Briefe von Shakespeare und seiner Geliebten sowie
In the chest have old letters of Shakespeare and his   mistress as-well-as
mehreren anderen Verehrerinnen gelegen.
several   other   admirers   lain

f. In der Truhe haben alte Briefe gelegen von Shakespeare und seiner Geliebten
In the chest have old letters lain   of Shakespeare and his   mistress
sowie   mehreren anderen Verehrerinnen.
as-well-as several   other   admirers

'In the chest lay old letters of Shakespeare and his mistress, as well as of several other

admirers.'

(34) a. Bei einer Ausgrabung wurden Teile von Skeletten gefunden.
At a   excavation were   parts of skeletons found

b. Bei einer Ausgrabung wurden Teile gefunden von Skeletten.
At a   excavation were   parts found   of skeletons

'During an archaeological excavation, parts of skeletons were found.'

c. Bei einer Ausgrabung wurden Teile von Skeletten aus der frühen Kreidezeit
At a   excavation were   parts of skeletons from the early   Cretaceous
gefunden.
found

d. Bei einer Ausgrabung wurden Teile gefunden von Skeletten aus der frühen
At a   excavation were   parts found   of skeletons from the early
Kreidezeit.
Cretaceous

'During an archaeological excavation, parts of skeletons from the early Cretaceous period were found.'

e. Bei einer Ausgrabung wurden Teile von Skeletten von bis   jetzt unbekannten
At a   excavation   were   parts of skeletons of   until now unknown
Dinosaurierarten aus   der frühen Kreidezeit gefunden.
dinosaur-species from the early   Cretaceous found

f. Bei einer Ausgrabung wurden Teile gefunden von Skeletten von bis   jetzt
At a   excavation   were   parts found   of skeletons of   until now
unbekannten Dinosaurierarten aus   der frühen Kreidezeit.
unknown   dinosaur-species from the early   Cretaceous

'During an archaeological excavation, parts of skeletons of previously unkown dinosaur species from the early Cretaceous period were found.'

(35)   a. Auf der Buchmesse wurden Gedichte von Goethe vorgelesen.
At the book-fair   were   poems   of Goethe read

b. Auf der Buchmesse wurden Gedichte vorgelesen von Goethe.
At the book-fair   were   poems   read   of Goethe

'At the book fair, poems by Goethe were read.'

c. Auf der Buchmesse wurden Gedichte von Goethe und anderen Dichtern vorgelesen.
At the book-fair   were   poems   of Goethe and other   poets   read

d. Auf der Buchmesse wurden Gedichte vorgelesen von Goethe und anderen Dichtern.
At the book-fair   were   poems   read   of Goethe and other   poets

'At the book fair, poems by Goethe and other poets were read.'

e. Auf der Buchmesse wurden Gedichte von Goethe, Schiller und anderen Dichtern
At the book-fair   were   poems   of Goethe, Schiller and other   poets
aus   dem 18. Jahrhundert vorgelesen.
from the 18th century   read

f. Auf der Buchmesse wurden Gedichte vorgelesen von Goethe, Schiller und anderen
At the book-fair   were   poems   read   of Goethe, Schiller and other
Dichtern aus   dem 18. Jahrhundert.
poets   from the 18th century

'At the book fair, poems by Goethe, Schiller and other poets from the 18th century were read.'

(36)   a. In unserem Verlag   werden Übersetzungen von Romanen angefertigt.
In our   publishing-house are   translations   of novels   made

b. In unserem Verlag   werden Übersetzungen angefertigt von Romanen.
In our   publishing-house are   translations   made   of novels

'Our publishing house provides translations of novels.'

c. In unserem Verlag   werden Übersetzungen von Romanen und
In our   publishing-house are   translations   of novels   and
wissenschaftlichen Texten angefertigt.
scientific   texts made

d. In unserem Verlag   werden Übersetzungen angefertigt von Romanen und
In our   publishing-house are   translations   made   of novels   and
wissenschaftlichen Texten.
scientific   texts

'Our publishing house provides translations of novels and scientific texts.'

e. In unserem Verlag   werden Übersetzungen von Romanen und
   In our   publishing-house are   translations   of   novels   and
   wissenschaftlichen Texten aus   dem Bereich der   Kunstgeschichte angefertigt.
   scientific   texts   from the   area   of-the art-history   made

f. In unserem Verlag   werden Übersetzungen angefertigt von Romanen und
   In our   publishing-house are   translations   made   of   novels   and
   wissenschaftlichen Texten aus   dem Bereich der   Kunstgeschichte.
   scientific   texts   from the   area   of-the art-history

'Our publishing house provides translations of novels and scientific texts belonging to the genre of art history.'

B.2 Stimuli Experiment 2

In the following, all thirty-six test sentences used in Experiment 2 are given. Each condition comes in a version with an adjacent PP (conditions a, c, and e) and one with an extraposed PP (conditions b, d and f). Furthermore, the conditions differ with regard to the length of the intervening material: verb (a and b), adverb and verb (c and d), and PP adverbial and verb (e and f).

(1) a. Vor   dem Fenster ist ein Schmetterling mit   großen gelben Flügeln geflattert.
    In-front-of the   window is a   butterfly   with big   yellow wings   fluttered

   b. Vor   dem Fenster ist ein Schmetterling geflattert mit   großen gelben Flügeln.
     In-front-of the   window is a   butterfly   fluttered with big   yellow wings
     'In front of the window, a butterfly with big yellow wings fluttered.'

   c. Vor   dem Fenster ist ein Schmetterling mit   großen gelben Flügeln fröhlich
     In-front-of the   window is a   butterfly   with big   yellow wings   happily
     geflattert.
     fluttered

   d. Vor   dem Fenster ist ein Schmetterling fröhlich geflattert mit   großen gelben
     In-front-of the   window is a   butterfly   happily fluttered with big   yellow
     Flügeln.
     wings
     'In front of the window, a butterfly with big yellow wings fluttered happily.'

   e. Vor   dem Fenster ist ein Schmetterling mit   großen gelben Flügeln in der
     In-front-of the   window is a   butterfly   with big   yellow wings   in the
     Sonne geflattert.
     sun   fluttered

   f. Vor   dem Fenster ist ein Schmetterling in der Sonne geflattert mit   großen
     In-front-of the   window is a   butterfly   in the sun   fluttered   with big
     gelben Flügeln.
     yellow wings
     'In front of the window, a butterfly with big yellow wings fluttered in the sun.'

(2) a. Im   Tropenhaus   hat ein Vogel mit tollen   bunten   Federn   gesungen.
    In-the tropical-house has a   bird   with amazing colourful feathers sung

b. Im   Tropenhaus   hat ein Vogel gesungen mit tollen   bunten   Federn.
In-the tropical-house has a   bird   sung   with amazing colourful feathers
'In the tropical house, a bird with amazing colourful feathers sang.'

c. Im   Tropenhaus   hat ein Vogel mit tollen   bunten   Federn laut
In-the tropical-house has a   bird   with amazing colourful feathers loudly
gesungen.
sung

d. Im   Tropenhaus   hat ein Vogel laut   gesungen mit tollen   bunten   Federn.
In-the tropical-house has a   bird   loudly sung   with amazing colourful feathers
'In the tropical house, a bird with amazing colourful feathers sang loudly."

e. Im   Tropenhaus   hat ein Vogel mit tollen   bunten   Federn auf einem Baum
In-the tropical-house has a   bird   with amazing colourful feathers on a   tree
gesessen.
sat

f. Im   Tropenhaus   hat ein Vogel auf einem Baum gesessen mit tollen
In-the tropical-house has a   bird   on a   tree   sat   with amazing
bunten   Federn.
colourful feathers
'In the tropical house, a bird with amazing colourful feathers sat on a tree.'

(3) a. Vor   der Tür hat eine Katze mit braunen und schwarzen Flecken geschlafen.
In-front-of the door has a   cat   with brown   and black   spots   slept

b. Vor   der Tür hat eine Katze geschlafen mit braunen und schwarzen Flecken.
In-front-of the door has a   cat   slept   with brown   and black   spots
'In front of the door, a cat with brown and black dots slept.'

c. Vor   der Tür hat eine Katze mit braunen und schwarzen Flecken seelenruhig
In-front-of the door has a   cat   with brown   and black   spots   placidly
geschlafen.
slept

d. Vor   der Tür hat eine Katze seelenruhig geschlafen mit braunen und
In-front-of the door has a   cat   placidly   slept   with brown   and
schwarzen Flecken.
black   spots
'In front of the door, a cat with brown and black dots slept placidly.'

e. Vor   der Tür hat eine Katze mit braunen und schwarzen Flecken in der
In-front-of the door has a   cat   with brown   and black   spots   in the
Sonne geschlafen.
sun   slept

f. Vor   der Tür hat eine Katze in der Sonne geschlafen mit braunen und
In-front-of the door has a   cat   in the sun   slept   with brown   and
schwarzen Flecken.
black   spots
'In front of the door, a cat with brown and black dots slept in the sun.

(4) a. Heute morgen hat eine Familie mit zwei kleinen Kindern abgesagt.
Today morning has a   family with two small   children cancelled

b. Heute morgen hat eine Familie abgesagt mit zwei kleinen Kindern.
Today morning has a   family cancelled with two small   children

'This morning, a family with two small children cancelled (their reservations).'

c. Heute morgen hat eine Familie mit   zwei kleinen Kindern kurzfristig   abgesagt.
   Today morning has a   family   with two   small   children at-short-notice cancelled

d. Heute morgen hat eine Familie kurzfristig   abgesagt mit   zwei kleinen
   Today morning has a   family   at-short-notice cancelled with two   small
   Kindern.
   children

   'This morning, a family with two small children cancelled (their reservations) on short

   notice.'

e. Heute morgen hat eine Familie mit   zwei kleinen Kindern ohne   einen Grund
   Today morning has a   family   with two   small   children without a   reason
   abgesagt.
   cancelled

f. Heute morgen hat eine Familie ohne   einen Grund abgesagt mit   zwei kleinen
   Today morning has a   family   without a   reason cancelled with two   small
   Kindern.
   children

   'This morning, a family with two small children cancelled (their reservations) without

   giving any reasons.'

(5) a. Im   Garten ist ein Nest mit   kleinen braunen Eiern runtergefallen.
        In-the garden is a   nest with small   brown   eggs fallen-down

     b. Im   Garten ist ein Nest runtergefallen mit   kleinen braunen Eiern.
        In-the garden is a   nest fallen-down   with small   brown   eggs

        'In the garden, a nest with small brown eggs has fallen down.'

     c. Im   Garten ist ein Nest mit   kleinen braunen Eiern plötzlich runtergefallen.
        In-the garden is a   nest with small   brown   eggs suddenly fallen-down

     d. Im   Garten ist ein Nest plötzlich runtergefallen mit   kleinen braunen Eiern.
        In-the garden is a   nest suddenly fallen-down   with small   brown   eggs

        'In the garden, a nest with small brown eggs suddenly fell down.'

     e. Im   Garten ist ein Nest mit   kleinen braunen Eiern von   einem Baum gefallen.
        In-the garden is a   nest with small   brown   eggs from a   tree fallen

     f. Im   Garten ist ein Nest von   einem Baum gefallen mit   kleinen braunen Eiern.
        In-the garden is a   nest from a   tree fallen   with small   brown   eggs

        'In the garden, a nest with small brown eggs has fallen from a tree.'

(6) a. Auf   dem Foto ist ein M/"adchen mit   langen blonden Zöpfen abgebildet.
        On-the photo is   a   girl with   long blond   braids   shown

     b. Auf   dem Foto ist ein M/"adchen abgebildet mit   langen blonden Zöpfen.
        On-the photo is   a   girl shown   with   long blond   braids

        'On the picture, a girl with long blond braids is shown.'

     c. Auf   dem Foto ist ein M/"adchen mit   langen blonden Zöpfen schlafend
        On-the photo is   a   girl with   long blond   braids   asleep shown
        abgebildet.

   d. Auf   dem Foto ist ein M/"adchen schlafend abgebildet mit langen blonden
      On-the photo is   a   girl asleep   shown   with   long blond braids
      Zöpfen.

      'On the picture, a girl with long blond braids is shown asleep.'

   e. Auf   dem Foto ist ein M/"adchen mit langen blonden Zöpfen   vor einem
      On-the photo is   a   girl with   long blond braids in-front-of a   lake
      See   abgebildet.
      shown

   f. Auf   dem Foto ist ein M/"adchen vor einem See   abgebildet mit langen
      On-the photo is   a   girl in-front-of a   lake   shown with   long blond
      blonden Zöpfen.
      braids

      'On the picture, a girl with long blond braids is shown (standing) in front of a lake.'

(7) a. Ein Notarzt   hat einen Verletzten   mit starken Blutungen und
      A emergency-physician has a   injured-person with severe bleeding   and
      Knochenbrüchen behandelt.
      bone-fractures   treated

   b. Ein Notarzt   hat einen Verletzten   behandelt mit starken Blutungen
      A emergency-physician has a   injured-person treated   with severe bleeding
      und Knochenbrüchen.
      and bone-fractures

      'An emergency physician has treated an injured man with severe bleeding and bone-fractures.'

   c. Ein Notarzt   hat einen Verletzten   mit starken Blutungen und
      A emergency-physician has a   injured-person with severe bleeding   and
      Knochenbrüchen notdürftig behandelt.
      bone-fractures   scantily   treated

   d. Ein Notarzt   hat einen Verletzten   notdürftig behandelt mit starken
      A emergency-physician has a   injured-person scantily   treated   with severe
      Blutungen und Knochenbrüchen.
      bleeding   and bone-fractures

      'An emergency physician has scantily treated an injured man with severe bleeding and bone-fractures.'

   e. Ein Notarzt   hat einen Verletzten   mit starken Blutungen und
      A emergency-physician has a   injured-person with severe bleeding   and
      Knochenbrüchen auf der Straße behandelt.
      bone-fractures   on the street treated

   f. Ein Notarzt   hat einen Verletzten   auf der Straße behandelt mit
      A emergency-physician has a   injured-person on the street treated   with
      starken Blutungen und Knochenbrüchen.
      severe bleeding   and bone-fractures

      'An emergency physician has treated an injured man with severe bleeding and bone-fractures on the street.'

(8) a. Ein Bekannter hat sich ein Auto mit Klimaanlage und Sitzheizung
A acquaintance has PRO.refl a car with air-conditioning and seat-heating
gekauft.
bought

b. Ein Bekannter hat sich ein Auto gekauft mit Klimaanlage und
A acquaintance has PRO.refl a car bought with air-conditioning and
Sitzheizung.
seat-heating

'An acquaintance has bought a car with air conditioning and seat heating.'

c. Ein Bekannter hat sich ein Auto mit Klimaanlage und Sitzheizung
A acquaintance has PRO.refl a car with air-conditioning and seat-heating
gebraucht gekauft.
second-hand bought

d. Ein Bekannter hat sich ein Auto gebraucht gekauft mit Klimaanlage
A acquaintance has PRO.refl a car second-hand bought with air-conditioning
und Sitzheizung.
and seat-heating

'An acquaintance has bought a second hand car with air conditioning and seat heating.'

e. Ein Bekannter hat sich ein Auto mit Klimaanlage und Sitzheizung von
A acquaintance has PRO.refl a car with air-conditioning and seat-heating from
seinem Ersparten gekauft.
his savings bought

f. Ein Bekannter hat sich ein Auto von seinem Ersparten gekauft mit
A acquaintance has PRO.refl a car from his savings bought with
Klimaanlage und Sitzheizung.
air-conditioning and seat-heating

'With his savings, an acquaintance has bought a car with air conditioning and seat heating.'

(9) a. Das Grünflächenamt hat einen Baum mit einem hohlen Stamm gefällt.
The park-authorities has a tree with a hollow trunk felled

b. Das Grünflächenamt hat einen Baum gefällt mit einem hohlen Stamm.
The park-authorities has a tree felled with a hollow trunk

'The park authorities have felled a tree with a hollow trunk.'

c. Das Grünflächenamt hat einen Baum mit einem hohlen Stamm lautstark gefällt.
The park-authorities has a tree with a hollow trunk loudly felled

d. Das Grünflächenamt hat einen Baum lautstark gefällt mit einem hohlen Stamm.
The park-authorities has a tree loudly felled with a hollow trunk

'The park authorities have loudly felled a tree with a hollow trunk.'

e. Das Grünflächenamt hat einen Baum mit einem hohlen Stamm vor meinem
The park-authorities has a tree with a hollow trunk in-front-of my
Haus gefällt.
house felled

f. Das Grünflächenamt hat einen Baum vor meinem Haus gefällt mit einem
The park-authorities has a tree in-front-of my house felled with a
hohlen Stamm.
hollow trunk

'The park authorities have felled a tree with a hollow trunk in front my house.'

(10) a. Eine Mutter hat eine Schultüte   mit vielen Süßigkeiten und Geschenken
          A   mother has a   school-cone with many sweets   and presents
          gebastelt.
          made

      b. Eine Mutter hat eine Schultüte   gebastelt mit vielen Süßigkeiten und
          A   mother has a   school-cone made   with many sweets   and
          Geschenken.
          presents

          'A mother made a school-cone with many sweets and presents.'

      c. Eine Mutter hat eine Schultüte   mit vielen Süßigkeiten und Geschenken selbst
          A   mother has a   school-cone with many sweets   and presents   herself
          gebastelt.
          made

      d. Eine Mutter hat eine Schultüte   selbst gebastelt mit vielen Süßigkeiten und
          A   mother has a   school-cone herself made   with many sweets   and
          Geschenken.
          presents

          'A mother made a school-cone herself with many sweets and presents.'

      e. Eine Mutter hat eine Schultüte   mit vielen Süßigkeiten und Geschenken für ihren
          A   mother has a   school-cone with many sweets   and presents   for her
          Sohn gebastelt.
          son   made

      f. Eine Mutter hat eine Schultüte   für ihren Sohn gebastelt mit vielen Süßigkeiten
          A   mother has a   school-cone for her   son   made   with many sweets
          und Geschenken.
          and presents

          'A mother made a school-cone with many sweets and presents for her son.'

(11) a. Ein Maulwurf hat ein Beet mit frisch gepflanzten Blumen durchwühlt.
          A   mole   has a bed with freshly planted   flowers churned

      b. Ein Maulwurf hat ein Beet durchwühlt mit frisch gepflanzten Blumen.
          A   mole   has a bed churned   with freshly planted   flowers

          'A mole churned a bed of freshly planted flowers.'

      c. Ein Maulwurf hat ein Beet mit frisch gepflanzten Blumen komplett   durchwühlt.
          A   mole   has a bed with freshly planted   flowers completely churned

      d. Ein Maulwurf hat ein Beet komplett   durchwühlt mit frisch gepflanzten Blumen.
          A   mole   has a bed completely churned   with freshly planted   flowers

          'A mole completely churned a bed of freshly planted flowers.'

      e. Ein Maulwurf hat ein Beet mit frisch gepflanzten Blumen neben der Terrasse
          A   mole   has a bed with freshly planted   flowers next-to the terrace
          durchwühlt.
          churned

      f. Ein Maulwurf hat ein Beet neben der Terrasse durchwühlt mit frisch gepflanzten
          A   mole   has a bed next-to the terrace churned   with freshly planted
          Blumen.
          flowers

'A mole churned a bed of freshly planted flowers right next to the terrace.'

(12)   a.   Ein Ladenbesitzer hat ein Schild mit der Aufschrift 'Alles   zum   halben Preis'
A shop-owner   has a   sign   with the inscription 'everything to-the half   price'
aufgestellt.
put-up

b.   Ein Ladenbesitzer hat ein Schild aufgestellt mit der Aufschrift 'Alles   zum
A shop-owner   has a   sign   put-up   with the inscription 'everything to-the
halben Preis'.
half   price'

'A shopkeeper put up a sign that read 'Everything at half-price.'

c.   Ein Ladenbesitzer hat ein Schild mit der Aufschrift 'Alles   zum   halben Preis'
A shop-owner   has a   sign   with the inscription 'everything to-the half   price'
draußen aufgestellt.
outside put-up

d.   Ein Ladenbesitzer hat ein Schild draußen aufgestellt mit der Aufschrift 'Alles
A shop-owner   has a   sign   outside put-up   with the inscription 'everything
zum   halben Preis'.
to-the half   price'

'A shopkeeper put up a sign outside that read 'Everything at half-price.'

e.   Ein Ladenbesitzer hat ein Schild mit der Aufschrift 'Alles   zum   halben Preis'
A shop-owner   has a   sign   with the inscription 'everything to-the half   price'
auf der Straße aufgestellt.
on the street put-up

f.   Ein Ladenbesitzer hat ein Schild auf der Straße aufgestellt mit der Aufschrift
A shop-owner   has a   sign   on the street put-up   with the inscription
'Alles   zum   halben Preis'.
'everything to-the half   price'

'A shopkeeper put up a sign on the street that read 'Everything at half-price.'

(13)   a.   Im   Keller hat noch eine Kiste von unserem alten Weinhändler   gestanden.
In-the cellar has still a   crate from our   old   wine-merchant stood

b.   Im   Keller hat noch eine Kiste gestanden von unserem alten Weinhändler.
In-the cellar has still a   crate stood   from our   old   wine-merchant

'In the cellar, there still stood a crate from our old wine merchant.'

c.   Im   Keller hat noch eine Kiste von unserem alten Weinhändler   ungeöffnet
In-the cellar has still a   crate from our   old   wine-merchant unopened
gestanden.
stood

d.   Im   Keller hat noch eine Kiste ungeöffnet gestanden von unserem alten
In-the cellar has still a   crate unopened stood   from our   old
Weinhändler.
wine-merchant

'In the cellar, there still stood an unopened crate from our old wine merchant.'

e.   Im   Keller hat noch eine Kiste von unserem alten Weinhändler   in einer Ecke
In-the cellar has still a   crate from our   old   wine-merchant in a   corner
gestanden.
stood

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f. Im   Keller hat noch eine Kiste in einer Ecke   gestanden von   unserem alten
In-the cellar has still   a   crate in a   corner stood   from our   old
Weinhändler.
wine-merchant
'In the cellar, there still stood a crate in the corner from our old wine merchant.'

(14)   a. Während der Mittagsruhe haben Kinder   von der nahegelegenen Schule gespielt.
During   the siesta   have   children from the nearby   school played

     b. Während der Mittagsruhe haben Kinder   gespielt von der nahegelegenen Schule.
During   the siesta   have   children played   from the nearby   school
'During the siesta, children from the nearby school played (outside).'

     c. Während der Mittagsruhe haben Kinder   von der nahegelegenen Schule laut
During   the siesta   have   children from the nearby   school loudly
gespielt.
played

     d. Während der Mittagsruhe haben Kinder   laut   gespielt von der nahegelegenen
During   the siesta   have   children loudly played   from the nearby
Schule.
school
'During the siesta, children from the nearby school played loudly.'

     e. Während der Mittagsruhe haben Kinder   von der nahegelegenen Schule auf der
During   the siesta   have   children from the nearby   school on the
Straße gespielt.
street played

     f. Während der Mittagsruhe haben Kinder   auf der Straße gespielt von der
During   the siesta   have   children on the street   played   from the
nahegelegenen Schule.
nearby   school
'During the siesta, children from the nearby school played on the street.'

(15)   a. Gestern   hat ein Exfreund   von meiner besten Freundin angerufen.
Yesterday has a   ex-boyfriend of my   best   friend   called

     b. Gestern   hat ein Exfreund   angerufen von meiner besten Freundin.
Yesterday has a   ex-boyfriend called   of my   best   friend
'Yesterday, an ex-boyfriend of my best friend called.'

     c. Gestern   hat ein Exfreund   von meiner besten Freundin unerwartet   angerufen.
Yesterday has a   ex-boyfriend of my   best   friend   unexpectedly called

     d. Gestern   hat ein Exfreund   unerwartet   angerufen von meiner besten Freundin.
Yesterday has a   ex-boyfriend unexpectedly called   of my   best   friend
'Yesterday, an ex-boyfriend of my best friend called unexpectedly.'

     e. Gestern   hat ein Exfreund   von meiner besten Freundin auf meinem
Yesterday has a   ex-boyfriend of my   best   friend   on my
Handy   angerufen.
mobile-phone called

     f. Gestern   hat ein Exfreund   auf meinem Handy   angerufen von meiner
Yesterday has a   ex-boyfriend on my   mobile-phone called   of   my
besten Freundin.
best   friend

'Yesterday, an ex-boyfriend of my best friend called on my mobile phone.'

(16) a. In der Zeitung   war ein Bild   von einem brutalen Serienmörder abgedruckt.
In the newspaper was a   picture of a   brutal   serial-killer   printed

b. In der Zeitung   war ein Bild   abgedruckt von einem brutalen Serienmörder.
In the newspaper was a   picture printed   of a   brutal   serial-killer

'In the newspaper, they published a picture of a brutal serial killer.'

c. In der Zeitung   war ein Bild   von einem brutalen Serienmörder groß abgedruckt.
In the newspaper was a   picture of a   brutal   serial-killer   big printed

d. In der Zeitung   war ein Bild   groß abgedruckt von einem brutalen Serienmörder.
In the newspaper was a   picture big printed   of a   brutal   serial-killer

'In the newspaper, they published a big picture of a brutal serial killer.'

e. In der Zeitung   war ein Bild   von einem brutalen Serienmörder auf der Titelseite
In the newspaper was a   picture of a   brutal   serial-killer   on the title-page
abgedruckt.
printed

f. In der Zeitung   war ein Bild   auf der Titelseite abgedruckt von einem brutalen
In the newspaper was a   picture on the title-page printed   of a   brutal
Serienmörder.
serial-killer

'In the newspaper, they published a picture of a brutal serial killer on the title page.'

(17) 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

'In the opera, a ballerina of a Russian ballet group performed.'

c. In der Oper hat eine Ballerina von einer russischen Ballettgruppe beeindruckend
In the opera has a   ballerina of a   russian   ballet-group impressively
getanzt.
danced

d. In der Oper hat eine Ballerina beeindruckend getanzt von einer russischen
In the opera has a   ballerina impressively   danced of a   russian
Ballettgruppe.
ballet-group

'In the opera, a ballerina of a Russian ballet group performed impressively.'

e. In der Oper hat eine Ballerina von einer russischen Ballettgruppe auf der Bühne
In the opera has a   ballerina of a   russian   ballet-group on the stage
getanzt.
danced

f. In der Oper hat eine Ballerina auf der Bühne getanzt von einer russischen
In the opera has a   ballerina on the stage   danced of a   russian
Ballettgruppe.
ballet-group

'In the opera, a ballerina of a Russian ballet group performed on stage.'

(18) a. Vor   einem Hotel hat ein Journalist von   einem englischen Klatschblatt
          In-front-of a   hotel has a   journalist from a   english   tabloid
          gelauert.
          lurked

      b. Vor   einem Hotel hat ein Journalist gelauert von   einem englischen
          In-front-of a   hotel has a   journalist lurked   from a   english
          Klatschblatt.
          tabloid

          'In front of a hotel, a journalist from an English tabloid was lurking.'

      c. Vor   einem Hotel hat ein Journalist von   einem englischen Klatschblatt
          In-front-of a   hotel has a   journalist from a   english   tabloid
          ungeduldig gelauert.
          impatiently lurked

      d. Vor   einem Hotel hat ein Journalist ungeduldig gelauert von   einem
          In-front-of a   hotel has a   journalist impatiently lurked   from a
          englischen Klatschblatt.
          english   tabloid

          'In front of a hotel, a journalist from an English tabloid was lurking impatiently.'

      e. Vor   einem Hotel hat ein Journalist von   einem englischen Klatschblatt
          In-front-of a   hotel has a   journalist from a   english   tabloid
          hinter   einem Gebüsch gelauert.
          behind a   bush   lurked

      f. Vor   einem Hotel hat ein Journalist hinter   einem Gebüsch gelauert von
          In-front-of a   hotel has a   journalist behind a   bush   lurked   from
          einem englischen Klatschblatt.
          a   english   tabloid

          'In front of a hotel, a journalist from an English tabloid was lurking behind a bush.'

(19) a. Ein Stalljunge hat ein Pferd von   einem englischen Millionär   umsorgt.
          A   stable-boy has a   horse from a   english   millionaire cared-for

      b. Ein Stalljunge hat ein Pferd umsorgt   von   einem englischen Millionär.
          A   stable-boy has a   horse cared-for from a   english   millionaire

          'A stable boy cared for a horse from an English millionaire.'

      c. Ein Stalljunge hat ein Pferd von   einem englischen Millionär   liebevoll umsorgt.
          A   stable-boy has a   horse from a   english   millionaire lovingly cared-for

      d. Ein Stalljunge hat ein Pferd liebevoll umsorgt   von   einem englischen Millionär.
          A   stable-boy has a   horse lovingly cared-for from a   english   millionaire

          'A stable boy cared lovingly for a horse from an English millionaire.'

      e. Ein Stalljunge hat ein Pferd von   einem englischen Millionär   mit viel   Liebe
          A   stable-boy has a   horse from a   english   millionaire with much love
          umsorgt.
          cared-for

      f. Ein Stalljunge hat ein Pferd mit viel   Liebe umsorgt   von   einem englischen
          A   stable-boy has a   horse with much love cared-for from a   english
          Millionär.
          millionaire

          'A stable boy cared with much love for a horse from an English millionaire.'

(20)   a. Ein kleines Mädchen hat ein Lied von einer Band aus den 70ern gesungen.
           A   little   girl   has a   song from a   band from the 70s   sung

        b. Ein kleines Mädchen hat ein Lied gesungen von einer Band aus   den 70ern.
           A   little   girl   has a   song sung   from a   band from the 70s
           'A little girl sang a song from a band from the 70s.'

        c. Ein kleines Mädchen hat ein Lied von einer Band aus den 70ern herzzerreißend
           A   little   girl   has a   song from a   band from the 70s   heartbreakingly
           gesungen.
           sung

        d. Ein kleines Mädchen hat ein Lied herzzerreißend gesungen von einer Band aus
           A   little   girl   has a   song heartbreakingly sung   from a   band from
           den 70ern.
           the 70s
           'A little girl sang a song heartbreakingly from a band from the 70s.'

        e. Ein kleines Mädchen hat ein Lied von einer Band aus den 70ern auf der Bühne
           A   little   girl   has a   song from a   band from the 70s   on the stage
           gesungen.
           sung

        f. Ein kleines Mädchen hat ein Lied auf der Bühne gesungen von einer Band aus
           A   little   girl   has a   song on the stage sung   from a   band from
           den 70ern.
           the 70s
           'A little girl sang a song on stage from a band from the 70s.'

(21)   a. Eine Freundin hat ein Rezept von einem Koch aus dem Fernsehen nachgekocht.
           A   friend   has a   recipe from a   chef from the television cooked-herself

        b. Eine Freundin hat ein Rezept nachgekocht   von einem Koch aus dem Fernsehen.
           A   friend   has a   recipe cooked-herself from a   chef from the television
           'A friend recreated a recipe from a TV chef.'

        c. Eine Freundin hat ein Rezept von einem Koch aus dem Fernsehen perfekt
           A   friend   has a   recipe from a   chef from the television perfectly
           nachgekocht.
           cooked-herself

        d. Eine Freundin hat ein Rezept perfekt   nachgekocht   von einem Koch aus   dem
           A   friend   has a   recipe perfectly cooked-herself from a   chef from the
           Fernsehen.
           television
           'A friend recreated a recipe from a TV chef just perfectly.'

        e. Eine Freundin hat ein Rezept von einem Koch aus dem Fernsehen bis ins
           A   friend   has a   recipe from a   chef from the television to in-the
           Detail nachgekocht.
           detail cooked-herself

        f. Eine Freundin hat ein Rezept bis ins   Detail nachgekocht   von einem Koch aus
           A   friend   has a   recipe to in-the detail cooked-herself from a   chef   from
           dem Fernsehen.
           the television
           'A friend recreated a recipe from a TV chef down to the last detail.'

(22)   a.   Eine Bibliothekarin hat ein Buch von einem bekannten Schriftsteller vorgelesen.
            A   librarian   has a book by a   known   writer   read

       b.   Eine Bibliothekarin hat ein Buch vorgelesen von einem bekannten Schriftsteller.
            A   librarian   has a book read   by a   known   writer
            'A librarian read aloud a book by a well-known writer.'

       c.   Eine Bibliothekarin hat ein Buch von einem bekannten Schriftsteller wunderschön
            A   librarian   has a book by a   known   writer   beautifully
            vorgelesen.
            read

       d.   Eine Bibliothekarin hat ein Buch wunderschön vorgelesen von einem bekannten
            A   librarian   has a book beautifully read   by a   known
            Schriftsteller.
            writer
            'A librarian read aloud a book beautifully by a well-known writer.'

       e.   Eine Bibliothekarin hat ein Buch von einem bekannten Schriftsteller in einer
            A   librarian   has a book by a   known   writer   in a
            Sitzecke   vorgelesen.
            reading-corner read

       f.   Eine Bibliothekarin hat ein Buch in einer Sitzecke   vorgelesen von einem
            A   librarian   has a book in a   reading-corner read   by a
            bekannten Schriftsteller.
            known   writer
            'In a reading corner, a librarian read aloud a book by a well-known writer.'

(23)   a.   Ein Besucher hat eine Vase von einem ber/"uhmten Künstler beschädigt.
            A   visitor   has a   vase by a   famous   artist   damaged

       b.   Ein Besucher hat eine Vase beschädigt von einem ber/"uhmten Künstler.
            A   visitor   has a   vase damaged   by a   famous   artist
            'A visitor damaged a vase by a famous artist.'

       c.   Ein Besucher hat eine Vase von einem ber/"uhmten Künstler versehentlich
            A   visitor   has a   vase by a   famous   artist   inadvertently
            beschädigt.
            damaged

       d.   Ein Besucher hat eine Vase versehentlich beschädigt von einem ber/"uhmten
            A   visitor   has a   vase inadvertently damaged   by a   famous
            Künstler.
            artist
            'A visitor inadvertently damaged a vase by a famous artist.'

       e.   Ein Besucher hat eine Vase von einem ber/"uhmten Künstler während einer
            A   visitor   has a   vase by a   famous   artist   during a
            Führung   beschädigt.
            guided-tour damaged

       f.   Ein Besucher hat eine Vase während einer Führung   beschädigt von einem
            A   visitor   has a   vase during a   guided-tour damaged   by a
            ber/"uhmten Künstler.
            famous   artist
            'During a guided tour, a visitor damaged a vase by a famous artist.'

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(24) a. Ein Freund hat ein Haus von einem ehemaligen Kollegen gekauft.
          A friend has a house of a   former   colleague bought

      b. Ein Freund hat ein Haus gekauft von einem ehemaligen Kollegen.
          A friend has a house bought of a   former   colleague
          'A friend has bought a house of a former colleague.'

      c. Ein Freund hat ein Haus von einem ehemaligen Kollegen preiswert   gekauft.
          A friend has a house of a   former   colleague inexpensively bought

      d. Ein Freund hat ein Haus preiswert   gekauft von einem ehemaligen Kollegen.
          A friend has a house inexpensively bought of a   former   colleague
          'A friend has bought a house of a former colleague at a low price.'

      e. Ein Freund hat ein Haus von einem ehemaligen Kollegen zu einem guten Preis
          A friend has a house of a   former   colleague to a   good price
          gekauft.
          bought

      f. Ein Freund hat ein Haus zu einem guten Preis gekauft von einem ehemaligen
          A friend has a house to a   good price bought of a   former
          Kollegen.
          colleague

          'A friend has bought a house of a former colleague at a good price.'

(25) a. Letzte Woche hat ein Vertreter für Staubsauger   und Haushaltsgeräte
          Last week has a salesman for vacuum-cleaners and household-appliances
          geklingelt.
          rang

      b. Letzte Woche hat ein Vertreter geklingelt für Staubsauger   und
          Last week has a salesman rang   for vacuum-cleaners and
          Haushaltsgeräte.
          household-appliances
          'Last week, a salesman for vaccum cleaners and household appliances rang (at the
          door).'

      c. Letzte Woche hat ein Vertreter für Staubsauger   und Haushaltsgeräte
          Last week has a salesman for vacuum-cleaners and household-appliances
          mehrfach geklingelt.
          repeatedly rang

      d. Letzte Woche hat ein Vertreter mehrfach geklingelt für Staubsauger   und
          Last week has a salesman repeatedly rang   for vacuum-cleaners and
          Haushaltsgeräte.
          household-appliances
          'Last week, a salesman for vaccum cleaners and household appliances repeatedly rang
          (at the door).'

      e. Letzte Woche hat ein Vertreter für Staubsauger   und Haushaltsgeräte   an
          Last week has a salesman for vacuum-cleaners and household-appliances at
          der Tür geklingelt.
          the door rang

      f. Letzte Woche hat ein Vertreter an der Tür geklingelt für Staubsauger   und
          Last week has a salesman at the door rang   for vacuum-cleaners and
          Haushaltsgeräte.
          household-appliances

'Last week, a salesman for vaccum cleaners and household appliances rang at the door.'

(26) a. Am   Morgen ist ein Experte für Mumien   und Goldschätze   eingetroffen.
In-the morning is a   expert   for mummies and gold-treasures arrived

      b. Am   Morgen ist ein Experte eingetroffen für Mumien   und Goldschätze
In-the morning is a   expert   arrived   for mummies and gold-treasures
'This morning, an expert for mummies and golden treasures arrived.'

      c. Am   Morgen ist ein Experte für Mumien   und Goldschätze   übermüdet
In-the morning is a   expert   for mummies and gold-treasures overtired
eingetroffen.
arrived

      d. Am   Morgen ist ein Experte übermüdet eingetroffen für Mumien   und
In-the morning is a   expert   overtired   arrived   for mummies and
Goldschätze.
gold-treasures
'This morning, an expert for mummies and golden treasures arrived overtired.'

      e. Am   Morgen ist ein Experte für Mumien   und Goldschätze   an der Fundstelle
In-the morning is a   expert   for mummies and gold-treasures at the site
eingetroffen.
arrived

      f. Am   Morgen ist ein Experte an der Fundstelle eingetroffen für Mumien   und
In-the morning is a   expert   at the site   arrived   for mummies and
Goldschätze.
gold-treasures
'This morning, an expert for mummies and golden treasures arrived at the archaeological site.'

(27) a. Unter der Matte hat ein Schlüssel für die Tür des   Einfamilienhauses gelegen.
Under the mat   has a   key   for the door of-the single-family-home laid

      b. Unter der Matte hat ein Schlüssel gelegen für die Tür des   Einfamilienhauses.
Under the mat   has a   key   laid   for the door of-the single-family-home
'Underneath the mat, a key for the door of the single-family home was laying.'

      c. Unter der Matte hat ein Schlüssel für die Tür des   Einfamilienhauses versteckt
Under the mat   has a   key   for the door of-the single-family-home hidden
gelegen.
lain

      d. Unter der Matte hat ein Schlüssel versteckt gelegen für die Tür des
Under the mat   has a   key   hidden   lain   for the door of-the
Einfamilienhauses.
single-family-home
'Underneath the mat, a key for the door of the single-family home was laying hidden.'

      e. Am   Eingang hat ein Schlüssel für die Tür des   Einfamilienhauses unter einer
At-the entrance has a   key   for the door of-the single-family-home under a
Matte gelegen.
mat   laid

    f. Am   Eingang hat ein Schlüssel unter einer Matte gelegen für die Tür des
       At-the entrance has a   key   under a   mat   laid   for the door of-the
       Einfamilienhauses.
       single-family-home

       'Near the entrance, a key for the door of the single-family home was laying underneath

       a mat.'

(28) a. Auf einem Bauernhof hat ein Schuppen für Brennholz und Stroh gebrannt.
       At a   farmstead has a   shed   for firewood and straw burned

    b. Auf einem Bauernhof hat ein Schuppen gebrannt für Brennholz und Stroh.
       At a   farmstead has a   shed   burned for firewood and straw

       'At a farmstead, a shed for firewood and straw was burning.'

    c. Auf einem Bauernhof hat ein Schuppen für Brennholz und Stroh lichterloh gebrannt.
       At a   farmstead has a   shed   for firewood and straw blazingly burned

    d. Auf einem Bauernhof hat ein Schuppen lichterloh gebrannt für Brennholz und Stroh.
       At a   farmstead has a   shed   blazingly burned for firewood and straw

       'At a farmstead, a shed for firewood and straw was ablaze.'

    e. Auf einem Bauernhof hat ein Schuppen für Brennholz und Stroh in der Nacht
       At a   farmstead has a   shed   for firewood and straw in the night
       gebrannt.
       burned

    f. Auf einem Bauernhof hat ein Schuppen in der Nacht gebrannt für Brennholz und
       At a   farmstead has a   shed   in the night burned for firewood and
       Stroh.
       straw

       'At a farmstead, a shed for firewood and straw was ablaze during the night.'

(29) a. In der Zeitung   wird   ein Nachfolger für einen verstorbenen Projektleiter
       In the newspaper is-being a   successor for a   deceased   project-manager
       gesucht.
       sought

    b. In der Zeitung   wird   ein Nachfolger gesucht für einen verstorbenen
       In the newspaper is-being a   successor sought for a   deceased
       Projektleiter.
       project-manager

       'In the newspaper, a successor for a deceased project manager is being sought.'

    c. In der Zeitung   wird   ein Nachfolger für einen verstorbenen Projektleiter
       In the newspaper is-being a   successor for a   deceased   project-manager
       dringend gesucht.
       urgently sought

    d. In der Zeitung   wird   ein Nachfolger dringend gesucht für einen verstorbenen
       In the newspaper is-being a   successor urgently sought for a   deceased
       Projektleiter.
       project-manager

       'In the newspaper, a successor for a deceased project manager is being sought

       urgently.'

e. In der Zeitung   wird   ein Nachfolger für einen verstorbenen Projektleiter
In the newspaper is-being a   successor for a   deceased   project-manager
zum   nächstmöglichen Termin gesucht.
to-the next-possible   date   sought

f. In der Zeitung   wird   ein Nachfolger zum   nächstmöglichen Termin gesuchtfür
In the newspaper is-being a   successor to-the next-possible   date   sought
einen verstorbenen Projektleiter.
for   a   deceased   project-manager
'In the newspaper, a successor for a deceased project manager is being sought at the
next possible date.'

(30) a. Heute wurde eine neue Schule für besonders begabte Kinder   eröffnet.
Today was   a   new school for especially talented children opened

b. Heute wurde eine neue Schule eröffnet für besonders begabte Kinder.
Today was   a   new school opened for especially talented children
'Today a new school for especially talented children was opened.'

c. Heute wurde eine neue Schule für besonders begabte Kinder   feierlich
Today was   a   new school for especially talented children ceremoniously
eröffnet.
opened

d. Heute wurde eine neue Schule feierlich   eröffnet für besonders begabte
Today was   a   new school ceremoniously opened for especially talented
Kinder.
children
'Today a new school for especially talented children was opened ceremoniously.'

e. Heute wurde eine neue Schule für besonders begabte Kinder   mit   einem Festakt
Today was   a   new school for especially talented children with a   ceremony
eröffnet.
opened

f. Heute wurde eine neue Schule mit   einem Festakt   eröffnet für besonders begabte
Today was   a   new school with a   ceremony opened for especially talented
Kinder.
children
'Today a new school for especially talented children was opened with a ceremony.'

(31) a. Ein Lehrer hat eine neue Idee für die Sauberhaltung des   Schulhofs vorgestellt.
A   teacher has a   new idea for the cleanliness   of-the schoolyard introduced

b. Ein Lehrer hat eine neue Idee vorgestellt für die Sauberhaltung des   Schulhofs.
A   teacher has a   new idea introduced for the cleanliness   of-the schoolyard
'A teacher introduced a new idea concerning the cleanliness of the schoolyard.'

c. Ein Lehrer hat eine neue Idee für die Sauberhaltung des   Schulhofs überzeugend
A   teacher has a   new idea for the cleanliness   of-the schoolyard convincingly
vorgestellt.
introduced

d. Ein Lehrer hat eine neue Idee überzeugend vorgestellt für die Sauberhaltung des
A   teacher has a   new idea convincingly introduced for the cleanliness   of-the
Schulhofs.
schoolyard

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'A teacher introduced a new idea concerning the cleanliness of the schoolyard convincingly.'

e. Ein Lehrer hat eine neue Idee für die Sauberhaltung des   Schulhofs beim letzten
   A teacher has a   new idea for the cleanliness   of-the schoolyard at-the last
   Elternabend   vorgestellt.
   parents-evening introduced

f. Ein Lehrer hat eine neue Idee beim letzten Elternabend   vorgestellt für die
   A teacher has a   new idea at-the last   parents-evening introduced for the
   Sauberhaltung des   Schulhof.
   cleanliness   of-the schoolyard

   'At the last parents' evening, a teacher introduced a new idea concerning the cleanliness of the schoolyard.'

(32) a. Ein Kino-Mitarbeiter hat Freikarten für einen neuen Film ausgeteilt.
        A cinema-employee has free-tickets for a   new   film handed-out

     b. Ein Kino-Mitarbeiter hat Freikarten ausgeteilt für einen neuen Film.
        A cinema-employee has free-tickets handed-out for a   new   film

        'An employee at the cinema handed out free tickets for a film.'

     c. Ein Kino-Mitarbeiter hat Freikarten für einen neuen Film lustlos   ausgeteilt.
        A cinema-employee has free-tickets for a   new   film listlessly handed-out

     d. Ein Kino-Mitarbeiter hat Freikarten lustlos   ausgeteilt für einen neuen Film.
        A cinema-employee has free-tickets listlessly handed-out for a   new   film

        'An employee at the cinema handed out free tickets for a film listlessly.'

     e. Ein Kino-Mitarbeiter hat Freikarten für einen neuen Film an der Kasse
        A cinema-employee has free-tickets for a   new   film at the ticket-office
        ausgeteilt.
        handed-out

     f. Ein Kino-Mitarbeiter hat Freikarten an der Kasse   ausgeteilt   für einen neuen
        A cinema-employee has free-tickets at the ticket-office handed-out for a   new
        Film.
        film

        'An employee at the cinema handed out free tickets for a film at the ticket office.'

(33) a. Ein Mann hat einen Gutschein   für eine Rundreise durch Italien gewonnen.
        A man   has a   gift-certificate for a   tour   through Italy   won

     b. Ein Mann hat einen Gutschein   gewonnen für eine Rundreise durch   Italien.
        A man   has a   gift-certificate won   for a   tour   through Italy

        'A man has won a gift certificate for a tour throughout Italy.'

     c. Ein Mann hat einen Gutschein   für eine Rundreise durch   Italien unerwartet
        A man   has a   gift-certificate for a   tour   through Italy   unexpectedly
        gewonnen.
        won

     d. Ein Mann hat einen Gutschein   unerwartet   gewonnen für eine Rundreise
        A man   has a   gift-certificate unexpectedly won   for a   tour
        durch   Italien.
        through Italy

        'A man has unexpectedly won a gift certificate for a tour throughout Italy.'

e. Ein Mann hat einen Gutschein   für eine Rundreise durch   Italien bei einer
   A   man has a   gift-certificate for a   tour   through Italy   at a
   Verlosung gewonnen.
   raffle   won

f. Ein Mann hat einen Gutschein   bei einer Verlosung gewonnen für eine Rundreise
   A   man has a   gift-certificate at a   raffle   won   for a   tour
   durch   Italien.
   through Italy

   'A man has won a gift certificate for a tour throughout Italy at a raffle.'

(34) a. Eine Kollegin   hat ein Geschenk für ihren jüngeren Bruder gekauft.
         A   colleague has a   present for her   younger brother bought

      b. Eine Kollegin   hat ein Geschenk gekauft für ihren jüngeren Bruder.
         A   colleague has a   present bought for her   younger brother

         'A colleague has bought a present for her younger brother.'

      c. Eine Kollegin   hat ein Geschenk für ihren jüngeren Bruder online gekauft.
         A   colleague has a   present for her   younger brother online bought

      d. Eine Kollegin   hat ein Geschenk online gekauft für ihren jüngeren Bruder.
         A   colleague has a   present online bought for her   younger brother

         'A colleague has bought a present online for her younger brother.'

      e. Eine Kollegin   hat ein Geschenk für ihren jüngeren Bruder in einem Online-Shop
         A   colleague has a   present for her   younger brother in a   online-shop
         gekauft.
         bought

      f. Eine Kollegin   hat ein Geschenk in einem Online-Shop gekauft für ihren jüngeren
         A   colleague has a   present in a   online-shop bought for her   younger
         Bruder.
         brother

         'A colleague has bought a present for her younger brother at an online shop.'

(35) a. Ein Tierwärter hat ein Aquarium für Fische und Schildkröten gereinigt.
         A   zookeeper has a   aquarium for fish   and turtles   cleaned

      b. Ein Tierwärter hat ein Aquarium gereinigt für Fische und Schildkröten.
         A   zookeeper has a   aquarium cleaned for fish   and turtles

         'A zookeeper cleaned an aquarium for fish and turtles.'

      c. Ein Tierwärter hat ein Aquarium für Fische und Schildkröten gründlich   gereinigt.
         A   zookeeper has a   aquarium for fish   and turtles   thoroughly cleaned

      d. Ein Tierwärter hat ein Aquarium gründlich   gereinigt für Fische und Schildkröten.
         A   zookeeper has a   aquarium thoroughly cleaned for fish   and turtles

         'A zookeeper thoroughly cleaned an aquarium for fish and turtles.'

      e. Ein Tierwärter hat ein Aquarium für Fische und Schildkröten in einem Nebenraum
         A   zookeeper has a   aquarium for fish   and turtles   in a   side-room
         gereinigt.
         cleaned

      f. Ein Tierwärter hat ein Aquarium in einem Nebenraum gereinigt für Fische und
         A   zookeeper has a   aquarium in a   side-room cleaned for fish   and
         Schildkröten.
         turtles

'In a side room, a zookeeper cleaned an aquarium for fish and turtles.'

(36) a. Ein Unternehmer hat eine App für Satellitenbilder von Gebirgsketten entwickelt.
A businessman has a app for satellite-pictures of mountain-ranges developed

b. Ein Unternehmer hat eine App entwickelt für Satellitenbilder von Gebirgsketten.
A businessman has a app developed for satellite-pictures of mountain-ranges

'A businessman has developed an app for satellite pictures of mountain ranges.'

c. Ein Unternehmer hat eine App für Satellitenbilder von Gebirgsketten
A businessman has a app for satellite-pictures of mountain-ranges
erfolgreich entwickelt.
successfully developed

d. Ein Unternehmer hat eine App erfolgreich entwickelt für Satellitenbilder von
A businessman has a app successfully developed for satellite-pictures of
Gebirgsketten.
mountain-ranges

'A businessman has successfully developed an app for satellite pictures of mountain ranges.'

e. Ein Unternehmer hat eine App für Satellitenbilder von Gebirgsketten mit viel
A businessman has a app for satellite-pictures of mountain-ranges with much
Erfolg entwickelt.
success developed

f. Ein Unternehmer hat eine App mit viel Erfolg entwickelt für Satellitenbilder
A businessman has a app with much success developed for satellite-pictures
von Gebirgsketten.
of mountain-ranges

'A businessman has developed an app for satellite pictures of mountain ranges with much success.'

B.3 Stimuli Experiment 3

In the following, all thirty-six test sentences used in Experiment 3 are given. Each condition comes in a version with an adjacent PP (conditions a, c, and e) and one with an extraposed PP (conditions b, d and f). Furthermore, the conditions differ with regard to length/number of verbs in the intervening material: verb particle (a and b), verb (c and d), and verb and auxiliary (e and f).[1]

(1) a. Die Forscher stellten einen Zusammenhang zwischen gesunder Ernährung
The researchers established a connection between healthy nutrition
und durchschnittlicher Lebenserwartung fest.
and average life-expectancy PART

b. Die Forscher stellten einen Zusammenhang fest zwischen gesunder
The researchers established a connection PART between healthy
Ernährung und durchschnittlicher Lebenserwartung.
nutrition and average life-expectancy

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[1]In cases in which there is no correspondent particle verb in English, the English translation is given with the verb, and the verb particles are glossed as PART.

'The researchers established a connection between healthy nutrition and average life expectancy.'

c. Die Forscher   haben einen Zusammenhang zwischen gesunder Ernährung und
The researchers have   a   connection   between healthy   nutrition   and
durchschnittlicher Lebenserwartung festgestellt.
average   life-expectancy   established

d. Die Forscher   haben einen Zusammenhang festgestellt zwischen gesunder
The researchers have   a   connection   established between   healthy
Ernährung und durchschnittlicher Lebenserwartung.
nutrition   and average   life-expectancy

'The researchers have established a connection between healthy nutrition and average life expectancy.'

e. Die Forscher   sollen   einen Zusammenhang zwischen gesunder Ernährung
The researchers are-supposed a   connection   between healthy   nutrition
und durchschnittlicher Lebenserwartung festgestellt haben.
and average   life-expectancy   established have

f. Die Forscher   sollen   einen Zusammenhang festgestellt haben zwischen
The researchers are-supposed a   connection   established have   between
gesunder Ernährung und durchschnittlicher Lebenserwartung.
healthy nutrition   and average   life-expectancy

'The researchers are supposed to have established a connection between healthy nutrition and average life expectancy.'

(2) a. Der US-Geheimdienst fing   eine Nachricht von einem Doppelagenten aus
The US-secret-service intercepted a   message from a   double-agent   from
Russland ab.
Russia   PART

b. Der US-Geheimdienst fing   eine Nachricht ab   von einem Doppelagenten
The US-secret-service intercepted a   message PART from a   double-agent
aus Russland.
from Russia

'The US secret service intercepted a message from a double agent from Russia.'

c. Der US-Geheimdienst hat eine Nachricht von einem Doppelagenten aus Russland
The US-secret-service has a   message from a   double-agent   from Russia
abgefangen.
intercepted

d. Der US-Geheimdienst hat eine Nachricht abgefangen von einem Doppelagenten
The US-secret-service has a   message intercepted from a   double-agent
aus Russland.
from Russia

'The US secret service has intercepted a message from a double agent from Russia.'

e. Der US-Geheimdienst soll   eine Nachricht von einem Doppelagenten aus
The US-secret-service is-supposed a   message from a   double-agent   from
Russland abgefangen haben.
Russia   intercepted have

f. Der US-Geheimdienst soll   eine Nachricht abgefangen haben von einem
The US-secret-service is-supposed a   message intercepted have   from a

Doppelagenten aus   Russland.
double-agent   from Russia

'The US secret service is supposed to have intercepted a message from a double agent from Russia.'

(3) a. Die Band sagte   ihren Auftritt beim Open-Air-Festival in Wacken ab.
         The band cancelled their gig   at-the open-air-festival   in Wacken PART

     b. Die Band sagte   ihren Auftritt ab   beim Open-Air-Festival in Wacken.
         The band cancelled their gig   PART at-the open-air-festival   in Wacken

         'The band cancelled their gig at the open-air festival in Wacken.'

     c. Die Band hat ihren Auftritt beim Open-Air-Festival in Wacken abgesagt.
         The band has their gig   at-the open-air-festival   in Wacken cancelled

     d. Die Band hat ihren Auftritt abgesagt beim Open-Air-Festival in Wacken.
         The band has their gig   cancelled at-the open-air-festival   in Wacken

         'The band has cancelled their gig at the open-air festival in Wacken.'

     e. Die Band soll   ihren Auftritt beim Open-Air-Festival in Wacken abgesagt
         The band is-supposed their gig   at-the open-air-festival   in Wacken cancelled
         haben.
         have

     f. Die Band soll   ihren Auftritt abgesagt haben beim Open-Air-Festival in
         The band is-supposed their gig   cancelled have at-the open-air-festival   in
         Wacken.
         Wacken

         'The band is supposed to have cancelled their gig at the open-air festival in Wacken.'

(4) a. Die Ärzte   wiesen einen Zusammenhang zwischen Alkoholkonsum   und
         The doctors proved a   connection   between alcohol-consumption and
         Leberversagen nach.
         liver-failure   PART

     b. Die Ärzte   wiesen einen Zusammenhang nach zwischen Alkoholkonsum   und
         The doctors proved a   connection   PART between alcohol-consumption and
         Leberversagen.
         liver-failure

         'The doctors proved a connection between alcohol consumption and liver failure.'

     c. Die Ärzte   haben einen Zusammenhang zwischen Alkoholkonsum   und
         The doctors have a   connection   between alcohol-consumption and
         Leberversagen nachgewiesen.
         liver-failure   proven

     d. Die Ärzte   haben einen Zusammenhang nachgewiesen zwischen
         The doctors have a   connection   proven   between
         Alkoholkonsum   und Leberversagen.
         alcohol-consumption and liver-failure

         'The doctors have proven a connection between alcohol consumption and liver failure.'

     e. Die Ärzte   sollen   einen Zusammenhang zwischen Alkoholkonsum   und
         The doctors are-supposed a   connection   between alcohol-consumption and
         Leberversagen nachgewiesen haben.
         liver-failure   proven   have

    f. Die Ärzte   sollen   einen Zusammenhang nachgewiesen haben zwischen
       The doctors are-supposed a   connection   proven   have between
       Alkoholkonsum   und Leberversagen.
       alcohol-consumption and liver-failure

       'The doctors are supposed to have proven a connection between alcohol consumption
       and liver failure.'

(5)   a. Das Museum stellt   eine Skulptur von einem berühmten Bildhauer aus.
       The museum exhibits a   sculpture of a   famous   sculptor PART

     b. Das Museum stellt   eine Skulptur aus   von einem berühmten Bildhauer.
       The museum exhibits a   sculpture PART of a   famous   sculptor

       'The museum exhibits a sculpture of a famous sculptor.'

     c. Das Museum hat eine Skulptur von einem berühmten Bildhauer ausgestellt.
       The museum has a   sculpture of a   famous   sculptor exhibited

     d. Das Museum hat eine Skulptur ausgestellt von einem berühmten Bildhauer.
       The museum has a   sculpture exhibited of a   famous   sculptor

       'The museum has exhibited a sculpture of a famous sculptor.'

     e. Das Museum soll   eine Skulptur von einem berühmten Bildhauer ausgestellt
       The museum is-supposed a   sculpture of a   famous   sculptor   exhibited
       haben.
       have

     f. Das Museum soll   eine Skulptur ausgestellt haben von einem berühmten
       The museum is-supposed a   sculpture exhibited have of a   famous
       Bildhauer.
       sculptor

       'The museum is supposed to have exhibited a sculpture of a famous sculptor.'

(6)   a. Die Sportlerin sagte ihre Teilnahme   an den nächsten Olympischen Spielen ab.
       The athlete   called her participation at the next   Olympic   Games off

     b. Die Sportlerin sagte ihre Teilnahme   ab an den nächsten Olympischen Spielen.
       The athlete   called her participation off at the next   Olympic   Games

       'The athlete called off her participation in the next Olympic Games.'

     c. Die Sportlerin hat ihre Teilnahme   an den nächsten Olympischen Spielen abgesagt.
       The athlete   has her participation at the next   Olympic   Games called-off

     d. Die Sportlerin hat ihre Teilnahme   abgesagt an den nächsten Olympischen
       The athlete   has her participation called-off at the next   Olympic
       Spielen.
       Games

       'The athlete has called off her participation in the next Olympic Games.'

     e. Die Sportlerin soll   ihre Teilnahme   an den nächsten Olympischen Spielen
       The athlete   is-supposed her participation at the next   Olympic   Games
       abgesagt haben.
       called-off have

     f. Die Sportlerin soll   ihre Teilnahme   abgesagt haben an den nächsten
       The athlete   is-supposed her participation called-off have at the next

Olympischen Spielen.
Olympic   Games
'The athlete is supposed to have called off her participation in the next Olympic Games.'

(7) a. Die Kinder   bliesen Luftballons mit   ihren Namen auf.
        The children blew   balloons   with their names up

     b. Die Kinder   bliesen Luftballons auf mit   ihren Namen.
        The children blew   balloons   up with their names

        'The children blew up balloons with their names (on them).'

     c. Die Kinder   haben Luftballons mit   ihren Namen aufgeblasen.
        The children have   balloons   with their names blown-up

     d. Die Kinder   haben Luftballons aufgeblasen mit   ihren Namen.
        The children have   balloons   blown-up   with their names

        'The children have blown up balloons with their names (on them).'

     e. Die Kinder   sollen   Luftballons mit   ihren Namen aufgeblasen haben.
        The children are-supposed balloons   with their names blown-up   have

     f. Die Kinder   sollen   Luftballons aufgeblasen haben mit   ihren Namen.
        The children are-supposed balloons   blown-up   have   with their names

        'The children are supposed to have blown up balloons with their names (on them).'

(8) a. Juwelendiebe brachen den Tresor mit   dem angeblich   sichersten Schloss der
        Jewel-thieves broke   the safe   with the supposedly safest   lock   of-the
        Welt auf.
        world open

     b. Juwelendiebe brachen den Tresor auf   mit   dem angeblich   sichersten Schloss
        Jewel-thieves broke   the safe   open with the supposedly safest   lock
        der   Welt.
        of-the world

        'Jewel thieves broke open the safe with the supposedly safest lock in the world.'

     c. Juwelendiebe haben den Tresor mit   dem angeblich   sichersten Schloss der
        Jewel-thieves have   the safe   with the supposedly safest   lock   of-the
        Welt aufgebrochen.
        world broken-open

     d. Juwelendiebe haben den Tresor aufgebrochen mit   dem angeblich   sichersten
        Jewel-thieves have   the safe   broken-open   with the supposedly safest
        Schloss der   Welt.
        lock   of-the world

        'Jewel thieves have broken open the safe with the supposedly safest lock in the world.'

     e. Juwelendiebe sollen   den Tresor mit   dem angeblich   sichersten Schloss
        Jewel-thieves are-supposed the safe   with the supposedly safest   lock
        der   Welt   aufgebrochen haben.
        of-the world broken-open   have

     f. Juwelendiebe sollen   den Tresor aufgebrochen haben mit   dem angeblich
        Jewel-thieves are-supposed the safe   broken-open   have   with the supposedly
        sichersten Schloss der   Welt.
        safest   lock   of-the world

'Jewel thieves are supposed to have broken open the safe with the supposedly safest lock in the world.'

(9) a. Ein ehemaliger Metzger macht ein neues Geschäft mit Lebensmitteln für
A former butcher makes a new shop with food-products for
Vegetarier auf.
vegetarians open

b. Ein ehemaliger Metzger macht ein neues Geschäft auf mit Lebensmitteln für
A former butcher makes a new shop open with food-products for
Vegetarier.
vegetarians

'A former butcher opens a new grocery store with food products for vegetarians.'

c. Ein ehemaliger Metzger hat ein neues Geschäft mit Lebensmitteln für Vegetarier
A former butcher has a new shop with food-products for vegetarians
aufgemacht.
open-made

d. Ein ehemaliger Metzger hat ein neues Geschäft aufgemacht mit Lebensmitteln für
A former butcher has a new shop open-made with food-products for
Vegetarier.
vegetarians

'A former butcher has opened a new grocery store with food products for vegetarians.'

e. Ein ehemaliger Metzger soll ein neues Geschäft mit Lebensmitteln für
A former butcher is-supposed a new shop with food-products for
Vegetarier aufgemacht haben.
vegetarians open-made have

f. Ein ehemaliger Metzger soll ein neues Geschäft aufgemacht haben mit
A former butcher is-supposed a new shop open-made have with
Lebensmitteln für Vegetarier.
food-products for vegetarians

'A former butcher is supposed to have opened a new grocery store with food products for vegetarians.'

(10) a. Max rief einen Bekannten aus Berlin an.
Max called a acquaintance from Berlin up

b. Max rief einen Bekannten an aus Berlin.
Max called a acquaintance up from Berlin

'Max called an acquaintance from Berlin.'

c. Max hat einen Bekannten aus Berlin angerufen.
Max has a acquaintance from Berlin called-up

d. Max hat einen Bekannten angerufen aus Berlin.
Max has a acquaintance called-up from Berlin

'Max has called an acquaintance from Berlin.'

e. Max soll einen Bekannten aus Berlin angerufen haben.
Max is-supposed a acquaintance from Berlin called-up have

f. Max soll einen Bekannten angerufen haben aus Berlin.
Max is-supposed a acquaintance called-up have from Berlin

'Max is supposed to have called an acquaintance from Berlin.'

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(11)   a.   Der Englischlehrer fragte   die Vokabeln   aus   der letzten Stunde ab.
             The english-teacher quizzed the vocabulary from the last   lesson   PART

         b.   Der Englischlehrer fragte   die Vokabeln   ab   aus   der letzten Stunde.
             The english-teacher quizzed the vocabulary PART from the last   lesson

             'The English teacher quizzed us about the vocabulary of the last lesson.'

         c.   Der Englischlehrer hat die Vokabeln   aus   der letzten Stunde abgefragt.
             The english-teacher has the vocabulary from the last   lesson   quizzed

         d.   Der Englischlehrer hat die Vokabeln   abgefragt aus   der letzten Stunde.
             The english-teacher has the vocabulary quizzed   from the last   lesson

             'The English teacher has quizzed us about the vocabulary of the last lesson.'

         e.   Der Englischlehrer soll   die Vokabeln aus   der letzten Stunde abgefragt
             The english-teacher is-supposed the vocabulary from the last   lesson   quizzed
             haben.
             have

         f.   Der Englischlehrer soll   die Vokabeln   abgefragt haben aus   der letzten
             The english-teacher is-supposed the vocabulary quizzed   have   from the last
             Stunde.
             lesson

             'The English teacher is supposed to have quizzed us about the vocabulary of the last

             lesson.'

(12)   a.   Die Universität schloss   einen Vertag   über das Nutzungsrecht des   Gebäudes
             The university   concluded a   contract over the usage-rights   of-the building
             ab.
             PART

         b.   Die Universität schloss   einen Vertag   ab   über das Nutzungsrecht des
             The university   concluded a   contract PART over the usage-rights   of-the
             Gebäudes.
             building

             'The university concluded a contract on the usage rights of the building.'

         c.   Die Universität hat einen Vertag   über das Nutzungsrecht des   Gebäudes
             The university   has a   contract over the usage-rights   of-the building
             abgeschlossen.
             concluded

         d.   Die Universität hat einen Vertag   abgeschlossen über das Nutzungsrecht des
             The university   has a   contract concluded   over the usage-rights   of-the
             Gebäudes.
             building

             'The university has concluded a contract on the usage rights of the building.'

         e.   Die Universität soll   einen Vertag   über das Nutzungsrecht des   Gebäudes
             The university   is-supposed a   contract over the usage-rights   of-the building
             abgeschlossen haben.
             concluded   have

         f.   Die Universität soll   einen Vertag   abgeschlossen haben über das
             The university   is-supposed a   contract concluded   have   over the
             Nutzungsrecht des   Gebäudes.
             usage-rights   of-the building

'The university is supposed to have concluded a contract on the usage rights of the building.'

(13) a. Die Lehrerin sammelte das Geld   für den nächsten Klassenausflug ein.
          The teacher   collected the money for the next   class-trip   PART

      b. Die Lehrerin sammelte das Geld   ein   für den nächsten Klassenausflug.
          The teacher   collected the money PART for the next   class-trip
          'The teacher collected the money for the next class trip.'

      c. Die Lehrerin hat das Geld   für den nächsten Klassenausflug eingesammelt.
          The teacher   has the money for the next   class-trip   collected

      d. Die Lehrerin hat das Geld   eingesammelt für den nächsten Klassenausflug.
          The teacher   has the money collected   for the next   class-trip
          'The teacher has collected the money for the next class trip.'

      e. Die Lehrerin soll   das Geld   für den nächsten Klassenausflug eingesammelt
          The teacher   is-supposed the money for the next   class-trip   collected
          haben.
          have

      f. Die Lehrerin soll   das Geld   für   den nächsten Klassenausflug.
          The teacher   is-supposed the money collected have for   the   next

          class-trip
          'The teacher is supposed to have collected the money for the next class trip.'

(14) a. Der Schreiner baute ein Regal für Bücher und DVDs ein.
          The carpenter built a   shelf for books   and DVDs in

      b. Der Schreiner baute ein Regal ein für Bücher und DVDs.
          The carpenter built a   shelf in for books   and DVDs
          'The carpenter installed a shelf for books and DVDs.'

      c. Der Schreiner hat ein Regal für Bücher und DVDs eingebaut.
          The carpenter has a   shelf for books   and DVDs built-in

      d. Der Schreiner hat ein Regal eingebaut für Bücher und DVDs.
          The carpenter has a   shelf built-in   for books   and DVDs
          'The carpenter has installed a shelf for books and DVDs.'

      e. Der Schreiner soll   ein Regal für Bücher und DVDs eingebaut haben.
          The carpenter is-supposed a   shelf for books   and DVDs built-in   have

      f. Der Schreiner soll   ein Regal eingebaut haben für Bücher und DVDs.
          The carpenter is-supposed a   shelf built-in   have for books   and DVDs
          'The carpenter is supposed to have installed a shelf for books and DVDs.'

(15) a. Die Polizei hörte ein Gespräch   zwischen zwei Verdächtigen ab.
          The police heard a   conversation between two suspects   PART

      b. Die Polizei hörte ein Gespräch   ab   zwischen zwei Verdächtigen.
          The police heard a   conversation PART between two suspects
          'The police tapped a conversation between two suspects.'

      c. Die Polizei hat ein Gespräch   zwischen zwei Verdächtigen abgehört.
          The police has a   conversation between two suspects   PART-heard

    d. Die Polizei hat ein Gespräch   abgehört   zwischen zwei Verdächtigen.
       The police has a   conversation PART-heard between two   suspects

       'The police has tapped a conversation between two suspects.'

    e. Die Polizei soll   ein Gespräch   zwischen zwei Verdächtigen abgehört
       The police is-supposed a   conversation between two suspects   PART-heard
       haben.
       have

    f. Die Polizei soll   ein Gespräch   abgehört   haben zwischen zwei
       The police is-supposed a   conversation PART-heard have   between two
       Verdächtigen.
       suspects

       'The police is supposed to have tapped a conversation between two suspects.'

(16)   a. Der Fernsehsender blendete Werbung   für eine neue Quiz-Sendung ein.
       The TV-station   showed promotion for a   new quiz-show   PART

    b. Der Fernsehsender blendete Werbung ein   für eine neue Quiz-Sendung.
       The TV-station   showed promotion PART for a   new quiz-show

       'The TV station showed a promotion for a new quiz show.'

    c. Der Fernsehsender hat Werbung   für eine neue Quiz-Sendung eingeblendet.
       The TV-station   has promotion for a   new quiz-show   showed

    d. Der Fernsehsender hat Werbung   eingeblendet für eine neue Quiz-Sendung.
       The TV-station   has promotion showed   for a   new quiz-show

       'The TV station has showed a promotion for a new quiz show.'

    e. Der Fernsehsender soll   Werbung für eine neue Quiz-Sendung eingeblendet
       The TV-station   is-supposed promotion for a   new quiz-show   showed
       haben.
       have

    f. Der Fernsehsender soll   Werbung eingeblendet haben für eine neue
       The TV-station   is-supposed promotion showed   have for a   new
       Quiz-Sendung.
       quiz-show

       'The TV station is supposed to have showed a promotion for a new quiz show.'

(17)   a. Das Hotel richtete ein Zimmer für die Gäste aus Japan her.
       The hotel prepared a   room   for the guests from Japan PART

    b. Das Hotel richtete ein Zimmer her   für die Gäste aus Japan.
       The hotel prepared a   room   PART for the guests from Japan

       'The hotel prepared a room for the guests from Japan.'

    c. Das Hotel hat ein Zimmer für die Gäste aus Japan hergerichtet.
       The hotel has a   room   for the guests from Japan prepared

    d. Das Hotel hat ein Zimmer hergerichtet für die Gäste aus Japan.
       The hotel has a   room   prepared   for the guests from Japan

       'The hotel has prepared a room for the guests from Japan.'

    e. Das Hotel soll   ein Zimmer für die Gäste aus Japan hergerichtet haben.
       The hotel is-supposed a   room   for the guests from Japan prepared   have

    f. Das Hotel soll   ein Zimmer hergerichtet haben für die Gäste aus Japan.
       The hotel is-supposed a   room   prepared   have   for the guests from Japan

'The hotel is supposed to have prepared a room for the guests from Japan.'

(18) a. Die Prüfer   legten   ihren Bericht über die Sicherheit von Spielplätzen vor.
The inspectors presented their report about the safety   of playgrounds PART

b. Die Prüfer   legten   ihren Bericht vor über die Sicherheit von Spielplätzen.
The inspectors presented their report PART about the safety   of   playgrounds

'The inspectors presented their report about the safety of playgrounds.'

c. Die Prüfer   haben ihren Bericht über die Sicherheit von Spielplätzen vorgelegt.
The inspectors have   their report about the safety   of playgrounds presented

d. Die Prüfer   haben ihren Bericht vorgelegt über die Sicherheit von Spielplätzen.
The inspectors have   their report presented about the safety   of   playgrounds

'The inspectors have presented their report about the safety of playgrounds.'

e. Die Prüfer   sollen   ihren Bericht über die Sicherheit von Spielplätzen
The inspectors are-supposed their report about the safety   of   playgrounds
vorgelegt haben.
presented have

f. Die Prüfer   sollen   ihren Bericht vorgelegt haben über die Sicherheit von
The inspectors are-supposed their report   presented have about the safety   of
Spielplätzen.
playgrounds

'The inspectors are supposed to have presented their report about the safety of playgrounds.'

(19) a. Der ADAC schleppte ein Auto mit einem kaputten Reifen ab.
The ADAC towed   a   car with a   broken tire   away

b. Der ADAC schleppte ein Auto ab   mit einem kaputten Reifen.
The ADAC towed   a   car away with a   broken   tire

'The ADAC (German automobile association) towed away a car with a broken tire.'

c. Der ADAC hat ein Auto mit einem kaputten Reifen abgeschleppt.
The ADAC has a   car with a   broken tire   towed-away

d. Der ADAC hat ein Auto abgeschleppt mit einem kaputten Reifen.
The ADAC has a   car towed-away   with a   broken tire

'The ADAC (German automobile association) has towed away a car with a broken tire.'

e. Der ADAC soll   ein Auto mit einem kaputten Reifen abgeschleppt haben.
The ADAC is-supposed a   car with a   broken tire   towed-away   have

f. Der ADAC soll   ein Auto abgeschleppt haben mit einem kaputten Reifen.
The ADAC is-supposed a   car towed-away   have with a   broken tire

'The ADAC (German automobile association) is supposed to have towed away a car with a broken tire.'

(20) a. Die Gewerkschaft weitete   den Streik für kürzere Arbeitszeiten   aus.
The trade-union   extended the strike for shorter working-hours PART

b. Die Gewerkschaft weitete   den Streik aus   für kürzere Arbeitszeiten.
The trade-union   extended the strike PART for shorter working-hours

'The trade union extended the strike for shorter working hours.'

    c. Die Gewerkschaft hat den Streik für kürzere Arbeitszeiten   ausgeweitet.
       The trade-union   has the strike for shorter working-hours extended

    d. Die Gewerkschaft hat den Streik ausgeweitet für kürzere Arbeitszeiten.
       The trade-union   has the strike extended   for shorter working-hours

       'The trade union has extended the strike for shorter working hours.'

    e. Die Gewerkschaft soll   den Streik für kürzere Arbeitszeiten   ausgeweitet
       The trade-union   is-supposed the strike for shorter working-hours extended
       haben.
       have

    f. Die Gewerkschaft soll   den Streik ausgeweitet haben für kürzere
      The trade-union   is-supposed the strike extended   have   for shorter
      Arbeitszeiten.
      working-hours

      'The trade union is supposed to have extended the strike for shorter working hours.'

(21) a. Der Sportler stellte einen neuen Rekord im   100-Meter-Lauf auf.
       The athlete set   a   new   record in-the 100-metre-run PART

    b. Der Sportler stellte einen neuen Rekord auf   im   100-Meter-Lauf.
       The athlete set   a   new   record PART in-the 100-metre-run

       'The athlete set a new record over 100 metres.'

    c. Der Sportler hat einen neuen Rekord im   100-Meter-Lauf aufgestellt.
       The athlete   has a   new   record in-the 100-metre-run   set

    d. Der Sportler hat einen neuen Rekord aufgestellt im   100-Meter-Lauf.
       The athlete   has a   new   record set   in-the 100-metre-run

       'The athlete has set a new record over 100 metres.'

    e. Der Sportler soll   einen neuen Rekord im   100-Meter-Lauf aufgestellt
       The athlete is-supposed a   new   record in-the 100-metre-run   set
       haben.
       have

    f. Der Sportler soll   einen neuen Rekord aufgestellt haben im
       The athlete is-supposed a   new   record set   have   in-the
      100-Meter-Lauf.
      100-metre-run

      'The athlete is supposed to have set a new record over 100 metres.'

(22) a. Anna suchte sich   ein neues Kleid für den Abschlussball aus.
       Anna picked herself a   new   dress for the prom   out

    b. Anna suchte sich   ein neues Kleid aus für den Abschlussball.
       Anna picked herself a   new   dress out for the prom

       'Anna picked a new dress for the prom.'

    c. Anna hat sich   ein neues Kleid für den Abschlussball ausgesucht.
       Anna has herself a   new   dress for the prom   picked-out

    d. Anna hat sich   ein neues Kleid ausgesucht für den Abschlussball.
       Anna has herself a   new   dress picked-out for the prom

       'Anna has picked a new dress for the prom.'

    e. Anna soll   sich   ein neues Kleid für den Abschlussball ausgesucht haben.
       Anna is-supposed herself a   new   dress for the prom   picked-out have

f. Anna soll   sich   ein neues Kleid ausgesucht haben für den Abschlussball.
Anna is-supposed herself a   new   dress picked-out have   for the   prom
'Anna is supposed to have picked a new dress for the prom.'

(23)   a. Maria las   ein Buch von einem berühmten Schriftsteller vor.
Maria read a   book by a   famous   writer   PART

b. Maria las   ein Buch vor   von einem berühmten Schriftsteller.
Maria read a   book PART by a   famous   writer
'Maria read (out loud) a book by a famous writer.'

c. Maria hat ein Buch von einem berühmten Schriftsteller vorgelesen.
Maria has a   book by a   famous   writer   read

d. Maria hat ein Buch vorgelesen von einem berühmten Schriftsteller.
Maria has a   book read   by a   famous   writer
'Maria has read (out loud) a book by a famous writer.'

e. Maria soll   ein Buch von einem berühmten Schriftsteller vorgelesen haben.
Maria is-supposed a   book by a   famous   writer   read   have

f. Maria soll   ein Buch vorgelesen haben von einem berühmten Schriftsteller.
Maria is-supposed a   book read   have by a   famous   writer
'Maria is supposed to have read (out loud) a book by a famous writer.'

(24)   a. Ein Beamter hielt   die Aussagen von allen Zeugen   der   Tat fest.
A   official   recorded the statements of all   witnesses of-the act PART

b. Ein Beamter hielt   die Aussagen fest von allen Zeugen   der   Tat.
A   official   recorded the statements PART of all   witnesses of-the act
'An official recorded the statements (made) by all the witnesses of the (criminal) act.'

c. Ein Beamter hat die Aussagen von allen Zeugen   der   Tat festgehalten.
A   official   has the statements of all   witnesses of-the act recorded

d. Ein Beamter hat die Aussagen festgehalten von allen Zeugen   der   Tat.
A   official   has the statements recorded   of all   witnesses of-the act
'An official has recorded the statements (made) by all the witnesses of the (criminal) act.'

e. Ein Beamter soll   die Aussagen von allen Zeugen   der   Tat festgehalten
A   official   is-supposed the statements of all   witnesses of-the act recorded
haben.
have

f. Ein Beamter soll   die Aussagen festgehalten haben von allen Zeugen
A   official   is-supposed the statements recorded   have of all   witnesses
der   Tat.
of-the act
'An official is supposed to have recorded the statements (made) by all the witnesses of
the (criminal) act.'

(25)   a. Die Studentin brach ihr Studium   in Geschichte und Soziologie ab.
The student   broke her course-of-studies in history   and sociology off

b. Die Studentin brach ihr Studium   ab in Geschichte und Soziologie.
The student   broke her course-of-studies off in history   and sociology
'The (female) student dropped out of her studies in history and sociology.'

    c. Die Studentin hat ihr Studium in Geschichte und Soziologie abgebrochen.
         The student has her course-of-studies in history and sociology broken-off

    d. Die Studentin hat ihr Studium abgebrochen in Geschichte und Soziologie.
         The student has her course-of-studies broken-off in history and sociology
         'The (female) student has dropped out of her studies in history and sociology.'

    e. Die Studentin soll ihr Studium in Geschichte und Soziologie
         The student is-supposed her course-of-studies in history and sociology
         abgebrochen haben.
         broken-off have

    f. Die Studentin soll ihr Studium abgebrochen haben in Geschichte
         The student is-supposed her course-of-studies broken-off have in history
         und Soziologie.
         and sociology
         'The (female) student is supposed to have dropped out of her studies in history and sociology.'

(26) a. Die Schatzsucher gruben eine Kiste mit Diamanten und Goldmünzen aus.
         The treasure-hunters dug a chest with diamonds and gold-coins out

    b. Die Schatzsucher gruben eine Kiste aus mit Diamanten und Goldmünzen.
         The treasure-hunters dug a chest out with diamonds and gold-coins
         'The treasure hunters dug out a chest with diamonds and gold coins.'

    c. Die Schatzsucher haben eine Kiste mit Diamanten und Goldmünzen
         The treasure-hunters have a chest with diamonds and gold-coins
         ausgegraben.
         dug-out

    d. Die Schatzsucher haben eine Kiste ausgegraben mit Diamanten und
         The treasure-hunters have a chest dug-out with diamonds and
         Goldmünzen.
         gold-coins
         'The treasure hunters have dug out a chest with diamonds and gold coins.'

    e. Die Schatzsucher sollen eine Kiste mit Diamanten und Goldmünzen
         The treasure-hunters are-supposed a chest with diamonds and gold-coins
         ausgegraben haben.
         dug-out have

    f. Die Schatzsucher sollen eine Kiste ausgegraben haben mit Diamanten
         The treasure-hunters are-supposed a chest dug-out have with diamonds
         und Goldmünzen.
         and gold-coins
         'The treasure hunters are supposed to have dug out a chest with diamonds and gold coins.'

(27) a. Das Rote Kreuz richtete eine Beratungsstelle für chronisch kranke Menschen
         The red cross set a counselling-centre for chronically sick people
         ein.
         up

b. Das Rote Kreuz richtete eine Beratungsstelle   ein für chronisch   kranke
   The red   cross set   a   counselling-centre up for chronically sick
   Menschen.
   people
   'The Red Cross set up a counselling centre for chronically sick people.'

c. Das Rote Kreuz hat eine Beratungsstelle   für chronisch   kranke Menschen
   The red   cross has a   counselling-centre for chronically sick   people
   eingerichtet.
   set-up

d. Das Rote Kreuz hat eine Beratungsstelle   eingerichtet für chronisch   kranke
   The red   cross has a   counselling-centre set-up   for chronically sick
   Menschen.
   people
   'The Red Cross has set up a counselling centre for chronically sick people.'

e. Das Rote Kreuz soll   eine Beratungsstelle   für chronisch   kranke
   The red   cross is-supposed a   counselling-centre for chronically sick
   Menschen eingerichtet haben.
   people   set-up   have

f. Das Rote Kreuz soll   eine Beratungsstelle   eingerichtet haben für
   The red   cross is-supposed a   counselling-centre set-up   have for
   chronisch   kranke Menschen.
   chronically sick   people

   'The Red Cross is supposed to have set up a counselling centre for chronically sick
   people.'

(28) a. Unbekannte   brannten eine Bibliothek mit mehr als   zehntausend Büchern
        Unknown-persons burned   a   library   with more than ten-thousand books
        ab.
        down

     b. Unbekannte   brannten eine Bibliothek ab   mit mehr als   zehntausend
        Unknown-persons burned   a   library   down with more than ten-thousand
        Büchern.
        books
        'Unknown persons burned down a library with more than ten thousand books.'

     c. Unbekannte   haben eine Bibliothek mit mehr als   zehntausend Büchern
        Unknown-persons have a   library   with more than ten-thousand books
        abgebrannt.
        burned-down

     d. Unbekannte   haben eine Bibliothek abgebrannt   mit mehr als   zehntausend
        Unknown-persons have a   library   burned-down with more than ten-thousand
        Büchern.
        books
        'Unknown persons have burned down a library with more than ten thousand books.'

     e. Unbekannte   sollen   eine Bibliothek mit mehr als   zehntausend
        Unknown-persons are-supposed a   library   with more than ten-thousand
        Büchern abgebrannt   haben.
        books   burned-down have

    f. Unbekannte   sollen   eine Bibliothek abgebrannt haben mit mehr als
       Unknown-persons are-supposed a   library   burned-down have with more than
       zehntausend Büchern.
       ten-thousand books

       'Unknown persons are supposed to have burned down a library with more than ten

       thousand books.'

(29)   a. Die Polizei griff   in einen Streit   zwischen zwei betrunkenen Fussballfans
       The police intervened in a   quarrel between two   drunk   football-fans
       ein.
       PART

    b. Die Polizei griff   in einen Streit ein   zwischen zwei betrunkenen
       The police intervened in a   quarrel PART between two   drunk
       Fussballfans.
       football-fans

       'The police intervened in a quarrel between two drunk football fans.'

    c. Die Polizei hat in einen Streit   zwischen zwei betrunkenen Fussballfans
       The police has in a   quarrel between two   drunk   football-fans
       eingegriffen.
       intervened

    d. Die Polizei hat in einen Streit   eingegriffen zwischen zwei betrunkenen
       The police has in a   quarrel intervened   between two   drunk
       Fussballfans.
       football-fans

       'The police has intervened in a quarrel between two drunk football fans.'

    e. Die Polizei soll   in einen Streit   zwischen zwei betrunkenen Fussballfans
       The police is-supposed in a   quarrel between two   drunk   football-fans
       eingegriffen haben.
       intervened   have

    f. Die Polizei soll   in einen Streit   eingegriffen haben zwischen zwei
       The police is-supposed in a   quarrel intervened   have   between two
       betrunkenen Fussballfans.
       drunk   football-fans intervened have

       'The police is supposed to have intervened in a quarrel between two drunk football

       fans.'

(30)   a. Die Lehrerin schlug   ein neues Konzept für den Unterricht in der Oberstufe vor.
       The teacher proposed a   new   concept for the lessons   in the sixth-form PART

    b. Die Lehrerin schlug   ein neues Konzept vor   für den Unterricht in der Oberstufe.
       The teacher proposed a   new   concept PART for the lessons   in the sixth-form

       'The teacher proposed a new concept for the lessons in sixth form.'

    c. Die Lehrerin hat ein neues Konzept für den Unterricht in der Oberstufe
       The teacher has a   new   concept for the lessons   in the sixth-form
       vorgeschlagen.
       proposed

    d. Die Lehrerin hat ein neues Konzept vorgeschlagen für den Unterricht in der
       The teacher has a   new   concept proposed   for the lessons   in the
       Oberstufe.
       sixth-form

'The teacher has proposed a new concept for the lessons in sixth form.'

e. Die Lehrerin soll   ein neues Konzept für den Unterricht in der Oberstufe
The teacher is-supposed a   new   concept for the lessons   in the sixth-form
vorgeschlagen haben.
proposed   have

f. Die Lehrerin soll   ein neues Konzept vorgeschlagen haben für den Unterricht
The teacher is-supposed a   new   concept proposed   have   for the lessons
in der Oberstufe.
in the sixth-form

'The teacher is supposed to have proposed a new concept for the lessons in sixth form.'

(31) a. Die kranke Frau   suchte   einen Spezialisten für Atemwegserkrankungen auf.
The sick   woman consulted a   specialist   for respiratory-diseases   PART

b. Die kranke Frau   suchte   einen Spezialisten auf   für Atemwegserkrankungen.
The sick   woman consulted a   specialist   PART for respiratory-diseases

'The sick woman consulted a specialist for respiratory diseases.'

c. Die kranke Frau   hat einen Spezialisten für Atemwegserkrankungen aufgesucht.
The sick   woman has a   specialist   for respiratory-diseases   consulted

d. Die kranke Frau   hat einen Spezialisten aufgesucht für Atemwegserkrankungen.
The sick   woman has a   specialist   consulted   for respiratory-diseases

'The sick woman has consulted a specialist for respiratory diseases.'

e. Die kranke Frau   soll   einen Spezialisten für Atemwegserkrankungen
The sick   woman is-supposed a   specialist   for respiratory-diseases
aufgesucht haben.
consulted   have

f. Die kranke Frau   soll   einen Spezialisten aufgesucht haben für
The sick   woman is-supposed a   specialist   consulted have   for
Atemwegserkrankungen.
respiratory-diseases

'The sick woman is supposed to have consulted a specialist for respiratory diseases.'

(32) a. Die Regierungen tauschten   Informationen über   mögliche Attentate aus.
The governments exchanged information   about possible   attacks   PART

b. Die Regierungen tauschten   Informationen aus   über   mögliche Attentate.
The governments exchanged information   PART about possible   attacks

'The governments exchanged information about possible attacks.'

c. Die Regierungen haben Informationen über   mögliche Attentate ausgetauscht.
The governments have   information   about possible   attacks   exchanged

d. Die Regierungen haben Informationen ausgetauscht über   mögliche Attentate.
The governments have   information   exchanged   about possible   attacks

'The governments have exchanged information about possible attacks.'

e. Die Regierungen sollen   Informationen über   mögliche Attentate
The governments are-supposed information   about possible   attacks
ausgetauscht haben.
exchanged   have

f. Die Regierungen sollen   Informationen ausgetauscht haben über   mögliche
The governments are-supposed information   exchanged   have   about possible
Attentate.
attacks
'The governments are supposed to have exchanged information about possible

attacks.'

(33)   a. Der Läufer füllte ein Formular für die Teilnahme   am   Marathon aus.
The runner filled a   form   for the participation at-the marathon out

b. Der Läufer füllte ein Formular aus für die Teilnahme   am   Marathon.
The runner filled a   form   out for the participation at-the marathon
'The runner filled out a form for the participation in the marathon.'

c. Der Läufer hat ein Formular für die Teilnahme   am   Marathon ausgefüllt.
The runner has a   form   for the participation at-the marathon filled-out

d. Der Läufer hat ein Formular ausgefüllt für die Teilnahme   am   Marathon.
The runner has a   form   filled-out for the participation at-the marathon
'The runner has filled out a form for the participation in the marathon.'

e. Der Läufer soll   ein Formular für die Teilnahme   am   Marathon ausgefüllt
The runner is-supposed a   form   for the participation at-the marathon filled-out
haben.
have

f. Der Läufer soll   ein Formular ausgefüllt haben für die Teilnahme   am
The runner is-supposed a   form   filled-out have   for the participation at-the
Marathon.
marathon
'The runner is supposed to have filled out a form for the participation in the marathon.'

(34)   a. Die Polizei geht   einem Hinweis auf mögliche Komplizen des   Bankräubers
The police follows a   lead   on possible accomplices of-the bank-robber
nach.
PART

b. Die Polizei geht   einem Hinweis nach auf mögliche Komplizen   des
The police follows a   lead   PART on possible accomplices of-the
Bankräubers.
bank-robber
'The police is following a lead about possible accomplices of the bank robber.'

c. Die Polizei ist einem Hinweis auf mögliche Komplizen des   Bankräubers
The police is a   lead   on possible accomplices of-the bank-robber
nachgegangen.
followed

d. Die Polizei ist einem Hinweis nachgegangen auf mögliche Komplizen   des
The police is a   lead   followed   on possible accomplices of-the
Bankräubers.
bank-robber
'The police has followed a lead about possible accomplices of the bank robber.'

e. Die Polizei soll   einem Hinweis auf mögliche Komplizen des
The police is-supposed a   lead   on possible accomplices of-the
Bankräubers nachgegangen sein.
bank-robber followed   be

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    f. Die Polizei soll   einem Hinweis nachgegangen sein auf mögliche
      The police is-supposed a   lead   followed   be on possible
      Komplizen des   Bankräubers.
      accomplices of-the bank-robber

      'The police is supposed to have followed a lead about possible accomplices of the
      bank robber.'

(35)   a. Der Bote   lieferte   ein Paket mit Geschenken für die Kinder aus.
      The courier delivered a   parcel with presents   for the children PART

    b. Der Bote   lieferte   ein Paket aus   mit Geschenken für die Kinder.
      The courier delivered a   parcel PART with presents   for the children

      'The courier delievered a parcel with presents for the children.'

    c. Der Bote   hat ein Paket mit Geschenken für die Kinder ausgeliefert.
      The courier has a   parcel with presents   for the children delivered

    d. Der Bote   hat ein Paket ausgeliefert mit Geschenken für die Kinder.
      The courier has a   parcel delivered   with presents   for the children

      'The courier has delievered a parcel with presents for the children.'

    e. Der Bote   soll   ein Paket mit Geschenken für die Kinder ausgeliefert
      The courier is-supposed a   parcel with presents   for the children delivered
      haben.
      have

    f. Der Bote   soll   ein Paket ausgeliefert haben mit Geschenken für die
      The courier is-supposed a   parcel delivered   have   with presents   for the
      Kinder.
      children

      'The courier is supposed to have delievered a parcel with presents for the children.'

(36)   a. Die Theatergruppe führte   ein Stück über das wahre Leben von Shakespeare
      The theatre-group performed a   play about the true   life   of Shakespeare
      auf.
      PART

    b. Die Theatergruppe führte   ein Stück auf   über das wahre Leben von
      The theatre-group performed a   play PART about the true   life   of
      Shakespeare.
      Shakespeare

      'The theatre group performed a play about the true life of Shakespeare.'

    c. Die Theatergruppe hat ein Stück über das wahre Leben von Shakespeare
      The theatre-group has a   play about the true   life   of Shakespeare
      aufgeführt.
      performed

    d. Die Theatergruppe hat ein Stück aufgeführt über das wahre Leben von
      The theatre-group has a   play performed about the true   life   of
      Shakespeare.
      Shakespeare

      'The theatre group has performed a play about the true life of Shakespeare.'

    e. Die Theatergruppe soll   ein Stück über das wahre Leben von Shakespeare
      The theatre-group is-supposed a   play about the true   life   of   Shakespeare
      aufgeführt haben.
      performed have

f. Die Theatergruppe soll ein Stück aufgeführt haben über das wahre Leben
The theatre-group is-supposed a play performed have about the true life
von Shakespeare.
of Shakespeare performed have
'The theatre group is supposed to have performed a play about the true life of Shakespeare.'

B.4 Stimuli Experiment 4

In the following, all twenty-four test sentences used in Experiment 4 are given. The conditions differ with regard to the type of the constituent, which is either a prepositional phrase (conditions a and b), or a relative clause (conditions c and d). Furthermore, each constituent type comes in an adjacent (conditions a and c) and in an extraposed (conditions b and d) version. In all cases, the intervening material consists of a verb particle.[2]

(1) a. Der US-Geheimdienst fing eine Nachricht von einem Doppelagenten aus
The US-secret-service intercepted a message from a double-agent from
Russland ab.
Russia PART

b. Der US-Geheimdienst fing eine Nachricht ab von einem Doppelagenten
The US-secret-service intercepted a message PART from a double-agent
aus Russland.
from Russia
'The US secret service intercepted a message from a double agent from Russia.'

c. Der US-Geheimdienst fing eine Nachricht, die von einem Agenten aus
The US-secret-service intercepted a message which from a agent from
Russland stammt, ab.
Russia originates PART

d. Der US-Geheimdienst fing eine Nachricht ab, die von einem Agenten
The US-secret-service intercepted a message PART which from a agent
aus Russland stammt.
from Russia originates
'The US secret service intercepted a message, which originates from an agent from Russia.'

(2) a. Die Band sagte den Auftritt beim Open-Air-Festival in Wacken ab.
The band cancelled the gig at-the open-air-festival in Wacken PART

b. Die Band sagte den Auftritt ab beim Open-Air-Festival in Wacken.
The band cancelled the gig PART at-the open-air-festival in Wacken
'The band cancelled the gig at the open-air festival in Wacken.'

c. Die Band sagte den Auftritt, der beim Musik-Festival geplant war, ab.
The band cancelled the gig which at-the music-festival planned was PART

d. Die Band sagte den Auftritt ab, der beim Musik-Festival geplant war.
The band cancelled the gig PART which at-the music-festival planned was
'The band cancelled the gig, which was planned at the music festival in Wacken.'

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[2]In cases in which there is no correspondent particle verb in English, the English translation is given with the verb, and the verb particles are glossed as PART.

(3) a. Die Ärzte   wiesen erstmals   den Zusammenhang zwischen
The doctors proved for-the-first-time the connection   between
Alkoholkonsum   und tödlichem Leberversagen nach.
alcohol-consumption and fatal   liver-failure   PART

b. Die Ärzte   wiesen erstmals   den Zusammenhang nach zwischen
The doctors proved for-the-first-time the connection   PART between
Alkoholkonsum   und tödlichem Leberversagen.
alcohol-consumption and fatal   liver-failure

'For the first time, doctors proved the connection between alcohol consumption and
fatal liver failure.'

c. Die Ärzte   wiesen erstmals   den Zusammenhang, der   zwischen
The doctors proved for-the-first-time the connection   which between
Alkoholkonsum   und Leberversagen besteht, nach.
alcohol-consumption and liver-failure   exists   PART

d. Die Ärzte   wiesen erstmals   den Zusammenhang nach, der   zwischen
The doctors proved for-the-first-time the connection   PART which between
Alkoholkonsum   und Leberversagen besteht.
alcohol-consumption and liver-failure   exists

'For the first time, doctors proved the connection, which exists between alcohol
consumption and liver failure.'

(4) a. Das Museum stellt   eine Skulptur von einem weltweit   bekannten Bildhauer
The museum exhibits a   sculpture of a   world-wide known   sculptor
aus.
PART

b. Das Museum stellt   eine Skulptur aus   von einem weltweit   bekannten
The museum exhibits a   sculpture PART of a   world-wide known
Bildhauer.
sculptor

'The museum exhibits a sculpture of a world-renowned sculptor.'

c. Das Museum stellt   eine Skulptur, die   von einem bekannten Bildhauer
The museum exhibits a   sculpture which of a   known   sculptor
stammt,   aus.
comesPART

d. Das Museum stellt   eine Skulptur aus, die   von einem bekannten Bildhauer
The museum exhibits a   sculpture PART which of a   known   sculptor
stammt.
comes

'The museum exhibits a sculpture, which was made by a known sculptor.'

(5) a. Juwelendiebe brachen den Tresor mit dem wohl   sichersten Schloss der
Jewel-thieves broke   the safe   with the supposedly safest   lock   of-the
Welt   auf.
world open

b. Juwelendiebe brachen den Tresor auf   mit dem wohl   sichersten Schloss
Jewel-thieves broke   the safe   open with the supposedly safest   lock
der   Welt .
of-the world

'Jewel thieves broke open the safe with the supposedly safest lock in the world.'

    c. Juwelendiebe brachen den Tresor, der   das sicherste Schloss der   Welt hat, auf.
       Jewel-thieves broke   the safe   which the safest   lock   of-the world has open

    d. Juwelendiebe brachen den Tresor auf,   der   das sicherste Schloss der   Welt hat.
       Jewel-thieves broke   the safe   open which the safest   lock   of-the world has
       'Jewel thieves broke open the safe, which has the safest lock in the world.'

(6)   a. Die Polizei hörte ein Gespräch   zwischen zwei Tatverdächtigen ab.
       The police heard a   conversation between two   suspects   PART

    b. Die Polizei hörte ein Gespräch   ab   zwischen zwei Tatverdächtigen.
       The police heard a   conversation PART between two   suspects
       'The police tapped a conversation between two suspects.'

    c. Die Polizei hörte ein Gespräch,   das   zwei Verdächtige führten, ab.
       The police heard a   conversation which two   suspects   led   PART

    d. Die Polizei hörte ein Gespräch   ab,   das   zwei Verdächtige führten.
       The police heard a   conversation PART which two   suspects   led
       'The police tapped a conversation, which two suspects were having.'

(7)   a. Der ADAC schleppte ein Auto mit   einem total   kaputten Reifen ab.
       The ADAC towed   a   car with a   totally broken tire   away

    b. Der ADAC schleppte ein Auto ab   mit einem total   kaputten Reifen.
       The ADAC towed   a   car away with a   totally broken tire
       'The ADAC (German automobile association) towed away a car with a totally broken
       tire.'

    c. Der ADAC schleppte ein Auto, das   einen kaputten Reifen hatte, ab.
       The ADAC towed   a   car which a   broken tire   had   away

    d. Der ADAC schleppte ein Auto ab,   das   einen kaputten Reifen hatte.
       The ADAC towed   a   car away which a   broken tire   had
       'The ADAC (German automobile association) towed away a car, which had a broken
       tire.'

(8)   a. Anna suchte sich   ein Kleid für den Abschlussball nächste Woche aus.
       Anna picked herself a   dress for the prom   next   week   out

    b. Anna suchte sich   ein Kleid aus für den Abschlussball nächste Woche.
       Anna picked herself a   dress out for the prom   next   week
       'Anna picked out a dress for the prom next week.'

    c. Anna suchte sich   ein Kleid, das   sie beim Abschlussball tragen wird, aus.
       Anna picked herself a   dress which she at-the prom   wear will out

    d. Anna suchte sich   ein Kleid aus, das   sie beim Abschlussball tragen wird.
       Anna picked herself a   dress out which she at-the prom   wear will
       'Anna picked out a dress, which she will wear at the prom.'

(9)   a. Ein Metzger macht ein Geschäft mit Lebensmitteln für Vegetarier auf.
       A butcher makes a   shop   with food-products for vegetarians open

    b. Ein Metzger macht ein Geschäft auf   mit Lebensmitteln für Vegetarier.
       A butcher makes a   shop   open with food-products for vegetarians
       'A butcher opens a grocery store with food products for vegetarians.'

    c. Ein Metzger macht ein Geschäft, das   Produkte für Vegetarier führt, auf.
       A   butcher makes a   shop   which products for vegetarians keeps open

    d. Ein Metzger macht ein Geschäft auf, das   Produkte für Vegetarier führt.
       A   butcher makes a   shop   open which products for vegetarians keeps
       'A butcher opens a grocery store, which offers products for vegetarians.'

(10)   a. Der Lehrer fragte die Vokabeln aus der letzten Englischstunde ab.
        The teacher quizzed the vocabulary from the last   english-lesson PART

    b. Der Lehrer fragte die Vokabeln ab   aus der letzten Englischstunde.
       The teacher quizzed the vocabulary PART from the last   english-lesson
       'The teacher quizzed us about the vocabulary of the last English lesson.'

    c. Der Lehrer fragte die Vokabeln, die   in der Stunde drankamen, ab.
       The teacher quizzed the vocabulary which in the lesson be-mentioned PART

    d. Der Lehrer fragte die Vokabeln ab, die   in der Stunde drankamen.
       The teacher quizzed the vocabulary PART which in the lesson be-mentioned
       'The teacher quizzed us about the vocabulary, which was part of the lesson.'

(11)   a. Das Hotel richtete das Zimmer für die wohlhabenden Gäste aus Japan her.
        The hotel prepared the room   for the wealthy   guests from Japan PART

    b. Das Hotel richtete das Zimmer her   für die wohlhabenden Gäste aus Japan.
       The hotel prepared the room   PART for the wealthy   guests from Japan
       'The hotel prepared the room for the wealthy guests from Japan.'

    c. Das Hotel richtete das Zimmer, das   die Gäste aus Japan gebucht hatten, her.
       The hotel prepared the room   which the guests from Japan booked had   PART

    d. Das Hotel richtete das Zimmer her, das   die Gäste aus Japan gebucht hatten.
       The hotel prepared the room   PART which the guests from Japan booked had
       'The hotel prepared the room, which the guests from Japan had booked.'

(12)   a. Die Universität schloss   einen Vertag über das Nutzungsrecht der   Gebäude
        The university concluded a   contract over the usage-rights   of-the buildings
        ab.
        PART

    b. Die Universität schloss   einen Vertag ab   über das Nutzungsrecht der
       The university concluded a   contract PART over the usage-rights   of-the
       Gebäude.
       buildings
       'The university concluded a contract on the usage rights of the buildings.'

    c. Die Universität schloss   einen Vertag, der   die Nutzung der   Gebäude
       The university concluded a   contract which the usage   of-the buildings
       regelt,   ab.
       regulates PART

    d. Die Universität schloss   einen Vertag ab, der   die Nutzung der   Gebäude
       The university concluded a   contract PART which the usage   of-the buildings
       regelt.
       regulates
       'The university concluded a contract, which regulates the usage of the buildings.'

(13)   a.   Die Prüfer   legten   ihren Bericht über   die Sicherheit von Spielplätzen vor.
               The inspectors presented their report   about the safety   of   playgrounds PART

           b.   Die Prüfer   legten   ihren Bericht vor   über   die Sicherheit von Spielplätzen.
               The inspectors presented their report   PART about the safety   of   playgrounds
               'The inspectors presented their report about the safety of playgrounds.'

           c.   Die Prüfer   legten   ihren Bericht, der   die Sicherheit von Spielplätzen
               The inspectors presented their report   which the safety   of   playgrounds
               prüft,   vor.
               examines PART

           d.   Die Prüfer   legten   ihren Bericht vor, der   die Sicherheit von Spielplätzen
               The inspectors presented their report   PART which the safety   of   playgrounds
               prüft.
               examines
               'The inspectors presented their report which examines the safety of playgrounds.'

(14)   a.   Die Theatergruppe führt   ein Stück über   das wahre Leben von William
               The theatre-group   performs a   play   about the true   life   of   William
               Shakespeare auf.
               Shaespeare   PART

           b.   Die Theatergruppe führt   ein Stück auf   über   das wahre Leben von William
               The theatre-group   performs a   play   PART about the true   life   of   William
               Shakespeare.
               Shaespeare
               'The theatre group performs a play about the true life of William Shakespeare.'

           c.   Die Theatergruppe führt   ein Stück, das   die wahre Geschichte von
               The theatre-group   performs a   play   which the true   story   of
               Shakespeare erzählt, auf.
               Shaespeare   tells   PART

           d.   Die Theatergruppe führt   ein Stück auf,   das   die wahre Geschichte von
               The theatre-group   performs a   play   PART which the true   story   of
               Shakespeare erzählt.
               Shaespeare   tells
               'The theatre group performs a play, which tells the true story of Shakespeare.'

(15)   a.   Die Polizei geht   einem Hinweis auf mögliche Komplizen des   Bankräubers
               The police   follows a   lead   on   possible   accomplices of-the bank-robber
               nach.
               PART

           b.   Die Polizei geht   einem Hinweis nach   auf mögliche Komplizen   des
               The police   follows a   lead   PART on   possible   accomplices of-the
               Bankräubers.
               bank-robber
               'The police is following a lead about possible accomplices of the bank robber.'

           c.   Die Polizei geht   einem Hinweis, der   mögliche Komplizen des   Räubers
               The police   follows a   lead   which possible   accomplices of-the robber
               nennt, nach.
               names PART

d. Die Polizei geht einem Hinweis nach, der mögliche Komplizen des
The police follows a lead PART which possible accomplices of-the
Räubers nennt.
robber names

'The police is following a lead, which names possible accomplices of the robber.'

(16) a. Der Läufer füllte das Formular für die erneute Teilnahme am Marathon aus.
The runner filled the form for the renewed participation at-the marathon out

b. Der Läufer füllte das Formular aus für die erneute Teilnahme am Marathon.
The runner filled the form out for the renewed participation at-the marathon

'The runner filled out the form for the renewed participation in the marathon.'

c. Der Läufer füllte das Formular, das die Teilnahme am Marathon bestätigt,
The runner filled the form which the participation at-the marathon confirms
aus.
out

d. Der Läufer füllte das Formular aus, das die Teilnahme am Marathon bestätigt.
The runner filled the form out which the participation at-the marathon confirms

'The runner filled out the form, which confirms the participation in the marathon.'

(17) a. Die Frau suchte einen Arzt für neue und spezielle Schmerztherapien auf.
The woman saw a doctor for new and special pain-therapies PART

b. Die Frau suchte einen Arzt auf für neue und spezielle Schmerztherapien.
The woman saw a doctor PART for new and special pain-therapies

'The woman went to see a doctor for new and special pain therapies.'

c. Die Frau suchte einen Arzt, der auf Schmerztherapien spezialisiert ist, auf.
The woman saw a doctor who on pain-therapies specialized is PART

d. Die Frau suchte einen Arzt auf, der auf Schmerztherapien spezialisiert ist.
The woman saw a doctor PART who on pain-therapies specialized is

'The woman went to see a doctor, who specializes in pain therapies.'

(18) a. Die Polizei griff in einen Streit zwischen zwei total betrunkenen
The police intervened in a quarrel between two totally drunk
Fussballfans ein.
football-fans PART

b. Die Polizei griff in einen Streit ein zwischen zwei total betrunkenen
The police intervened in a quarrel PART between totally two drunk
Fussballfans.
football-fans

'The police intervened in a quarrel between two totally drunk football fans.'

c. Die Polizei griff in einen Streit, der zwischen zwei Fussballfans
The police intervened in a quarrel which between two football-fans
ausgebrochen war, ein.
broken-out wasPART

d. Die Polizei griff in einen Streit ein, der zwischen zwei Fussballfans
The police intervened in a quarrel PART which between two football-fans
ausgebrochen war.
broken-out was

'The police intervened in a quarrel, which had broken out between two football fans.'

(19) a. Die Schatzsucher   gruben eine Kiste mit Diamanten und Goldmünzen aus.
The treasure-hunters dug   a   chest with diamonds   and gold-coins   out

b. Die Schatzsucher   gruben eine Kiste aus mit Diamanten und Goldmünzen.
The treasure-hunters dug   a   chest out with diamonds   and gold-coins
'The treasure hunters dug out a chest with diamonds and gold coins.'

c. Die Schatzsucher   gruben eine Kiste, die   mit Diamanten gefüllt war, aus.
The treasure-hunters dug   a   chest which with diamonds   filled   was out

d. Die Schatzsucher   gruben eine Kiste aus, die   mit Diamanten gefüllt war.
The treasure-hunters dug   a   chest out which with diamonds   filled   was
'The treasure hunters dug out a chest, which was filled with diamonds.'

(20) a. Die Lehrerin sammelte das Geld   für die Klassenfahrt in die Schweiz   ein.
The teacher   collected the money for the class-trip   in the Switzerland PART

b. Die Lehrerin sammelte das Geld ein   für die Klassenfahrt in die Schweiz.
The teacher   collected the money PART for the class-trip   in the Switzerland
'The teacher collected the money for the class trip to Switzerland.'

c. Die Lehrerin sammelte das Geld, das   die Klassenfahrt kosten wird, ein.
The teacher   collected the money which the class-trip   cost   will   PART

d. Die Lehrerin sammelte das Geld ein, das   die Klassenfahrt kosten wird.
The teacher   collected the money PART which the class-trip   cost   will
'The teacher collected the money, which the class trip will cost.'

(21) a. Unbekannte   brannten eine Bibliothek mit mehr als zehntausend wertvollen
Unknown-persons burned   a   library   with more than ten-thousand valuable
Büchern ab.
books   down

b. Unbekannte   brannten eine Bibliothek ab   mit mehr als zehntausend
Unknown-persons burned   a   library   down with more than ten-thousand
wertvollen Büchern.
valuable   books
'Unknown persons burned down a library with more than ten thousand valuable
books.'

c. Unbekannte   brannten eine Bibliothek, die   viele tausend Bücher
Unknown-persons burned   a   library   which many thousand books
aufbewahrte, ab.
kept   down

d. Unbekannte   brannten eine Bibliothek ab,   die   viele tausend Bücher
Unknown-persons burned   a   library   down which many thousand books
aufbewahrte.
kept
'Unknown persons burned down a library, which kept thousands of books.'

(22) a. Der Schreiner baute einen Schrank aus seltenem Holz aus Kanada ein.
The carpenter built a   cabinet from rare   wood from Canada in

b. Der Schreiner baute einen Schrank ein aus   seltenem Holz aus   Kanada.
The carpenter built a   cabinet in from rare   wood from Canada
'The carpenter installed a cabinet made of rare wood from Canada.'

c. Der Schreiner baute einen Schrank, der aus seltenem Holz gemacht war, ein.
The carpenter built a cabinet which from rare wood made was in

d. Der Schreiner baute einen Schrank ein, der aus seltenem Holz gemacht war.
The carpenter built a cabinet in which from rare wood made was

'The carpenter installed a cabinet, which was made of rare wood.'

(23) a. Maria las ein Buch von einem völlig unbekannten Schriftsteller vor.
Maria read a book of a completely unknown writer PART

b. Maria las ein Buch vor von einem völlig unbekannten Schriftsteller.
Maria read a book PART of a completely unknown writer

'Maria read (out loud) a book by a completely unknown writer.'

c. Maria las ein Buch, das von einem unbekannten Schriftsteller war, vor.
Maria read a book which of a unknown writer was PART

d. Maria las ein Buch vor, das von einem unbekannten Schriftsteller war.
Maria read a book PART which of a unknown writer was

'Maria read (out loud) a book, which was by an unknown writer.'

(24) a. Ein Polizist hielt die Aussagen von allen Zeugen der Tat fest.
A police-officer recorded the statements of all witnesses of-the act PART

b. Ein Polizist hielt die Aussagen fest von allen Zeugen der Tat.
A police-officer recorded the statements PART of all witnesses of-the act

'A police officer recorded the statements of all witnesses of the (criminal) act.'

c. Ein Polizist hielt die Aussagen, die die Tatzeugen machten, fest.
A police-officer recorded the statements which the witnesses made PART

d. Ein Polizist hielt die Aussagen fest, die die Tatzeugen machten.
A police-officer recorded the statements PART which the witnesses made

'A police officer recorded the statements, which the witnesses gave.'

B.5 Stimuli Experiment 6

In the following, all twenty-four test sentences used in Experiment 6 are given. The conditions differ with regard to the definiteness of the NP out of which is extraposed, which is either indefinite (conditions a and b) or definite (conditions c and d). Furthermore, both indefinite and definite sentences come in an adjacent (conditions a and c) and in an extraposed (conditions b and d) version. In all cases, the intervening material consists of a verb.

(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 familly 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 familly with the small child cancelled (their stay).'

(3)   a. Im   Krankenwagen hat ein Mann mit einer schweren Gehirnerschütterung
           In the ambulance   has a   man with a   severe   concussion
           gelegen.
           lain

       b. Im   Krankenwagen hat ein Mann gelegen mit einer schweren
           In the ambulance   has a   man lain   with a   severe
           Gehirnerschütterung.
           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 thhe 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
At the horse race   has a   stallion of a   american   millionaire
gewonnen.
won

b. Beim Pferderennen hat ein Hengst gewonnen von einem amerikanischen
At the horse race   has a   stallion won   of a   american
Millionär.
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
         The treasure hunters have a   sarcophagus with a   age-olf mummy
         ausgegraben.
         excavated

      b. Die Schatzsucher   haben einen Sarkophag ausgegraben mit einer uralten
         The treasure hunters have a   sarcophagus excavated   with a   age-olf
         Mumie.
         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
         A emergency physician has a   injured person with severe   bone fractures
         behandelt.
         treated

      b. Ein Notarzt   hat einen Verletzten   behandelt mit schweren
         A emergency physician has a   injured person treated   with severe
         Knochenbrüchen.
         bone fractures

         'An emergency physician has treated an injured person with severe bone fractures.'

      c. Ein Notarzt   hat den Verletzten   mit den schweren
         A emergency physician has the injured person with the severe
         Knochenbrüchen behandelt.
         bone fractures   treated

      d. Ein Notarzt   hat den Verletzten   behandelt mit den schweren
         A emergency physician has the injured person treated   with the severe
         Knochenbrüchen.
         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.'

B.6 Stimuli Experiment 7

In the following, all twenty-four test sentences used in Experiment 7 are given. The conditions differ with regard to the Inner Structure of the PP, which is either 'PP only' (conditions a and b) or 'PP + RC' (conditions c and d). Furthermore, both structures come in an adjacent (conditions a and c) and in an extraposed (conditions b and d) version. In all cases, the intervening material consists of a verb.

(1) a. Vor   der Tür hat eine weiße Katze mit   einem buschigen schwarz gestreiften
         In front of the door has a   white cat   with a   bushy   black   striped
         Schwanz gelegen.
         tail   lain

     b. Vor   der Tür hat eine weiße Katze gelegen mit   einem buschigen schwarz
         In front of the door has a   white cat   lain   with a   bushy   black
         gestreiften Schwanz.
         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,
         In front of the door has a   white cat   with a   tail   that striped   was
         gelegen.
         lain

     d. Vor   der Tür hat eine weiße Katze gelegen mit   einem Schwanz, der gestreift
         In front of the door has a   white cat   lain   with a   tail   that striped
         war.
         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
         Today morning has a   family with a   suddenly ill   become   child
         abgesagt.
         cancelled

     b. Heute Morgen hat eine Familie abgesagt mit   einem plötzlich krank gewordenen
         Today morning has a   family cancelled with a   suddenly ill   become
         Kind.
         child

         'This morning a familly 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 familly with a child that is ill cancelled (their stay).'

(3) a. Bei   dem Sturm ist ein Baum mit   einem innen völlig   hohlen Stamm
         During the storm is a   tree with a   inside completely hollow trunk
         umgefallen.
         fell

b. Bei   dem Sturm ist ein Baum umgefallen mit einem innen völlig   hohlen
During the storm is a   tree   fell   with a   inside completely hollow
Stamm.
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
Today was   a   new school for especially talented children and youths
eröffnet.
opened

b. Heute wurde eine neue Schule eröffnet für besonders begabte Kinder   und
Today was   a   new school opened for especially talented children and
Jugendliche.
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
Last night is a   library   with valuable   books   from the antiquity
abgebrannt.
burned down

b. Letzte Nacht ist eine Bibliothek abgebrannt   mit wertvollen Büchern aus   der
Last night is a   library   burned down with valuable   books   from the
Antike.
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,
        Last   night is a   library   with books   that inestimably valuable was
        abgebrannt.
        burned down

    d. Letzte Nacht ist eine Bibliothek abgebrannt   mit Büchern, die unschätzbar
        Last   night is a   library   burned down with books   that inestimably
        wertvoll waren.
        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
        The Red Cross has a   outreach clinic for from chronic   diseases   suffering
        Menschen eingerichtet.
        people   set up

    b. Das Rote Kreuz hat eine Beratungsstelle eingerichtet für an   chronischen
        The Red Cross has a   outreach clinic set up   for from chronic
        Krankheiten leidende Menschen.
        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
        The Red Cross has a   outreach clinic for people   who chronic   diseases
        haben, eingerichtet.
        have   set up

    d. Das Rote Kreuz hat eine Beratungsstelle eingerichtet für Menschen, die chronische
        The Red Cross has a   outreach clinic set up   for people   who chronic
        Krankheiten haben.
        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   unbekannten Krankheit
        A   doctor has a   man with a   hitherto completely unknown   disease
        untersucht.
        examined

    b. Ein Arzt   hat einen Mann untersucht mit einer bisher   völlig   unbekannten
        A   doctor has a   man examined with a   hitherto completely unknown
        Krankheit.
        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
   In the emergency room has a   man with a   highly contagious   and
   gefährlichen Tropenvirus   gelegen.
   dangerous   tropical virus lain

   b. In der Notaufnahme   hat ein Mann gelegen mit einem hoch   ansteckenden und
   In the emergency room has a   man lain   with a   highly contagious   and
   gefährlichen Tropenvirus.
   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
   In the emergency room has a   man with a   tropical virus that highly
   ansteckend ist, gelegen.
   contagious is   lain

   d. In der Notaufnahme   hat ein Mann gelegen mit einem Tropenvirus, der hoch
   In the emergency room has a   man lain   with a   tropical virus that highly
   ansteckend ist.
   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
   Yesterday has a   bath   with a   tower of twenty metres height
   aufgemacht.
   opened

   b. Gestern   hat ein Schwimmbad aufgemacht mit einem Turm von zwanzig Metern
   Yesterday has a   bath   opened   with a   tower of twenty metres
   Höhe.
   height

   'Yesterday, a bath with a tower of 20 metres height opened.'

   c. Gestern   hat ein Schwimmbad mit einem Turm, der zwanzig Meter zählt,
   Yesterday has a   bath   with a   tower that twenty   metres measures
   aufgemacht.
   opened

   d. Gestern   hat ein Schwimmbad aufgemacht mit einem Turm, der zwanzig Meter
   Yesterday has a   bath   opened   with a   tower that twenty   metres
   zählt.
   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
   Yesterday has a   funeral service for a   young and very popular   politician
   stattgefunden.
   taken place

   b. 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 young and very popular politician.'

c. 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

d. Gestern   hat eine Trauerfeier   stattgefunden für einen Politiker, der sehr
Yesterday has a   funeral service taken place   for a   politician who very
beliebt war.
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
Yesterday is a   church spire with a   over three tonnes weighing   bell
eingestürzt.
collapsed

b. Gestern   ist ein Kirchturm   eingestürzt mit einer über drei Tonnen wiegenden
Yesterday is a   church spire collapsed   with a   over three tonnes weighing
Glocke.
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,
Yesterday is a   church spire with a   bell   that three tonnes   weighs
eingestürzt.
collapsed

d. Gestern   ist ein Kirchturm   eingestürzt mit einer Glocke, die drei Tonnen
Yesterday is a   church spire collapsed   with a   bell   that three tonnes
wiegt.
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
In the attic   has a   box with as good as never used   toys
gestanden.
stood

b. Auf dem Speicher hat eine Kiste gestanden mit so gut   wie nie   benutzten
In the attic   has a   box stood   with as good as never used
Spielsachen.
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,
In the attic   has a   box with toys   that never used   been   were
gestanden.
stood

d. Auf dem Speicher hat eine Kiste gestanden mit Spielsachen, die nie   benutzt
In the attic   has a   box stood   with toys   that never used
worden sind.
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
A friend has a   present   for his   in Australia living   older sister
gekauft.
bought

      b. Ein Freund hat ein Geschenk gekauft für seine in Australien lebende ältere
A friend has a   present   bought for his   in Australia living   older
Schwester.
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
Jewel thieves have a   safe   with the allegedly safest   lock   of the
Welt aufgebrochen.
world broken open

      b. Juwelendiebe haben einen Tresor aufgebrochen mit dem angeblich sichersten
Jewel thieves have a   safe   broken open with the   allegedly safest
Schloss der   Welt.
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
Jewel thieves have a   safe   with a   lock   that allegedly burglarproof
ist, aufgebrochen.
is   broken open

      d. Juwelendiebe haben einen Tresor aufgebrochen mit einem Schloss, das angeblich
Jewel thieves have a   safe   broken open with a   lock   that allegedly
einbruchsicher ist.
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
A actor   has a   contract for a   in the old   Egypt   playing
Abenteuerfilm unterschrieben.
adventure film signed

      b. Ein Schauspieler hat einen Vertrag unterschrieben für einen im   alten Ägypten
A actor   has a   contract signed   for a   in the old   Egypt
spielenden Abenteuerfilm.
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,
A actor   has a   contract for a   adventure film that in Egypt   plays
unterschrieben.
signed

    d. Ein Schauspieler hat einen Vertrag unterschrieben für einen Abenteuerfilm, der in
       A actor   has a   contract signed   for a   adventure film that in
       Ägypten spielt.
       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 sehen Exponaten aus   dem
       In the museum has a   exhibition with rare to see   exhibits   from the
       Orient eröffnet.
       orient opened

    b. Im   Museum hat eine Ausstellung eröffnet mit selten zu sehen Exponaten
       In the museum has a   exhibition opened with rare to see   exhibits
       aus dem Orient.
       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
       In the museum has a   exhibition with exhibits   that one rarely to see
       bekommt, eröffnet.
       gets   opened

    d. Im   Museum hat eine Ausstellung eröffnet mit Exponaten, die man selten zu
       In the museum has a   exhibition opened with exhibits   that one rarely to
       sehen bekommt.
       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
       A librarian   has a book of a   recently deceased   author
       aus der Schweiz   vorgelesen.
       from the Switzerland read

    b. Eine Bibliothekarin hat ein Buch vorgelesen von einem kürzlich verstorbenen
       A librarian   has a book read   of a   recently deceased
       Schriftsteller aus der Schweiz.
       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
       A librarian   has a book of a   author   who recently
       gestorben ist, vorgelesen.
       died   is read

    d. Eine Bibliothekarin hat ein Buch vorgelesen von einem Schriftsteller, der
       A librarian   has a book read   of a   author   who
       vor kurzem gestorben ist.
       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
       The police has in a   quarrel between two heavily intoxicated and Pro.REFL
       prügelnden Fussballfans eingegriffen.
       fighting   football fans intervened

b. Die Polizei hat in einen Streit   eingegriffen zwischen zwei stark   betrunkenen und
The police has in a   quarrel intervened   between   two   heavily intoxicated   and
sich   prügelnden Fussballfans.
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
The police has in a   quarrel between   two   football fans who both   heavily
betrunken   waren, eingegriffen.
intoxicated were   intervened

d. Die Polizei hat in einen Streit   eingegriffen zwischen zwei Fussballfans, die   beide
The police has in a   quarrel intervened   between   two   football fans who both
stark   betrunken   waren.
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
A   nun   has a   gift certificate for a   trip   through Northern Italy and
die Schweiz   gewonnen.
the Switzerland won

b. Eine Nonne hat einen Gutschein   gewonnen für eine Rundreise durch
A   nun   has a   gift certificate won   for a   trip   through
Norditalien   und die Schweiz.
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
A   nun   has a   gift certificate for a   trip   that through whole Italy
führt, gewonnen.
leads won

d. Eine Nonne hat einen Gutschein   gewonnen für eine Rundreise, die durch
A   nun   has a   gift certificate won   for a   trip   that through
ganz   Italien führt.
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
A   stranger   has a   car with a   wheel   and rims   from pure gold
geklaut.
stolen

b. Ein Unbekannter hat ein Auto geklaut mit   einem Lenkrad und Felgen aus   purem
A   stranger   has a   car   stolen with a   wheel   and rims   from pure
Gold.
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,
A   stranger   has a   car with a   wheel   that from pure   gold is
geklaut.
stolen

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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
        A girl   has a song of a   in past   times very successful   band
        gesungen.
        sung

     b. Ein Mädchen hat ein Lied gesungen von einer in früheren Zeiten sehr erfolgreichen
        A girl   has a song sung   of a   in past   times very successful
        Band.
        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,
        A girl   has a song of a   band that in the past very successful was
        gesungen.
        sung

     d. Ein Mädchen hat ein Lied gesungen von einer Band, die früher   sehr erfolgreich
        A girl   has a song sung   of a   band that in the past very successful
        war.
        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
        A archaeologist has a   sarcophagus with a   in valuable golden   clothes
        eingewickelten Mumie gefunden.
        wrapped   mummy found

     b. Ein Archäologe hat einen Sarkophag gefunden mit einer in kostbaren goldenen
        A archaeologist has a   sarcophagus found   with a   in valuable golden
        Tüchern eingewickelten Mumie.
        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
        A archaeologist has a   sarcophagus with a   mummy that in golden clothes
        eingewickelt war, gefunden.
        wrapped   was found

     d. Ein Archäologe hat einen Sarkophag gefunden mit einer Mumie, die in
        A archaeologist has a   sarcophagus found   with a   mummy that in
        Goldtüchern   eingewickelt war.
        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
        A friend   has a recipe of a   famous   chef with a   own
        Fernsehsendung nachgekocht.
        TV show   cooked-after

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b. Eine Freundin hat ein Rezept nachgekocht von einem berühmten Koch mit einer
A friend has a recipe cooked-after of a famous chef with a
eigenen Fernsehsendung.
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,
A friend has a recipe of a chef who a own TV show has
nachgekocht.
cooked-after

d. Eine Freundin hat ein Rezept von einem Koch, der eine eigene Fernsehsendung hat,
A friend has a recipe of a chef who a own TV show has
nachgekocht.
cooked-after

'A friend has prepared a dish following the recipe of a chef who has his own TV show.'

Deutsche Zusammenfassung

Die vorliegende Arbeit beschäftigt sich mit der Extraposition von Präpositionalphrasen aus Nominalphrasen im Deutschen. Extraposition ist eine Konstruktion, in der eine Konstituente rechts von der Position realisiert wird, die man als die kanonische ansehen würde. Ein besonderer Fall von Extraposition ist die Extraposition aus Nominalphrasen (NPs), bei der eine Konstituente aus der NP an das Satzende extraponiert wird. Das Beispiel in (1a) zeigt die PP in der kanonischen Position adjazent zum Kopfnomen. In (1b) ist die PP aus der NP an das Satzende extraponiert.

(1)   a. Gestern hat eine Frau **mit einer lauten, schrillen Stimme** angerufen.

       b. Gestern hat eine Frau angerufen **mit einer lauten, schrillen Stimme**.

Mit Blick auf Extraposition aus NPs sind zwei Hauptaspekte zu beachten. Zum einen spielt die Länge der extraponierten Konstituente (in diesem Fall der PP) eine Rolle, zum anderen hat auch die Länge des intervenierenden Materials einen Einfluss auf die Akzeptabilität von Extraposition und auf die Extrapositionsraten in Sprachproduktion. Weitere Faktoren sind die Zusammensetzung des intervenierenden Materials und die Definitheit der NP aus der extraponiert wird.

Im ersten Teil dieser Dissertation werden theoretische Ansätze und experimentelle Erkenntnisse eingeführt und erläutert. In den folgenden Kapiteln werden dann sieben eigene Experimente, die sich mit Extraposition in Sprachproduktion sowie mit der Akzeptabilität von Extraposition unter den genanten Aspekten beschäftigten, vorgestellt und diskutiert. Die Kombination von Sprachproduktion und Akzeptabilitätsstudien, in denen zum Teil das gleiche experimentelle Material getestet wird, soll dazu beitragen ein vollständigeres Bild des Phänomens zu erhalten. Nach dem einleitenden Kapitel gliedert sich die Dissertation daher wie folgt:

Kapitel 2 stellt Literatur zum theoretischen Hintergrund in Bezug auf syntaktische und phonologische Aspekte der Extraposition vor. Es werden auch diskurs-pragmatische Faktoren diskutiert. Die zwei syntaktischen Hauptansätze zur Extraposition, Bewegung und Basisgeneration werden genauso vorgestellt wie eine post-syntaktische Analyse der Rechtsbewegung. Außerdem werden die Grundideen der *Prosodic Structure* Theorie und der *Optimalitätstheorie* vorgestellt, und es wird diskutiert in wie weit Extraposition dabei helfen kann Verletzungen von prosodischen Beschränkungen zu vermeiden.

Kapitel 3 stellt die zwei Hauptfaktoren, die zur Motivation von Extraposition beitragen, vor: die *Länge* der extraponierten Konstituente und die *Distanz* der extraponierten Konstituente zu ihrem Kopfnomen. Außerdem werden zwei Theorien zur Sprachverarbeitung vorgestellt, die besonders relevant für das Thema dieser Dissertation sind: die *Early Immediate Constituents* von Hawkins (1994, 2004, 2014) und die *Dependency Locality Theory* von Gibson (1998, 2000).

Kapitel 4 beschreibt die vier Experimente zur elizitierten Produktion. Zuerst wird die experimentelle Mehode, *Production from Memory*, vorgestellt. Das erste

Experiment behandelt den Einfluss, den die Länge der extraponierten PP auf die Extrapositionsraten in der Reproduktion von Sätzen hat. Die folgenden zwei Experimente untersuchen den Einfluss des intervenierenden Materials auf die Extrapositionsraten in der Reproduktion: in Experiment 2 unterscheidet sich die Länge des intervenierenden Materials zwischen Verb, Adverb und Verb, und PP Adverbial und Verb. In Experiment 3 besteht das intervenierende Material nur aus verbalem Material. Der Unterschied in der Länge liegt hier zwischen Verbpartikel, Verb, und Hilfsverb und Verb. Das vierte Produktionsexperiment beschäftigt sich mit dem Unterschied zwischen der Extraposition von PPs und Relativsätzen (RS) in elizitierter Produktion.

Kapitel 5 stellt drei Experimente zur Akzeptabilität von Extraposition vor. In Experiment 5 wird das gleiche Material getestet wie in Experiment 2, aber eine andere experimentelle Methode wird angewandt: *Magnitude Estimation*. Daraus ergibt sich die Möglichkeit, Ähnlichkeiten und Unterschiede zwischen Sprachproduktion und Akzeptabilität zu beobachten. In den zwei weiteren Experimente wurden Likert Skalen verwendet, um die Akzeptabilität von Extraposition zu testen. Experiment 6 untersucht den Einfluss der Definitheit der NP aus der extraponiert wird auf die Akzeptabilität von Extraposition. Es wird die Frage untersucht, ob im Deutschen ebenfalls ein *soft constraint* für die Definitheit der NP bei PP Extraposition gefunden werden kann. Experiment 7 beschäftigt sich mit der *Schwere* der extraponierten Konstituente und der Frage, ob die Anzahl der Phrasenknoten innerhalb einer Konstituente (einfache PP vs. PP, die einen RS beinhaltet) einen Einfluss auf die Akzeptabilität von Extraposition hat.

Kapitel 6 fasst die wichtigsten Ergebnisse und Erkenntnisse dieser Arbeit in einer abschließenden Diskussion zusammen.