

# Processing complexity in prenominal present participle constructions in German

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# List of Abbreviations

Abbreviation	Meaning
A	adjective
ACC	accusative
AP	adjectival phrase
Adj	Adjunct
Arg	argument
CP	complementizer phrase
CGN	case gender number
D	determiner
df	degrees of freedom
DAT	dative
DeReKo	Deutsches Referenzkorpus (German Reference Corpus)
DLT	dependency locality theory
DP	determiner phrase
EEG	electroencephalography
EPP	extended projection principle
EU	energy unit
GEN	genitive
ind	indicative
LOC	locative
ms	milliseconds
MU	memory unit
N	noun
PL	plural
PP	prepositional phrase
RC	relative clause

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REFL	reflexive
RegPath	Regression-path duration
RegOut	Regression likelihood
RT	reading time
SG	singular
SPLT	syntactic prediction locality theory
SPR	self-paced reading
t	trace
TP	tense phrase
UID	uniform information density
V	verb
VP	verb phrase
vP	little VP



# Chapter 1

## Introduction

### 1.1 Sentential pre- and postnominal modifiers in German

A crucial aspect of languages is that there are several ways to express the same content. While there might be pragmatic differences, the two events described in (1), namely *the cat destroys the sofa* and *the cat is hungry*, are always the same.

- (1)
- a. *Die Katze zerstört das Sofa. Sie hat vermutlich Hunger.*  
the cat destroys the sofa she has presumably hunger
  - b. *Die Katze hat vermutlich Hunger, da sie das Sofa zerstört.*  
the cat has presumably hunger because she the sofa destroys
  - c. *Die Katze, die das Sofa zerstört, hat vermutlich Hunger.*  
the cat that the sofa destroys has presumably hunger
  - d. *Die das Sofa zerstörende Katze hat vermutlich Hunger.*  
the the sofa destroying cat has presumably hunger

By expressing one of the events as a nominal modifier as in (1-c) and (1-d), the content can be formulated in a compressed way. However, sentential prenominal modifiers as in (1-d) are sometimes perceived as complex or heavy and restricted to written language (Weber, 1994). This perception suggests that some constructions can be more difficult for language comprehension than others.

The subject of this thesis is extended prenominal participles in German, i.e. verbal forms that also have adjectival properties. They can be used as prenominal attributes and they have a sentential structure, cf. (1-d). In this construction, the noun, e.g. *Katze* ‘cat’, is preceded by the modifier, an adjective or in this case a

participle, which takes arguments like *das Sofa* ‘the sofa’ and adjuncts like *schon wieder* ‘yet again’ (see (28)) and is therefore extended.

- (2) *die schon wieder das Sofa zerstörende Katze (hat vermutlich Hunger.)*  
the yet again the sofa destroying cat (has presumably hunger)  
‘The cat destroying the sofa again (is presumably hungry.)’

Due to the underlying SOV order of German, the adjectival element has to occur after its extensions. Being a “hybrid” of adjective and verb (cf. Rapp, 1997), participles are especially interesting, as they keep their verbal argument structure. For regular adjectives, however, the set of adjectives that frequently take arguments is rare. Among participles, the present participle is the most verbal category: it is able to assign accusative case to its arguments (Fanselow, 1986) and its predicative use is restricted (cf. Struckmeier, 2007, p.1).

The same content can be expressed in a relative clause (RC), which follows the noun (3).

- (3) *die Katze, die das Sofa zerstört, (hat vermutlich Hunger.)*  
the cat that the sofa destroys (has presumably hunger)  
‘the cat (that is) destroying the sofa (is presumably hungry.)’

Whereas several aspects of the processing of RCs have been studied extensively (e.g. for English: Grodner and Gibson 2005; for German: Vasishth and Drenhaus 2011, Konieczny 2000), there has not been much research on extended adjectival elements, especially in a language with mixed word order, where extended adjectives and RCs vary in their position with respect to the head noun. Fabricius-Hansen (2016) compares the alternation of prenominal and postnominal elements in German, but she observes a lack of controlled experimental studies on the topic. Another interesting aspect of the construction is that it seems to occur mainly in written language (Weber, 1994) and not in German dialects (Weiß, 2017).

The thesis will investigate the following questions: (i) Is complex prenominal modification more difficult to process than postnominal RCs? (ii) Does the difficulty for participle phrases increase when the modifier exceeds a certain length? (iv) How does the internal complexity of the modifier affect the acceptability and processing of the construction?

## 1.2 What is complexity?

The notion of “complexity” in linguistics is in itself a complex issue. In this thesis, I focus on different factors that have been attributed to affect the processing of certain constructions. In the experimental part, I investigate how the comprehension of prenominal participles is affected, in comparison to RCs. The aim of this thesis is not only to determine what affects the processing of prenominal participles, i.e. under which conditions the construction is easier or more difficult to process, but also to provide evidence for or against the assumptions about processing mechanisms that are reflected in effects caused by these factors.

The first factor is dependency length: how does a greater distance between two dependents (e.g. verb and arguments) affect processing? This has been assumed to play a role in language production and the development of grammars (Hawkins, 1983, 2003, 2004; Temperley, 2019) as well as in comprehension (e.g. Gibson, 1998, 2000). Processing difficulties due to an increase between the distance of two dependents are in line with the assumption that representations need to be stored in memory and that the capacity of this memory component is limited (Just and Carpenter, 1992). Due to the position of sentential prenominal attributes in German inside the DP, i.e. between determiner and noun, it is possible that longer prenominal modifier phrases are more problematic than short ones. (4) shows an example of prenominal modifiers and RCs with different modifier length.

- (4)
- a. *der ein Eis essende Schüler*  
the an ice cream eating student
  - b. *der im Park bei schönem Wetter ein Eis essende Schüler*  
the in the park during nice weather an ice cream eating student
  - c. *der Schüler, der ein Eis aß*  
the student who an ice cream ate
  - d. *der Schüler, der im Park bei schönem Wetter ein Eis aß*  
the student who in the park during nice weather an ice cream ate  
'the student (who was) eating ice cream (in the park during nice weather)'

## 1.2. What is complexity?

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Part of the experiments in this thesis focus on this aspect. Modifier length will be tested for offline processing, using acceptability judgments, and for online processing, with a self-paced reading and an eye-tracking experiment. Processing difficulties with increasing modifier length would provide evidence for memory-based processing accounts. There is, however, also the possibility that a longer modifier facilitates the processing of the end of the modifier and the head noun, as more material leads to a higher predictability of these elements. This is in line with an experience-based view on language processing (e.g. Hale, 2001; Levy, 2008a).

As a second factor, I investigate the syntactic and semantic complexity, more precisely whether there is a difference between arguments and adjuncts for processing. An example for arguments versus adjuncts in prenominal participles and RCs is shown in (5), with either an adverbial PP ((5-a) and (5-c)) or an accusative object (5-b) and (5-d)).

- (5)
- a. *die seit Stunden putzende Tante*  
the since hours cleaning aunt
  - b. *die ein Regal putzende Tante*  
the a shelf cleaning aunt
  - c. *die Tante, die seit Stunden putzt*  
the aunt who since hours cleans
  - d. *die Tante, die ein Regal putzt*  
the aunt who since hours cleans  
'the aunt (who is) cleaning for hours/ a shelf'

There are several possibilities how this might affect the processing of the two constructions: arguments have been found to facilitate the processing of a verb in head final constructions (Konieczny and Döring, 2003; Levy and Keller, 2013), which applies to the construction under investigation. However, being adjectival and verbal at the same time, present participles might be preferred and easier to process if they do not have a complex verbal structure. In this thesis, this factor is investigated in offline and online processing (acceptability judgments and self-paced reading).

Thirdly, complexity can also be measured as the levels of embedding. This has been suggested to cause processing difficulties (Chomsky, 1957, 1965; Yngve, 1960; Chomsky and Miller, 1963; Miller and Chomsky, 1963; Miller and Isard, 1964) and is also a component in memory-based theories like the *dependency locality theory*.

(6) shows double embedded participle phrases and RCs and corresponding single embedded modifiers of the same length.

- (6) a. *die einen nach Zimt duftenden Apfelkuchen backende Nachbarin*  
the a like cinnamon smelling apple pie baking neighbor
- b. *die am frühen Morgen einen Apfelkuchen backende Nachbarin*  
the in.the early morning an apple pie baking neighbor
- c. *die Nachbarin, die einen Apfelkuchen, der nach Zimt duftet, backt*  
the neighbor who an apple pie that like cinnamon smells  
bakes
- d. *die Nachbarin, die am frühen Morgen einen Apfelkuchen backt*  
the neighbor who in.the early morning an apple pie bakes  
'the neighbor (who is) baking an apple pie that smells/smelling like  
cinnamon/ in the early morning.'

As prenominal attributes are already embedded in the DP, the question is whether and how an additional prenominal modifier as in (6-a) affects the processing of the construction. One possibility is that the additional layer of embedding increases memory load, leading to a higher increase in processing difficulty for double embedded participle phrases, compared to single embedded ones, than for double embedded RCs. I test this with acceptability judgment experiments.

### 1.3 Thesis outline

The thesis is organized in the following way: Chapter 2 provides an overview of the properties of sentential nominal modifiers in German, with the main focus on participles. This includes descriptive properties of attributive participles, their occurrence and semantic properties of the participle. Furthermore, syntactic analyses suggested for adjective and participle phrases are reviewed, with respect to their position in the DP (see e.g. Cinque, 2010) as well as their internal structure (see e.g. Struckmeier, 2007, 2010). In addition, the properties and structure of RCs will be discussed, as they are an alternative to the construction and used as a control condition in the experiments.

Chapter 3 introduces the processing background that is necessary to formulate precise hypotheses for the experimental investigation. In this chapter, I discuss suggested accounts that explain why processing difficulties occur under certain con-

ditions. The main focus lies on memory-based and expectation-based processing mechanisms, which in some cases lead to contrary predictions. Furthermore, the chapter includes previous experiments that provide evidence for these theories and that investigated the factors that are tested in the experimental part of this thesis.

In Chapter 4, I formulate the hypotheses for the processing of (extended) prenominal participles. To that end, previous research that discusses the alternation of prenominal modification and RCs is reviewed. In addition, the production of the constructions is further investigated with corpus data. Previous research, corpus data and the processing theories discussed in Chapter 3 are then combined to form hypotheses for the comprehension of attributive participles.

The first of the experimental chapters, Chapter 5, includes five experiments. The first two (Experiment 1 and 2) are offline experiments that test the acceptability of participle phrases and RCs. In these experiments, two of the factors are manipulated: length and the presence or absence of an argument. The two factors are then investigated further in separate online experiments: Experiment 3 is a self-paced reading experiment that tests how the presence of an argument compared to an adjunct affects the processing of participle constructions and RCs respectively. Experiment 4 tests whether a manipulation of the modifier length has an effect on online processing, again using self-paced reading. This is followed up by an eye-tracking experiment (Experiment 5) with the same material.

Chapter 6 consists of two further experiments: Experiment 6 and 7 test the acceptability of prenominal participles and RCs with an additional modifier embedded in them. The double embedded modifiers are compared to single embedded ones with the same length.

In the general discussion, Chapter 7, I will discuss the results and further implications. This includes alternative explanations for the experimental findings, the role of present participle phrases in German and hypotheses for the processing of similar constructions in other languages.

Finally, Chapter 8 concludes the thesis with a summary of the results and suggestions for future research.

## Chapter 2

# Properties of prenominal participles in German

The main focus of this thesis is to investigate the processing of different kinds of nominal modifiers by comparing prenominal participles with postnominal RCs. In order to formulate predictions for the processing of present participle phrases, their structure needs to be taken into account. This applies in particular to dependency relations and to the surface word order.

As the syntactic analysis of adjectives in general is controversial, I will give an overview of this issue. The same applies for the structure of RCs, which will be introduced and compared to prenominal modifiers. A look into these structures can reveal how similar these structures are, which can play a role for the formulation of hypotheses concerning processing: if certain aspects, e.g. dependency relations, are the same for present participle phrases and RCs, the same effects can be expected in processing. However, it is also important to consider differences of the constructions which might explain different patterns in the following experiments.

This chapter starts with a description of prenominal present participle phrases, previous findings concerning their occurrence and their surface structure. In the next part, I summarize syntactic analyses of the internal structure of adjectives (including participles) and their position inside of the DP. Participles have been described as ‘hybrids’ between adjectives and verbs (Fuhrhop and Teuber, 2000; Lübbe and Rapp, 2011), as they show to specific semantic and syntactic properties that will be further described. After taking a closer look at prenominal attributes, I discuss properties of RCs and compare them to participle phrases.

## 2.1 Surface properties of present participles

Before describing the surface properties of extended present participle phrases in German, I will first introduce the present participle in general. The Duden discusses present participles together with adjectives, although it is stated that the categorical status of the participle is not easy to define (Dudenredaktion, 2016, p. 764). Following Bech (1955), the present participle is usually considered as part of the verbal paradigm and, together with past participles and gerunds, it belongs to the infinitival verb forms because it cannot govern other verbs (see also Fuhrhop and Teuber 2000; Weiß 2017, cf. Eisenberg 2016, p. 147f). In order to form the present participle, the stem is combined with the suffix *-end*. Present participles can be formed productively. The properties and the use of the present participle overlap partly with adjectives and past participles. The status of present participles will be discussed further in Section 2.3.

Present participles are mainly used in two ways: as attributes that modify a noun, see (1-a), and as verbal modifiers<sup>1</sup>, see (1-b).

- (1) a. attributive use (nominal modifier)  
*Die **schlafende** Katze liegt auf dem Sofa*  
the sleeping cat lies on the couch
- b. secondary predication (verbal modifier)  
*Die Katze liegt **schlafend** auf dem Sofa*  
the cat lies sleeping on the couch  
'the cat lies on the couch, sleeping'

Furthermore, they can occur as nouns, e.g. *der/die Studierende* 'the student' (Durrell, 2011). Sometimes a predicative use is also possible, as in (2). These cases are considered to be lexicalized as adjectives (Weber, 1971, p. 159f).

- (2) *die Ansätze sind bedeutend*  
the accounts are meaning  
'the accounts are meaningful'

(Weber, 1971, p. 159f; gloss added)

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<sup>1</sup>In this case, only an intersective reading is possible. (1-b) can be interpreted as 'the cat is lying on the couch and the cat is sleeping', but not as 'the cat is lying in on the couch in a sleeping manner' (Rapp, 2015).



Only the attributive use will be considered for the research questions and experiments in this thesis. In this case the present participle appears between the determiner and the noun. The participle agrees with the noun in gender, number and case. Adjectival agreement in German follows two different agreement paradigms: whether it shows weak or strong agreement depends on the presence or absence of a definite determiner (see e.g. Eisenberg, 2016, p. 240f). In terms of position and agreement, present participles behave like regular adjectives and past participles in their use as nominal attributes. Hence, I will refer to adjectives, present participles and past participles in this construction with the term ‘prenominal attribute’, following Fabricius-Hansen (2016).

Present participles and other prenominal attributes can be extended, i.e. they can be combined with adjuncts or arguments as in (3). In this case, the participle phrase is still prenominal and the participle always appears at the end of the modifier. This corresponds to the basic verb final order in German and is different to e.g. English, where extended adjectival phrases are usually postponed (with exceptions) and where the extensions follow the participle (for a comparison of prenominal attributes in Germanic languages see Fabricius-Hansen, 2010).

(3) present participle

*die leider gerade das Sofa zerstörende Katze* (*hat vermutlich  
the unfortunately now the couch destroying cat (is presumably  
Hunger).*  
hungry)

‘The cat that is unfortunately destroying the couch now (is presumably hungry).’

(4) and (5) show an overview of the different elements that can occur inside the participle phrase (cf. also Weber, 1971, p. 150).

(4) a. accusative object:

*die das Sofa zerstörende Katze*  
the the couch destroying cat

b. reflexive:

*die sich putzende Katze*  
the REFL. grooming cat

## 2.1. Surface properties of present participles

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- c. dative object:  
*die dem Besitzer gehorchende Katze*  
the the owner obeying cat
  
  - d. genitive object (not very common):  
*die großer Aufmerksamkeit bedürfende Katze*  
the great attention needing cat
  
  - e. PP object:  
*die auf das Futter wartende Katze*  
the for the food waiting cat
- (5)
- a. PP adjunct:  
*die auf dem Sofa schlafende Katze*  
the on the couch sleeping cat
  
  - b. adverbial accusative DPs:  
*die den ganzen Tag schlafende Katze*  
the the whole day sleeping cat
  
  - c. adverbs:  
*die leider / ständig schlafende Katze*  
the unfortunately / all the time sleeping cat

The argument structure of the verb stays the same for the attributive participle, with the exception of the subject, which functions as head noun. Hence, any kind of object licensed by the verb can appear. The property of taking objects or allowing adjuncts also applies to adjectives and past participle, see (6).

- (6)
- a. present participle  
*die eine Maus jagende Katze*  
the a mouse hunting cat  
‘the cat hunting a mouse’
  
  - b. past participle  
*die von dem Kind gejagte Katze*  
the by the child hunted cat  
‘the cat hunted by the child’

## c. adjective

*der dem Herrchen treue Hund*  
 the the owner loyal dog  
 ‘the dog loyal to his owner’

Accusative objects do not occur with past participles due to their passive structure and only rarely with regular adjectives (Fanselow, 1986). Weber (1971), Abraham (1995), p. 247, and Harbert (2006) list several adjectives that occur with accusative DPs, with part of them describing size (e.g. *groß* ‘big’, *lang* ‘long’, *dick* ‘thick’).<sup>2</sup> However, these can be considered as exceptions (see also Struckmeier, 2007, p. 9).

It is also possible to postpone attributive participles, as so-called appositions, but then there is no agreement with the noun (see (7)). According to Weber (1971), p. 25, and 1994, p. 155, this construction plays a marginal role as it occurs infrequently and is mainly used for stylistic reasons.

- (7) *die Katze, das Sofa zerstörend, miaute laut.*  
 the cat the couch destroying meowed loudly

In theory, every sentence can be turned into a prenominal modifier, which means that participle phrases can also be quite long. Furthermore, the structure can also be recursive, leading to multiple center embedding ((8), see also Weber 1971, p. 212f).

- (8) *die die einen Käse fressende Maus jagende Katze*  
 the the a cheese eating mouse chasing cat  
 ‘the cat that is chasing the mouse that is eating cheese’

Although long or multiple embedded participle phrases are grammatical, they are not considered acceptable and do not occur often in language use. This has been attributed to the processing load that is caused by the high information density of the construction and/or the disruption of the DP (Weber, 1971; Fabricius-Hansen, 2016). The latter of course only applies when a determiner is present, which does not necessarily have to be the case, e.g. for plural as in (9). The experiments in the following chapters only consider DPs with a determiner and the suggested processing difficulties caused by the distance between determiner and noun. Bare DPs modified

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<sup>2</sup>They also list further adjectives, e.g. *müde* ‘tired’, *leid* ‘sorry’, *los* ‘free’. However, part of those are not grammatical when they are used as a prenominal attribute with an accusative object (Abraham 1995, p. 263, see also Struckmeier 2007, p. 9).

by extended participle phrases may lead to a different kind of processing difficulties, as they are locally ambiguous (Bader, 2010).

- (9) *Auf dem Sofa schlafende Katzen sind niedlich.*  
On the couch sleeping cats are cute  
'Cats sleeping on the couch are cute.'

To sum up, attributive participle phrases occur prenominal in German, hence between the determiner and the noun. They can be extended by different elements and there is no restriction for their length or recursive use of the construction in the grammar, but their complexity is supposed to cause restrictions for language performance. In the following section, I will review previous literature on the occurrence and diachronic development of attributive participle phrases.

## 2.2 Occurrence and diachronic development

Present participle phrases can vary highly in their complexity and length, as shown in the previous section. Before investigating how this may affect the comprehension of this construction, it is also helpful to consider its actual occurrence in natural language and its origin. Here, the focus is on the more complex form, the extended participle phrase.

Weber (1971, 1994) describes extended attributes as a written language phenomenon. They are common in written texts, e.g. in newspaper texts (10). They also occur also in spoken language which is based on a written text, e.g. in documentaries (11) or TV news (12). For the use of extended attributes in specific kinds of texts, see Filipovic (1977); Kim (1999); Thurmair (2007); Mertzlufft (2010); Kwaśniak (2012); Lötscher (2016).

- (10) *Am 22./23. September öffnen die rund 90 auf dem ehemaligen  
at 22./23. September open the around 90 on the former  
AEG-Gelände arbeitenden Künstler ihre Ateliers und laden zum Besuch  
AEG-site working artists their studios and invite to visit  
ein.*

'On September 22nd/23rd, the around 90 artists working on the former AEG site will open their studios and invite you to visit.' (NUN12/SEP.00970 Nürnberger Nachrichten, 10.09.2012, p. 24; Neuauflage von "Offen auf AEG";

Künstler laden in ihre Ateliers Messe und Ausstellungen; taken from DeReKo, IDS Mannheim)

- (11) *das sich gegen ihn wehrende Tier...*  
 the REFL against him defending animal...  
 ‘the animal that defends itself against him’

(BBC documentary “Unsere Erde - Eiswelten”)

- (12) *Wegen der dort massiv steigenden Infektionszahlen gilt in Paris von morgen an die höchste Corona-Warnstufe.*  
 Due to the there massively rising numbers of infections applies in Paris from tomorrow on the highest Corona warning level  
 ‘Because of the massively increasing number of infections there, the highest corona warning level will apply in Paris from tomorrow on.’

(ZDF Heute Journal, 05.10.2020)

Evidence for the assumption that extended attributes are mainly restricted to written language comes from a corpus analysis in contemporary German (Weber, 1990, 1994), taking into account texts that are close to spoken language and texts that are closer to written language. He found only 4 instances of extended adjectives or participles in texts designed for spoken language, compared to 100 in written texts. Nevertheless, extended attributes can be found in spoken language as well. Weber (1994) mentions examples from a talk show, but he also notes that these cases are usually regular adjectives, not present participles, that are extended by adverbs (e.g. *sehr* ‘very’). Hence, there seems to be a difference depending on the head of attributive phrases and different kinds of extensions, with extended participle phrases being less frequently used in spoken language.

As a reason why they rarely occur in spoken language, Weber (1994) suggests that the construction is highly complex and therefore causes difficulties. This complexity is caused by compressing the content of a whole sentence into the nominal phrase. Fabricius-Hansen (2016) also suggests that extended prenominal attributes cause high processing load. The experimental part of this thesis is concerned with the question whether extended participle phrases really lead to processing difficulties and if so, what causes them. Potential reasons will be discussed in detail in Chapter 4, after reviewing the relevant processing literature.

## 2.2. Occurrence and diachronic development

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Table 2.1: Diachronic overview of extended prenominal attributes in German (from Weber 1971, 214). The text size is measured as per 1000 print marks, i.e. letters, numbers and punctuation marks.

Century	Text size	Present participle	Past participle	Gerund	Adjective	Sum (extended modifiers)
16th	808	17	71	–	65	153
17th	763	132	342	2	241	717
18th	793	140	315	11	315	781
19th	776	199	445	26	316	986
20th	1853	356	767	41	640	1.805

The origin of extended prenominal attributes in German is also quite informative (Weber, 1971): the first occurrences in Old High German were highly influenced by the Latin texts from which they were translated (see also Fleischer and Schallert, 2011, p. 271–273). In Middle High German, this construction was rarely used; if so, the instances were regular adjectives combined with a degree adverb. Only in texts of documents from 1300 did extended attributes become more common, although in the beginning they were restricted to a small number of specific tokens. According to Weber (1971), there is a change in syntax around 1550: before, adjectives could only be derived from the verb/predicate itself, this is why they can only be extended by adverbs. In Early New High German, however, whole clauses could be turned into adjectives, hence arguments of the attributes occurred.

Weber (1971) provides a diachronic corpus analysis, in which he investigates the frequency of extended prenominal attributes since the 16th century. Table 2.1 shows the occurrences depending on the modifier head: present participle (e.g. *lesende* ‘reading’), past participle (e.g. *gelesen*), gerund (*zu lesen* ‘to read’) and a regular adjective.

First of all, the sum of occurrences compared to the text size shows that extended modifiers in general became more frequent in the 17th century and again in the 19th century, with an increase of certain text forms like legal texts. The increase of the construction was also influenced by translations from Latin. Today, the construction is fully grammatical. However, Weber (1971) states that prescriptive grammars of the 20th century recommend avoiding very long and complex prenominal adjectives and participles. In addition to the general development of extended attributes, Table 2.1 shows that past participles and adjectives constitute the ma-

Table 2.2: Distribution of the kinds of extension (see Weber 1971, 215; note that multiple elements can occur inside one attribute.)

TOTAL	accusative	dative	preposition	adverbial
1.805	91	94	763	1.191

majority of extended prenominal attributes. Extended present participles occur half as frequently as past participles.

A lack or very restricted existence of extended attributes in German dialects supports the observation that they are a written language phenomenon. Many dialects do not allow attributive present participles (Behaghel 1924, p. 373; Weiß 2017, for different dialects see also Reis 1891; Staedele 1927; Newton 1990; Mottaus 2009). In other dialects present participles are productively used, but there are restrictions in the grammar (Schirmunski, 1962). For Bavarian, Weiß (2017) observes that attributive present participles from complex verbs, transitive verbs and unaccusative verbs are not possible. Furthermore, they can never be extended. His generalization is less strict than the one in the previous literature that suggests that attributive present participles in Bavarian are only possible if they denote a property (instead of an event) (Nagl, 1886; Schirmunski, 1962). There seems to be a tendency that present participles are mainly possible for verbs denoting states, whereas activity verbs and therefore most transitive verbs cannot be used as present participles.

After discussing the overall occurrence of extended prenominal attributes and prenominal participles, it is also interesting to take a closer look at the elements inside the modifier. Weber (1971), p. 215, also provides corpus data for the distribution of elements inside the prenominal attribute; see Table 2.2.<sup>3</sup>

The data shows that adverbs and PPs occur more frequently than accusative or dative DPs.<sup>4</sup> It is important to emphasize that this table shows the elements inside any kind of modifier, i.e. present participles, past participles, gerunds and adjectives. The majority of instances are past participles and adjectives (cf. Table 2.1). These cannot take accusative objects and dative objects are less frequent in general (Weber, 1971, p. 217). Therefore, it is not surprising that accusative and

<sup>3</sup>Weber (1971) provides a diachronic overview. The focus of this thesis, however, is contemporary German. Therefore, the table only contains data from the 20th century. Furthermore, the column showing the text size (in 1000 print marks) is omitted because it is the same as in 2.1.

<sup>4</sup>Weber (1971) does not distinguish between objects and adjuncts for the PPs and DPs.

dative DPs occur more rarely than PPs and adverbs. However, Weber states that accusative objects occur frequently in finite clauses, hence it could be expected to find them more frequently with prenominal attributes, which is not the case. In Chapter 4, I will provide a corpus analysis which focuses on present participles only, in order to provide a clearer picture. The data for present participles will also be compared to RCs.

To sum up, attributive present participles and extended prenominal attributes in general became more frequent with the increase of e.g. legal texts in (Early) New High German. Their grammaticality in dialects is very restricted, which supports the claim that they are a written language phenomenon. Furthermore, extended present participles occur less frequently than past participles and regular adjectives. Prenominal attributes are mostly extended by adverbs or PPs, although the distribution for present participles cannot be obtained from the data provided by Weber (1971).

## **2.3 Participles as hybrids of verbs and adjectives**

Many of the properties of attributive present participle also hold for regular adjectives. However, the diachrony and the distribution in written and spoken language as well as in dialects of German suggest that not all nominal modifiers behave in the same way, even if they look similar on the surface. This raises the question whether present participles differ from adjectives. In the following, I will compare present participles with regular adjectives and past participles in order to determine how adjectival or verbal they actually are. Although some properties can be clearly distinguished, participles are usually considered a “hybrid” category (Fuhrhop and Teuber, 2000; Lübbe and Rapp, 2011) or “mixed projection” (Lowe, 2020, p. 344f). If there really is a distinction in language use between more or less adjectival prenominal modifiers, this could affect the comprehension or acceptability of the construction.

### **2.3.1 Verb or adjective? Present participles as a hybrid category**

Several authors have discussed the category of the present participle and they all had to acknowledge that it bears both adjectival and verbal properties (see Lenz



1993; Faucher 1994; Fuhrhop and Teuber 2000; Lowe 2020; for Dutch: Bennis and Wehrmann 1990). Like adjectives, it can be used as a nominal or verbal modifier, in which case it appears in the same position as adjectives. Furthermore, the present participle agrees with the noun in case, gender and number. These are agreement features that occur with adjectives, whereas verbs agree in person and number in German. These properties are in favor of a categorization as a regular adjective, which could be formed by derivation (Zifonun et al., 1997, p. 2205).

However, present participles behave differently than adjectives in certain aspects. Fuhrhop and Teuber (2000) argue that derivation (e.g. with the suffix *-bar*) is mostly only allowed by a subgroup of a word class, whereas it is possible to form a present participle from any verb. Although they say that such productivity does not completely rule out derivation, it suggests the possibility that the present participle is instead formed by inflection (see also Haspelmath, 1996).

As far as the morphology is concerned, most present participles do not follow the same rules as adjectives. Note that there are exceptions, which I will discuss later. Firstly, it is not possible to combine present participles with adjectival affixes like *un-* or *-heit/-keit*. In this respect they also seem to be less adjectival than past participles, which can be combined with *un-*, like *das ungesungene Lied* ‘the unsung song’ (Fuhrhop and Teuber, 2000, p. 102).

Furthermore, forming the comparative is problematic for many present participles. It is not clear, however, whether this is due to semantic restrictions or because they are less adjectival. According to Fuhrhop and Teuber (2000), a periphrastic form is preferred even for present participles that allow a comparative semantics, as in (13).

- (13) a. *?der sprudelndere Brunnen*  
the bubbling-COMP fountain
- b. *der stärker sprudelnde Brunnen*  
the stronger bubbling fountain  
‘the fountain that is bubbling more (strongly).’

They consider the comparative morpheme to be closer to the root and see a parallel to nominal inflection: here, nouns that are derived from other categories like (14) do not have a plural form because the plural morpheme is close to the core, but they bear case.

### 2.3. Participles as hybrids of verbs and adjectives

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- (14) a. *die Kunst des Singens*  
the art of singing  
b. \**die Singen*  
the-PL singings

(Fuhrhop and Teuber, 2000, p. 103; gloss added)

A verbal property of present participles is their argument structure. Obligatory arguments need to be realized in the attributive phrase, which even applies to the reflexive *sich*, see (15).

- (15) a. *das sich wehrende Tier*  
the REFL defending animal  
b. \**das wehrende Tier*  
the defending animal

Another verbal property is the possibility to combine present participles with manner adverbs, as in (16) (Rapp, 2015).

- (16) *Der eifrig ein Buch lesende Mann saß am Tisch.*  
the diligent a book reading man sat at\_the table  
'The man who was diligently reading a book was sitting at the table.'

(Rapp, 2015, p. 2)

Lowe (2020) observes that from an internal perspective, i.e. inside the participle phrase, the participle functions as a verb – contrary to the external function in the DP, where it has the position of adjectives and shows adjectival agreement.

Present participles also cannot be combined with an auxiliary, which is another crucial difference to regular adjectives (see e.g. (17); Fuhrhop and Teuber 2000; Rapp 2015). There are again exceptions to this rule (e.g. (18)) and sometimes the judgments may vary. With extended participles, however, the predicative use is not grammatical (see (19)).

- (17) ?*die Katze ist schlafend.*  
the cat is sleeping  
(18) *Die Kennzeichnung der Parkhäuser ist verwirrend*  
the labeling of\_the parking garages is confusing

(U11/JUN.00575 Süddeutsche Zeitung, 04.06.2011, S. V2/9; Ein bisschen Spaß muss sein, from DeReKo, IDS Mannheim)

- (19) \**Die Katze ist das Sofa zerstörend*  
the cat is the couch destroying

Due to its verbal properties, the present participle is mainly considered as a verbal form, more precisely an infinitival form (Bech, 1955). Fuhrhop and Teuber (2000) show that present participles and other infinitives are in a complementary distribution: whereas e.g. the *zu*-infinitive occurs with auxiliaries, only present participles can be used attributively. Therefore, they conclude that the present participle is an adjectival infinitive. The question whether the participle is formed by inflection or derivation could be interesting for processing because there might be a difference, e.g. for predictability, if it is a different lexical entry or a form of the specific verb. The fact that the argument structure is the same for the participle and the finite verb (or other non-finite forms) suggests that the same dependency relations hold and also that the arguments contribute to predictability in the same way.

As mentioned above, there are seeming exceptions to each of these rules: even though predicative use is not possible with most present participles, it is grammatical with others, as in (20-a). However, in this case the present participle is lexicalized as a full adjective (e.g. Dudenredaktion, 2016, p. 431). Weber (1971) shows that, on the one hand, *bedeuten* ‘to mean’ cannot be used as an intransitive verb, although it is possible in the copula construction. On the other hand, if *bedeutend* takes arguments, it cannot be used predicatively.

- (20) a. *die Ansätze sind bedeutend*  
the accounts are meaning  
‘the accounts are meaningful’  
b. \**die Ansätze bedeuten*  
the accounts mean  
c. *die Ansätze bedeuten einen großen Fortschritt*  
the accounts mean a huge progress  
d. \**die Ansätze sind einen großen Fortschritt bedeutend*  
the accounts are a huge progress meaning

(Weber, 1971, p. 159f; gloss added)

Furthermore, *bedeutend* can be combined with the adjectival prefix *un-*, but again only if it is not extended by an argument, cf. (21).

- (21) a. *die unbedeutenden Ansätze*  
the un-meaning accounts  
'the accounts that are not meaningful'
- b. \**die einen großen Fortschritt unbedeutenden Ansätze*  
the a huge progress un-meaning accounts

There is also a change in meaning when it is used as in (20-a) compared to the transitive use. It is possible to form the comparative and superlative. Furthermore, it can be combined with a degree adverb like *sehr* 'very' (Weber, 1971; Rapp, 2015). All of this indicates that the two forms are fundamentally different. Present participles that behave like *bedeutend* can therefore be considered as full adjectives. Note, however, that there still exists a verbal present participle that is homophone and that can also be used attributively, as in (22).

- (22) *die einen großen Fortschritt bedeutenden Ansätze*  
the a huge progress meaning accounts  
'The accounts meaning a huge progress'

#### 2.3.2 Temporal interpretation and aspect of present participles

Having established that the present participle can be considered as verbal, I now focus on the temporal interpretation of the event that the participle denotes. Although going into detail about the underlying semantics of attributive participles is beyond the scope of this thesis, I will provide a summary of previous research. This will be relevant as the possible temporal relations between the participle, noun and main clause could potentially have an effect on the acceptability or the processing of this construction.

Lübbe and Rapp (2011) observe that the present participle is usually interpreted with imperfective aspect and as simultaneous to the main clause predicate, see (23). This becomes even more noticeable when present participles are compared with past participles, which are perfective and the event is usually interpreted as anterior to the main clause event, cf. (24).

- (23) a. *Die am Sofa kratzende Katze hat vermutlich Hunger.*  
the on-the couch scratching cat is presumably hungry  
‘The cat scratching on the sofa is probably hungry’
- b. #*Die am Sofa kratzende Katze schläft.*  
the on-the couch scratching cat sleeps  
‘The cat scratching on the sofa is sleeping’
- (24) a. #*Die gefütterte Katze wartet geduldig auf das Abendessen*  
the fed cat waits patiently for the dinner  
‘The fed cat is waiting patiently for dinner’
- b. *Die gefütterte Katze schläft*  
the fed cat sleeps  
‘The fed cat is sleeping’

However, they claim that only the aspectual interpretation is inherent to the participle. The tense of the event denoted by the participle is inferred pragmatically due to this aspectual properties or due to adverbials that indicate tense (see also Brandt, 1993, p. 195). The imperfective aspect of the present participle means that the event of the participle includes the topic time (Reichenbach, 1947; Bäuerle, 1979; Klein, 1994; Lübbe and Rapp, 2011), as shown in 2.1. The topic time can be established with previous context, it can correspond to the time of the utterance or it can be the tense in the main clause.

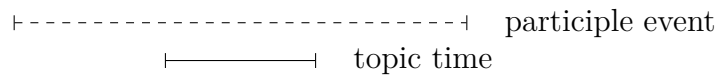


Figure 2.1: Time span of the participle event relative to the topic time.

Without previous context, the most natural interpretation would be that the time span of the participle event includes that of the main clause predicate. If these two events overlap, the interpretation would be that they happen simultaneously. However, there are cases where this interpretation is implausible and the event of the present participle needs to be interpreted as anterior or posterior to the matrix clause predicate. Rapp (2015) also observes a difference between definite and indefinite DPs that are modified by present participles: if they are indefinite, the participle is always interpreted as simultaneous with the matrix clause predicate, whereas if they are definite, a simultaneous interpretation is preferred. It is, however, also possible that the event denoted by the participle happened in the past.

### 2.3. Participles as hybrids of verbs and adjectives

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Following the *Intersective Predicate Generalization* by Keshet (2008), Rapp (2015) claims that participles are temporally dependent on the noun, if they are used as nominal modifiers. This is the reason for the oddness of sentences like (25).

- (25) *#Ich kenne einen in Brooklyn in den Kindergarten gehenden Mann.*  
I know a in Brooklyn in the kindergarten going man  
'I know a man going to kindergarten in Brooklyn.'

With this, she also explains the difference between definite and indefinite DPs for the temporal interpretation with respect to the main clause tense: indefinite DPs are temporally dependent on the main clause predicate, whereas definite DPs are temporally independent. The reason is that definite DPs are temporally anchored in the topic time, which can also be the previous context or the utterance time. Therefore, it is possible to interpret sentences like (26-b) with an anterior time for the present participle in relation to the main clause predicate. Indefinite DPs only have the simultaneous interpretation that leads to a contradiction for the sentence in (26-a).

- (26) a. *#Ein brüllender Junge saß friedlich auf einer Bank.*  
a screaming boy sat peaceful on a bench  
'a screaming boy sat peacefully on a bench'
- b. *Draußen spielten einige Jungen. Einer brüllte laut. Ich ging hinein, um den Lehrer zu rufen. Als wir wieder herauskamen, saß der brüllende Junge friedlich auf einer Bank.*  
outside played some boys. one screamed loud I went inside for the teacher to call when we again out\_came sat the screaming boy peaceful on a bench  
'There were some boys playing outside. One of them screamed loudly. I went inside to call the teacher. When we got out again, the screaming boy was peacefully sitting on a bench.'

(Rapp, 2015, p. 5)

However, following Musan (1995), Rapp (2015) assumes that the default interpretation for definite DPs would also be simultaneous because the main clause provides the context. Only if this causes a contradiction, as in (26), the hearer or reader will search for an alternative context as temporal anchor. Without previous context, this could be the utterance time.

To sum up, present participles are clearly verbal and they denote events. Their aspect is inherently imperfective. The temporal interpretation seems to be flexible. There is a preferred temporal interpretation which is that the event of the participle is simultaneous with the event of the main clause. However, in cases where this results in an implausible interpretation, it is possible to accommodate the event time of the participle phrase, e.g, through previous context, by overt adverbs or the utterance time.

## 2.4 Syntactic analyses of participle phrases in German

After describing the properties of prenominal present participles and taking a closer look at their interpretation with respect to the event time, I will now review suggested syntactic structures. Here, the verbal properties of the participle again play a crucial role and a syntactic structure needs to capture the possibility of extending the modifier.

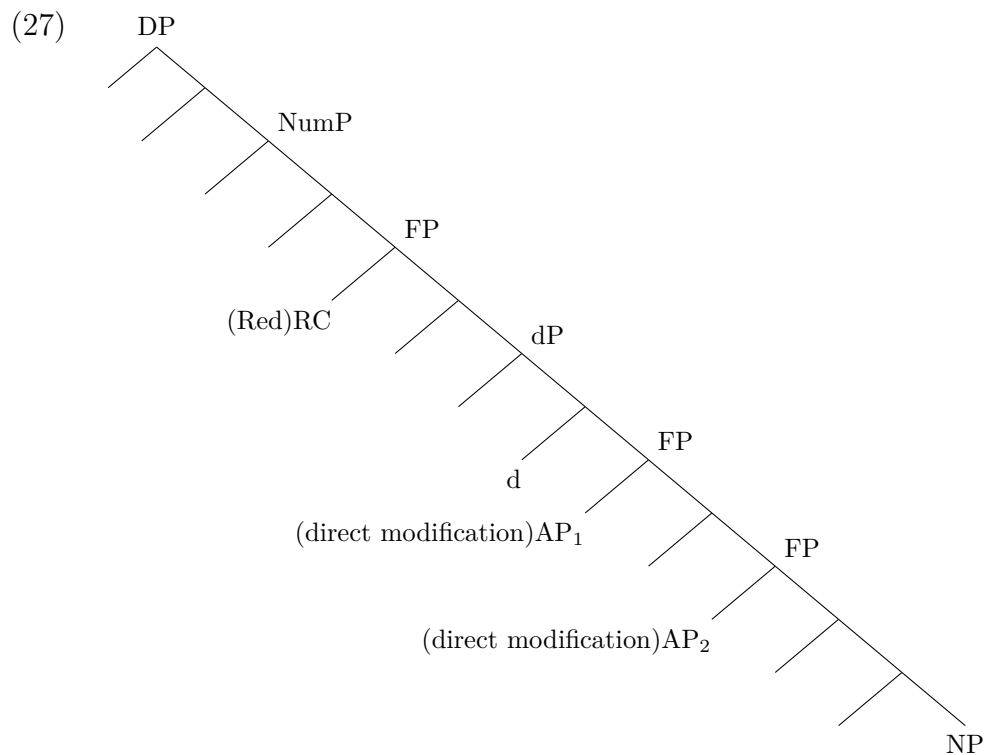
Following Abney (1987), I assume that determiner and noun form a DP, with the determiner as the head. The question then is how and where in this structure an adjective or participle is represented. For a detailed overview and discussion of suggested positions of adjectives, see Alexiadou and Wilder (1998), Cinque (2010), Leu (2014), p.60–68, and Schwarz (2020), p.17–19 (see also Haider, 1988; Olsen, 1991; Demske, 2001; Alexiadou et al., 2008). Several properties of adjectival modification are important for an analysis. It has been suggested that the AP is an adjunct between D and N (Olsen, 1989; Valois, 1993; Bernstein, 1994; Svenonius, 1994; Hankamer and Mikkelsen, 2002). In German, however, definiteness affects adjectival agreement as well, which indicates a relation to the determiner. Hence it cannot be adjoined to the NP (Sternefeld, 2008, p. 236ff).

Cinque (2010) makes a proposal that takes arguments against earlier analyses into account: adjectives are inside an additional functional projection between D and N (see also Crisma, 1993; Cinque, 1994; Giusti, 1994; Gallmann, 1996; Kester, 1996; Scott, 2002; Shlonsky, 2004; Laenzlinger, 2005; Leu, 2014; Schwarz, 2020). He argues that there are several layers of functional projections for different kinds of adjectives, as shown in (27). Participles, and certain adjectives, are considered

## 2.4. Syntactic analyses of participle phrases in German

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as reduced RCs. Following Sproat and Shih (1990), Cinque considered them as instances of indirect modification.



(Cinque, 2010, p. 34)

Under the assumption that participle phrases are in a specific position dedicated to reduced RCs, I will now review analyses of the internal structure of these phrases. Fanselow (1986) and Struckmeier (2010) name several reasons for a sentential structure:

(i) all adjectives can take objects and especially present participles can take an accusative object. (28) shows an example of a present participle taking a dative and an accusative object. This similarity to finite clauses indicates a VP (and vP) structure.

- (28) *die dem Besitzer<sub>DAT</sub> eine Maus<sub>ACC</sub> bringende Katze*  
 the the owner<sub>DAT</sub> a mouse<sub>ACC</sub> bringing cat  
 ‘the cat bringing the owner a mouse’



(ii) It is possible to have a bound anaphor inside the modifier; as shown in (29-a), the reflexive *sich* is coindexed with the head noun. However, it cannot be coindexed with any other noun outside the modifier than the head noun, cf. (29-b).

- (29) a. *die sich<sub>i</sub> treue Frau<sub>i</sub>*  
the refl. true woman  
‘the woman who is true to herself’  
b. *\*Peters<sub>i</sub> sich<sub>i</sub> treue Frau*  
Peter’s himself faithful wife  
Intended: ‘Peter’s wife who is faithful to him’

(Fanselow, 1986, p. 343)

The fact that an anaphor inside an adjectival phrase exists and has to be co-referent with the noun also raises further questions about the representation of the noun inside this phrase.

Fanselow (1986) assumes an operator (or PRO, see Cinque 2010, p. 54–56) which is co-referent with the noun.<sup>5</sup> This co-reference is established semantically (Fanselow 1986, p. 360; cf. (30)).

- (30) (*die (op<sub>j</sub> e<sub>j</sub> sich<sub>j</sub> treue) Frau<sub>i</sub>*)  
the refl. true woman

(iii) Scrambling can occur inside the modifier: like in the middle field of a German main clause, focus on an object or adverbial can result in a change of position for prenominal modifier phrases as well, as in (31).

- (31) a. [<sub>DP</sub> *der* [<sub>AP</sub> [<sub>DP</sub> *ihr*] [<sub>immer</sub>] *treue*] *Max*]  
the to-her always faithful Max  
b. [<sub>DP</sub> *der* [<sub>AP</sub> [<sub>immer</sub>] [<sub>DP</sub> *IHR*] *treue*] *Max*]  
the always to-her faithful Max  
‘Max, who is always faithful to her’

(Struckmeier, 2010, p. 343)

(iv) Elements that are supposed to occur high in the clause structure, like sentence adverbials (*leider* ‘unfortunately’; Frey see e.g. 2003) and modals (*wohl*), can occur inside the modifier (Struckmeier 2010, Struckmeier, p.c.), but cf. Brandt 1993, p. 196ff; cf. (32)).

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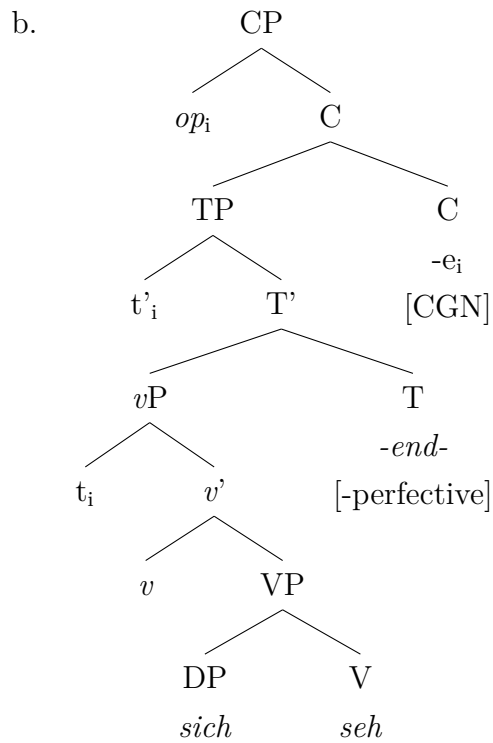
<sup>5</sup>See also Leu (2014), who argues that the noun actually originates inside the reduced RC.

- (32) *das leider* / *wohl* *ziemlich teure* *Restaurant*  
the unfortunately / presumably quite expensive restaurant  
'the restaurant which is unfortunately / presumably quite expensive'

While a reduced RC structure has been suggested for a long time, the analyses differ in whether they assume a sentential structure for all adjectives (e.g. Chomsky, 1957; Smith, 1961; Kayne, 1994) or only for a subset, i.e. only adjectives that can be used predicatively or that bear certain syntactic or semantic properties (e.g. Alexiadou and Wilder, 1998; Cinque, 2010). As present participles have the most verbal properties of all adjectival elements, they undoubtedly fall under the reduced RC analysis.

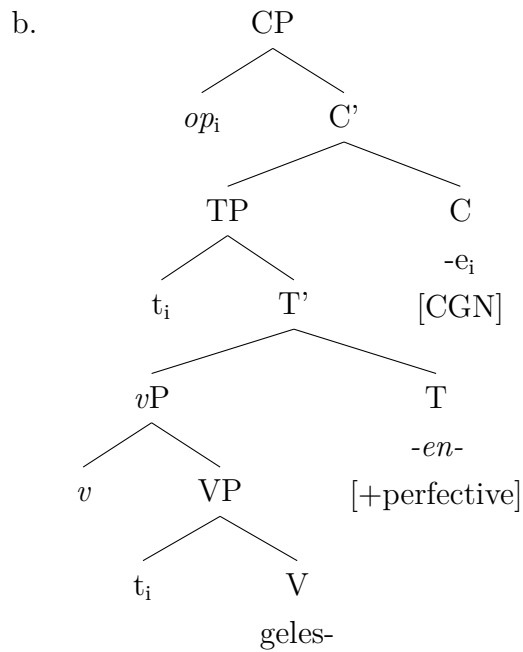
With the aim to capture a uniform internal structure of several kinds of nominal attributes in German, namely adjectives, past participles and present participles, Struckmeier (2007, 2010) suggests a CP structure. For his analysis, he uses the minimalist framework (Chomsky, 1995). The modifier is headed by a CGN-element, i.e. a head that contains the case, gender and number features of the noun. The existence of a TP ensures scrambling. As for prenominal modifiers, he explains binding inside the DP with an operator *op* which moves to the specifier of CGN-CP. There, it is at the edge of the phase and therefore visible for Agree outside the DP. This is essential, as the verbal or adjectival element is infinite and cannot license nominative case. Struckmeier assumes that *op* is defective as it lacks person features. Due to this defectiveness, the probe of the modified noun can also have an asymmetrical Agree relation with *op* and license its case. The noun is in a symmetrical Agree relation with the same probe, therefore the uninterpretable features of *op* are licensed. The exact structure depends on the modifying element: participles have aspectual features which are located in TP. With present participles an internal and external argument exists, therefore *op* is base-generated in the position of the external argument (33-b). The past participle, however, only has an internal argument (34-b). Adjectives have no aspectual head, but TP is nevertheless necessary to ensure scrambling. Hence, Struckmeier assumes an impoverished TP with only EPP features (35-b).

- (33) a. *der **sich** **sehende** Mann*  
the REFL seeing man  
'the man who is seeing himself' (Struckmeier, 2010, p. 682)

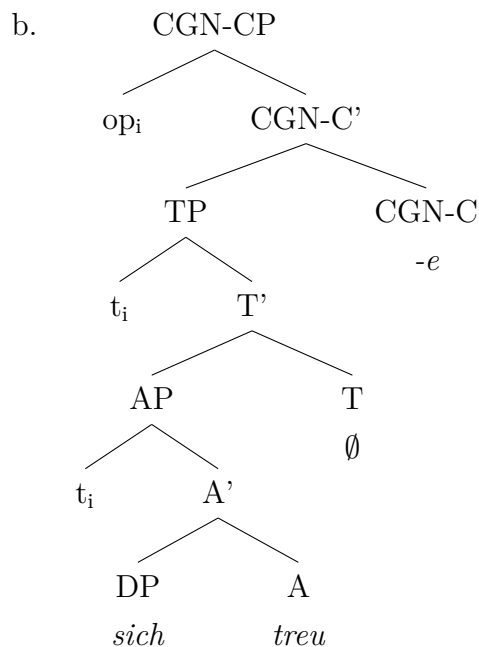


- (34) a. *das **gelesene** Buch*  
 the read book  
 'the book read'

(Struckmeier, 2010, p. 685)



- (35) a. *der sich treue Mann*  
 the REFL true man  
 ‘the man who is true to himself’ (Struckmeier, 2010, p. 686)



Besides capturing the sentential properties of prenominal modifiers, this analysis has the advantage that the DP with its sentence-like modifier parallels the main clause, which can also take CPs as complements (Struckmeier, 2010). Furthermore, participles and adjectives have a different structure due to their lexical properties, with the most verbal structure for present participles.

To sum up, sentential properties of prenominal attributes in general have contributed to the discussion of the syntactic structure of DPs and of these modifiers. The described analyses assume a complex structure for certain modifiers. Present participles, which are in the focus of the experimental part of this work, can be considered as the most sentential prenominal attributes according to the analysis by Struckmeier (2007, 2010) and fall under a reduced RC analysis.

## 2.5 Alternation of prenominal attributes and relative clauses

In the experimental part of this work, prenominal participles will be compared to post-nominal RCs. The comparison has the advantage that the same content can be expressed, but either with a prenominal participle or with a post-nominal RC.

- (36) a. *die das Sofa zerstörende Katze*  
 the the sofa destroying cat
- b. *die Katze, die das Sofa zerstört*  
 the cat that the sofa destroys  
 ‘The cat (that is) destroying the sofa’

As extended participle phrases are supposed to be a written language phenomenon, as discussed in section 2.2, the RC could be an alternative especially for longer or more complex phrases (see Chapter 4). Therefore, I will also summarize the properties and structure of RCs in the following sections. I will mainly focus on RCs in German and the comparison of prenominal attributes and RCs. For a detailed discussion and analysis, see e.g. Cinque (2020); De Vries (2002).

### 2.5.1 Properties of RCs and suggested structures

There are different kinds of RCs in German which have different properties (e.g. Blühdorn, 2007). I will focus on RCs that modify a noun and not discuss free RCs because these are not relevant for the experimental studies.

RCs in German are post-nominal and verb-final. The RC is introduced by a relative pronoun formed with *d-* (*der, die, das*).<sup>6</sup> The relative pronoun agrees with the gender and number features of the head noun, but case is assigned by the RC verb. Contrary to prenominal attributes, all arguments of the verb, including the subject, can be realized inside the RC. Furthermore, the head noun can be represented as any argument (Struckmeier, 2007, p. 7).

Linguistic research has been focusing on RCs from a theoretic perspective as well as from a processing view (see Chapter 3). Theoretical work discusses particular properties that are challenging for a syntactic analysis. One of these properties is that RCs can either be used restrictively, as in (37-a) or non-restrictively (37-b).

<sup>6</sup>A wh-pronoun (*welcher, welche, welches*) is also possible but this form is less frequent.

- (37) a. restrictive  
*Meine Schwester hat zwei Katzen.*  
 my sister has two cats  
*Die Katze, die am Sofa kratzt, hat vermutlich Hunger.*  
 the cat which at-the sofa scratches has presumably hunger  
 ‘My sister has two cats. The cat that is scratching at the sofa is presumably hungry.’
- b. non-restrictive  
*Meine Schwester hat eine Katze.*  
 my sister has a cat  
*Die Katze, die am Sofa kratzt, hat vermutlich Hunger.*  
 the cat which at-the sofa scratches has presumably hunger  
 ‘My sister has a cat. The cat, which is scratching at the sofa, is presumably hungry.’

Simply speaking, a restrictive RC provides information that is necessary to distinguish a referent from a set of potential referents, whereas non-restrictive RCs provide additional information about a referent that is already identified in the context.<sup>7</sup> Corpus data of spoken language shows that non-restrictive and restrictive RCs differ in prosody (Hirschberg et al., 2014). This distinction raised the question whether the difference between restrictive and non-restrictive RCs lies in their syntactic structure or whether it is based on pragmatics (see e.g. Potts 2005; Sternefeld 2008; Simons et al. 2010 for a unified analysis and Ross 1967; Jackendoff 1977; Emonds 1979; McCawley 1982; Fabb 1990; Zifonun et al. 1997; De Vries 2002 for two different structures).

The properties of the relative pronoun that were described above have also been challenging for an analysis of RCs. It shares the features of the head noun, but there is also RC internal case assignment. Therefore, the connection between relative pronoun and head noun needs to be captured (for an overview, see De Vries 2002, Schwarz 2020, p. 19–20). Suggested structures differ in whether they assume that the head noun originates inside the RC, the so-called raising analysis (see e.g. Kayne, 1994; Bianchi, 1999; De Vries, 2002) or whether the head noun is based-generated outside the RC with only a semantic connection between head noun and

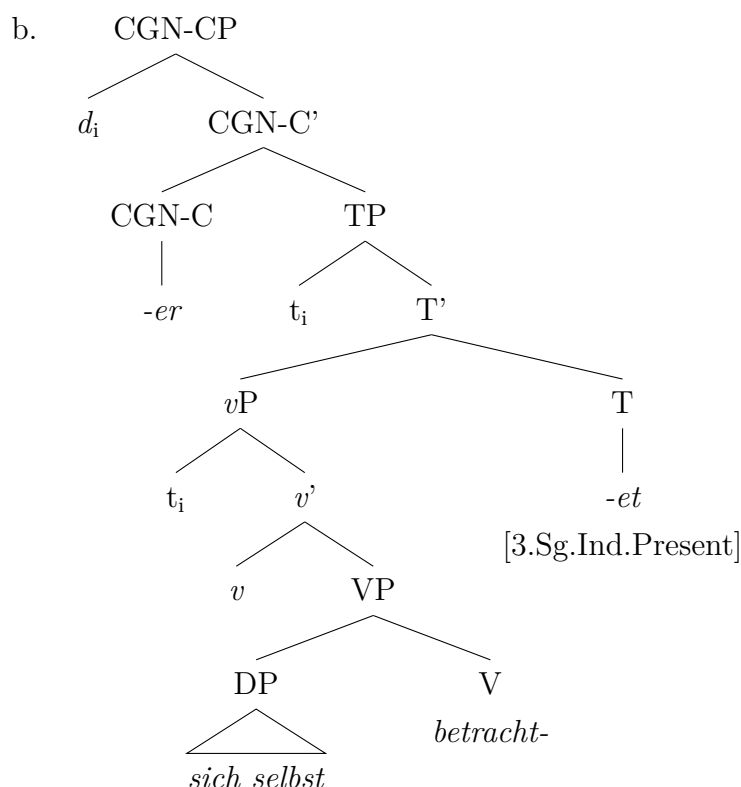
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<sup>7</sup>The exact definition of restrictive and non-restrictive RCs is more complicated because more factors need to be taken into consideration. See e.g. Schaffranietz (1999); Blühdorn (2007) for a more detailed discussion.

the relative pronoun (Quine, 1960; Partee, 1975; Chomsky, 1973, 1977; Jackendoff, 1977; Heim and Kratzer, 1998). A combination of both is the so-called matching analysis with an external head that corresponds to a phonologically empty operator originating inside the RC (e.g. Lees, 1964; Chomsky, 1965; Sauerland, 1998; Hulseley and Sauerland, 2006).

In this thesis, I will present an analysis of RCs suggested by Struckmeier (2007, 2010) because it links relative clauses to the different prenominal attributes in German. He assumes that RCs are headed by CGN, i.e. a head with case, gender and number features, like prenominal attributes in (33-b), (34-b) and (35-b), but have a d- element in the specifier position. As the TP is not impoverished, the verb can assign case and therefore the case of the d- element can differ from that of the modified noun (38-b).

- (38) a. *der Mann, **der sich selbst betrachtet***  
 the man who REFL self looks-at  
 the man who looks at himself' (Struckmeier, 2010, p. 687)



Another property of RCs in German is the possibility to extrapose them. In this case, the RC does not directly follow its head noun like in (39-a) but instead appears at the right edge of the clause, see (39-b).

- (39) a. *Peter ist von der Katze, die gerade schon wieder das Sofa zerstört,*  
Peter is by the cat that now yet again the sofa destroys  
*genervt.*  
annoyed
- b. *Peter ist von der Katze genervt, die gerade schon wieder das Sofa*  
Peter is by the cat annoyed that now yet again the sofa  
*zerstört.*  
destroys  
'Peter is annoyed by the cat that destroys the sofa yet again'

Extrapolation occurs in particular, when the RC is heavy, i.e. contains a lot of material (Behaghel, 1932; Weber, 1971; Struckmeier, 2010).

This section has shown that RCs have several properties that are challenging and interesting for theoretical analyses. This applies in particular to the distinction between a restrictive and a non-restrictive interpretation, but also to the question how the relation between head noun and RC pronoun is established. Although I will mainly focus on surface word order in the main part of this thesis, it is useful for the interpretation of the experiment to keep these properties in mind. Furthermore, the assumption that prenominal reduced RCs and full RCs are closely related, by e.g. Struckmeier (2007, 2010), suggests that the choice and the comprehension is guided by the same processing factors.

### 2.5.2 Comparison of participle phrases and relative clauses

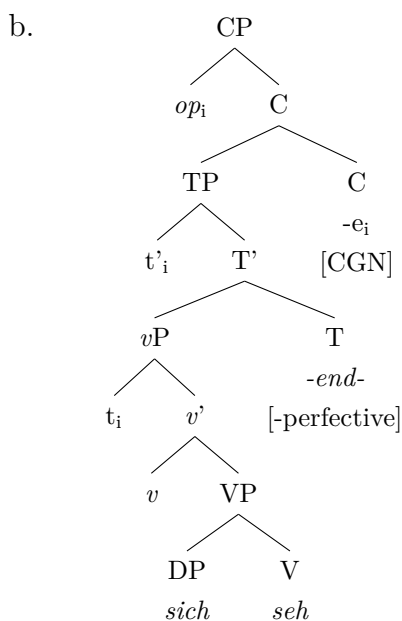
In the course of this thesis, prenominal participles and RCs will be compared, in particular because nouns modified by RCs can serve as a control in the experiments. In online processing, reading times measured at the noun can be compared between the two constructions. In addition, testing both constructions can show whether internal processing effects of prenominal modifiers also occur in finite clauses. For these reasons, it is very important to determine how similar and therefore how comparable the constructions are, but also which differences exist that could affect processing.



A similarity between prenominal attributes or, more precisely, reduced RCs and full RCs in German is the possibility to take arguments. For present participles this means that they are verbal (Bech, 1955) and they keep their argument structure. Furthermore, all kinds of adjuncts can occur. From a syntactic perspective, I will follow Struckmeier (2007, 2010) in assuming a CP structure for both, present participles and RCs. The trees for the attributive present participle and the RC (repeated in (40) and (41)) show this structural similarity.

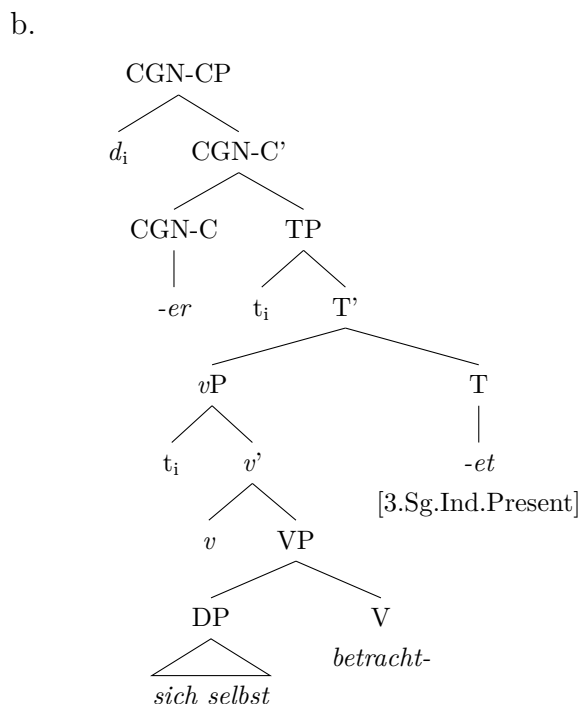
(40)

a. *der sich sehende Mann*  
 the REFL seeing man  
 ‘the man who is seeing himself’



(41)

a. *der Mann, der sich selbst betrachtet*  
 the man who REFL self  
 looks-at  
 the man who looks at himself’



(Struckmeier, 2010, p. 682, 687)

The analysis entails that both have an internal subject which is located at the beginning of the reduced or full RC. This means that there is a subject-verb dependency in both modifiers and this could result in the same processing effects e.g. caused by increasing the distance between the phonologically empty subject or relative pronoun and the participle or RC verb.

The assumption of a shared underlying structure even suggests that RCs might be a way to extrapose the prenominal participle out of the DP, although this is a simplified view because it does not take the difference in finiteness into account (cf. also Brandt, 1993, for further differences between participles and RCs). The same factors that lead to an extraposition of RC to the end of a clause, like length or weight (e.g. Behaghel, 1932; Hawkins, 2004, see Chapter 3) could play a role in the realization as prenominal participle or RC, and they could also affect comprehension.

The structures of both constructions also have several differences, which is interesting for a comparison but might also lead to the problem of teasing apart the causes of certain findings. The probably most obvious difference is the position of the modifier: participles occur between determiner and noun whereas RCs are postnominal. This will be discussed from a processing perspective and investigated further in the course of this thesis.

A further difference lies in the properties of the participle compared to the RC verb. Present participles are not finite, but they have a fixed aspectual interpretation, which is imperfective aspect (Lübbe and Rapp, 2011). For the RC verbs, the aspect is not fixed. Furthermore, as discussed in Section 2.3.2, the preferred temporal interpretation of the participle is simultaneous to the matrix clause verb, which can result in a perceived oddness of certain sentences, see (42-a). For the RC, however, tense is overtly expressed on the verb and therefore an anterior event can easily be expressed, as in (42-b).

- (42) a. *#Die am Sofa kratzende Katze schläft.*  
the at-the sofa scratching cat sleeps  
'The cat scratching at the sofa is sleeping'
- b. *Die Katze, die am Sofa gekratzt hat, schläft.*  
the cat that at-the sofa scratching cat sleeps  
'The cat that was scratching at the sofa is sleeping'

The difference in finiteness, or in Struckmeier's analysis the difference between the defective TP of the participle and the complete TP of the RC, also leads to a restriction for the argument structure. For participles, the head noun always needs to be the subject, whereas it can be any argument with an RC.

A point that will not directly be investigated in this thesis but nevertheless plays a crucial role for modifiers is restrictiveness. As described in the previous section, there are several authors who assume that restrictive RCs differ in their structure

from non-restrictive RCs (Ross, 1967; Jackendoff, 1977; Emonds, 1979; McCawley, 1982; Fabb, 1990; Zifonun et al., 1997; De Vries, 2002). Furthermore, restrictive and non-restrictive RCs are also prosodically different. Prenominal attributes can also be restrictive or non-restrictive (cf. (43) and (44)).

(43) restrictive:

context: *Meine Schwester hat zwei Katzen.*

My sister has two cats

- a. *Die Katze, die am Sofa kratzt, hat vermutlich Hunger.*  
the cat which at-the sofa scratches has presumably hunger  
'The cat that is scratching at the sofa is presumably hungry.'
- b. *Die schwarze Katze hat vermutlich Hunger.*  
the black cat has presumably hunger  
'The black cat is presumably hungry.'
- c. *Die am Sofa kratzende Katze hat vermutlich Hunger.*  
the at-the sofa scratching cat has presumably hunger.  
'The cat that is scratching at the sofa is presumably hungry.'

(44) non-restrictive

context: *Meine Schwester hat eine Katze.*

My sister has a cat

'My sister has a cat.'

- a. *Die Katze, die am Sofa kratzt, hat vermutlich Hunger.*  
the cat which at-the sofa scratches has presumably hunger  
'The cat that is scratching at the sofa is presumably hungry.'
- b. *Die schwarze Katze hat vermutlich Hunger.*  
the black cat has presumably hunger  
'The black cat is presumably hungry.'
- c. *Die am Sofa kratzende Katze hat vermutlich Hunger.*  
the at-the sofa scratching cat has presumably hunger.  
'The cat that is scratching at the sofa is presumably hungry.'

However, there is no difference in prosody (Fabricius-Hansen, 2009). Furthermore, there is no assumption of a structural difference for prenominal attributes, contrary to RCs (Schwarz, 2020). For the course of this thesis, it is mainly relevant that both kinds of modifiers can be restrictive or non-restrictive. As I am considering mainly the surface word order, I will keep the sentences in the experimental part ambiguous with respect to restrictiveness.

Lastly, it could also be relevant that the present participle shows adjectival agreement, i.e. it agrees with the head noun in case, gender and number. In Struckmeier's analysis, this is the CGN-head and it is at the beginning of the modifier for RCs, but at the end for participles.

This section has shown that there are similarities and differences between the two constructions, although they express the same meaning. Most important for the following studies is the sentential character of both constructions. With both constructions being verb-final, this enables a direct comparison of modifier-internal processing effects. However, there are in particular two crucial differences, namely the position of the modifier and the properties of the verb, which is finite in the RC and non-finite in the participle phrase.

## 2.6 Summary

This chapter has shown that attributive present participle phrases are considered to be sentence-like constructions. Cinque (2010)'s reduced RC analysis and the analysis of attributes in German by Struckmeier (2007, 2010) take these sentential properties at face value and assume a CP structure for prenominal attributes as well. The participle in itself is a non-finite verbal form with fixed aspect. The temporal interpretation is usually simultaneous to the matrix clause event, but for definite DPs it can be more flexible (Rapp, 1997).

A closer look at the diachronic development and the occurrence in German dialects suggests that attributive present participles as well as extended prenominal attributes in general differ from regular adjectives. Historically, they developed later than regular adjectives and they originated in the translation from Latin texts (Weber, 1971). Furthermore, in some dialects there seems to be a distinction between adjectives and sentential modifiers. However, there seems to be no clear line between present participles and adjectives: in some dialects, like Bavarian, present participles that are more like typical adjectives are grammatical as nominal modifiers (Weiß, 2017).

The properties and suggested structures of present participles (and other prenominal attributes) were compared to RCs in this chapter because both constructions will be compared in the experimental part as well. Both express the same content and it has been suggested that they have a similar underlying structure. However, they differ in their position (pre- vs. postnominal). RCs have an overt relative

pronoun which can be realized as any argument, whereas for participles the head noun needs to be the subject and RC verbs are finite, contrary to participles which are non-finite and have a fixed imperfective aspect.

# Chapter 3

## Processing background

This chapter provides an overview of theories about the mechanisms that underlie language comprehension. In addition, I will discuss previous empirical findings that provide evidence for these theories. The hypotheses and predictions for the processing of attributive participle phrases in Chapter 4 will be based on the literature discussed in this chapter.

The first part consists of a general overview of explanations for processing effects. This is followed by a review on previous experimental findings and explanations that are relevant for the experiments in Chapter 5 and 6, namely the effect of (non-)locality of dependency configurations on processing, how the presence of an argument can affect processing and previous research related to (multiple) center embedding.

### **3.1 Theoretical approaches to processing effects in non-ambiguous structures**

The theories on sentence processing I am focusing on in this chapter can be divided into two different approaches: those focusing on constraints of working memory and those focusing on the expectations of hearers or readers in the course of a sentence. For both, there is an underlying assumption that sentences are parsed incrementally: when a sentence is processed, hearers do not wait until they have heard all the words, instead the representation of a syntactic structure is built on a word-by-word basis and adapted, if necessary.

The main difference in the theories presented in the following sections is whether they focus on a memory component, i.e. that words or phrases that have already been parsed need to be remembered and connected to upcoming material (cf. Section 3.1.1), or on the anticipation of elements, i.e. whether an upcoming word can already be predicted (cf. Section 3.1.2). These two views are not necessarily mutually exclusive, therefore theories combining these aspects also exist (cf. Section 3.1.3).

### 3.1.1 Memory-based processing accounts

The leading assumption of memory-based theories is that elements like words or phrases have to be kept in working memory during sentence processing. The role of working memory in language processing is traditionally associated with list learning, i.e. elements that are kept in the *phonological loop* (Baddeley and Hitch 1974, see Gathercole and Baddeley 1993 for a detailed overview). This storage capacity is limited to approximately seven elements. However, longer sentences can be stored, as words are combined to chunks while parsing (Miller, 1963). Another view on how sentences are stored in memory is provided by Potter and Lombardi (1990), who state that only the meaning of a sentence but not its surface structure is present after it has been processed (see also Lombardi and Potter, 1992; Potter and Lombardi, 1998). If a sentence is reproduced from memory, its syntactic structure might resemble the original sentence due to lexical activation or structural priming. However, this applies to sentences that are completely processed. The theories in this section focus on the role of working memory when a sentence is only partially parsed and parts of the sentence need to be kept in memory in order to combine them with elements that occur at a later point. Just and Carpenter (1992) suggest that working memory is needed for storage and processing. Due to its limitation, processing difficulties arise when the overall memory load becomes too high. Therefore, elements processed earlier in the sentence could be forgotten or could take longer to be retrieved when they are needed to complete a structure.

The idea that memory constraints affect the production and the acceptability of structures that are in principal grammatical was already stated in the 1960s. Yngve (1960) acknowledges the role of a finite memory in language production: he assumes that natural languages have limits with respect to the depths of embedding.

The fact that languages avoid a certain depth can explain underlying properties of languages, like a preference for binary branching structures “perhaps even to the

### 3.1. Theoretical approaches to processing effects in non-ambiguous structures

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almost complete exclusion of ternary or other larger rules” (Yngve, 1960, p. 454) and the closer connection of object and verb, although the verb agrees with the subject. Furthermore, he claims that every construction that leads to a higher depth when it is applied recursively will have an alternative. This hypothesis is tested on several constructions in English and it is shown that alternatives exist, like postponing the construction or turning it into a discontinuous phrase. In this context, he also mentions extended adjectives: whereas several adjectives do not lead to a higher depth ((1) and Figure 3.1), adjectives that are extended by adverbs lead to higher complexity ((2) and Figure 3.2) (Yngve, 1960, p. 459).

(1) in their big new red house

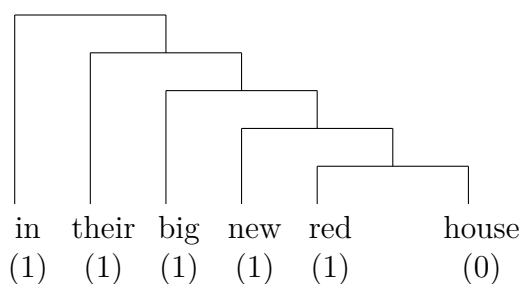


Figure 3.1: Stacked adjectives which have an overall low depth (Yngve, 1960, p. 459)

(2) in their very well built house

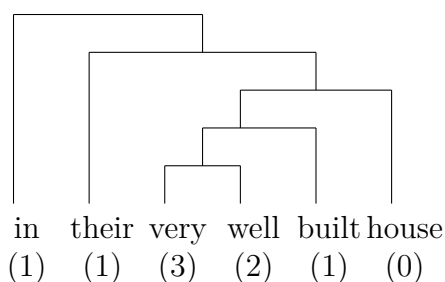


Figure 3.2: Adjective modified by an adjunct, leading to higher depth (Yngve, 1960, p. 459)

The higher depth is avoided, if possible, by postponing parts of the phrase and therefore creating a discontinuous construction ((3) and Figure 3.3). Besides showing that memory load (higher depth) affects the acceptability of sentences and



leads to the use of an alternative, Yngve (1960) hypothesizes that it can also have an effect on grammar as it might guide language change.

(3) a good man for the job

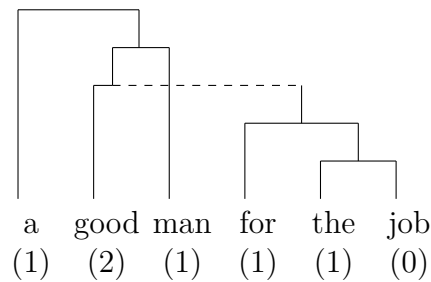


Figure 3.3: Example of a discontinuous phrase to avoid high depth (Yngve, 1960, p. 460)

The observation that otherwise grammatical sentences can become unacceptable or impossible to process due to memory limitations is also discussed in Chomsky (1957, 1965); Chomsky and Miller (1963); Miller and Chomsky (1963); Miller and Isard (1964). Multiply center embedded sentences, e.g. subject-modifying RCs as in (4-a), pose so much difficulty that they are usually perceived as ungrammatical (cf. Section 3.4). If the RCs are passivized and therefore not center embedded, as in (4-b), the whole sentence becomes much easier to process.

- (4) a. This is the malt that the rat that the cat that the dog worried killed ate.  
 b. This is the malt that was eaten by the rat that was killed by the cat that was worried by the dog.

(Miller and Chomsky, 1963; Levy, 2013)

Following these early accounts, the intuition that the limit of memory capacity plays a role in empirically observable processing difficulties has played a crucial role in memory-based theories of language processing. Not only the level of embedding, but also the distance of two dependent elements is assumed to affect processing.

Dependent elements are usually defined as a head of a phrase and its dependent (Temperly and Gildea, 2018), for example a verb as head of a VP and a noun which

### 3.1. Theoretical approaches to processing effects in non-ambiguous structures

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is the subject. How the distance between those elements is defined depends on the assumptions of different processing theories.

There are several theories that discuss an effect of dependency length on production (see e.g. Hawkins 1983, 2003, 2004; the *dependency length minimization*, Temperley 2008; Temperley and Gildea 2018).

Here, I will describe an influential theory for comprehension based on working memory limitations: the syntactic prediction locality theory (SPLT; Gibson 1998) and its newer version, the dependency locality theory (DLT; Gibson 2000). Gibson explains difficulties with complex sentences like center-embedded RCs with two kinds of processing costs: storage and integration costs. Storage costs are defined in the following way:

- (5) DLT STORAGE COSTS  
 1 memory unit (MU) is associated with each syntactic head required to complete the current input as a grammatical sentence.  
 (Gibson, 2000, p. 114)

These costs are in line with the earlier assumptions of Miller and Chomsky (1963) and Yngve (1960): at any point in the sentence, the simplest structure necessary to complete a grammatical sentence has to be stored in memory. (6) shows the storage costs for an object RC. After hearing the first word, the determiner *the*, the hearer will assume that the upcoming words will result in a grammatical sentence.

		The	reporter	who	the
(6)	Storage cost (in MUs)	2	1	3	4
		N, V	V	V (RC), t (RC), V	N, V (RC), t (RC), V

senator	attacked	disliked	the	editor.
3	1	1	1	0
V (RC), t (RC), V	V	DP	N	–

(Gibson 2000, p. 114; I added the structural heads that are predicted)

The simplest syntactic structure needed to achieve this is a noun and a verb, e.g. *The man sleeps*, therefore the storage costs are 2 MUs. After hearing the

next word, *reporter*, the DP is completed, hence only a verb is required to obtain a grammatical sentence (e.g. *The reporter sleeps*), which corresponds to one MU. If the next word is not a verb, but a relative pronoun, more syntactic heads are needed to complete the sentence: at least a RC verb, a gap that is in some way connected with the head noun and the main clause verb, adding up to 3 MUs. In the case of an object RC, as in this example, the storage costs stay high up to the RC verb. One result of the storage cost metric is that nested structures require more open dependencies and are costlier.

Note that storage costs occur at a point in the sentence where a complex structure begins, e.g. at the beginning of a RC. However, experiments showed that reading times are higher when the open dependency is resolved, e.g. at a RC verb. Because of this fact, Gibson (2000, 1998) assumes a second kind of processing costs: *integration costs* arise when a head has to be integrated into the already built structure. Integration costs at a certain point in a sentence are a combination of *discourse processing costs* and *structural integration costs*. Discourse processing costs (cf. (7)) arise for new discourse referents. New discourse referents are usually introduced by heads of DPs, which refer to individuals, or heads of VPs, which refer to events, and have not been previously mentioned in the context. First and second person pronouns refer to the speaker and hearer of an utterance and therefore do not need to be introduced into the discourse.

(7) DLT simplified discourse processing cost

(the cost associated with accessing or constructing the discourse structure for the maximal projection of the input word head  $h_2$ ) 1 energy unit (EU) is consumed if  $h_2$  is the head of a new discourse referent; 0 EUs otherwise.

(Gibson, 2000, p. 104)

In addition to the discourse processing costs, structural integration costs (cf. (8)) arise as well. These costs are especially important for processing effects caused by a greater distance between dependents, which will be discussed in Section 3.2. They arise when a second dependent needs to be integrated into an already built structure. The more material (i.e. new discourse referents) there is between the first and the second dependent, the more difficult it is to retrieve the necessary information from memory when the second dependent needs to be integrated into the structure and the higher the structural integration costs are. As described

above, new discourse referents are nouns or verbs that have not been mentioned before. Warren and Gibson (2002) provide evidence that the distinction might be more fine-grained than a binary one (new vs. old discourse referent) and that the effect of an intervening element on the integration costs might depend on its status based on the *Givenness Hierarchy* of Gundel et al. (1993).<sup>1</sup>

(8) DLT structural integration cost

The structural integration cost associated with connecting the syntactic structure for a newly input head  $h_2$  to a projection of a head  $h_1$  that is part of the current structure for the input is dependent on the complexity of the computations that took place between  $h_1$  and  $h_2$ . For simplicity, it is assumed that 1 EU is consumed for each new discourse referent in the intervening region.

(Gibson, 2000, p. 105)

In the DLT, the measure for distance, which leads to higher memory costs, is defined as the number of new discourse referents between two dependent elements. Gordon et al. (2001) showed that it might not be the discourse status, but rather the similarity of the intervening element and the first dependent, which makes the integration of the second dependent more difficult. In a number of experiments they tested how the reading times (RTs) at the verb of an object RC (or subject RC as control) are affected by the referential expression used for the DP inside the RC, when the head noun was a definite description. In a first experiment, they found that an intervening pronoun did not lead to higher processing cost, compared to a definite DP. This could be due to the fact that definite DPs and pronouns are less similar than two definite descriptions, but the finding is also in line with the DLT. In a follow-up experiment, an intervening proper name did not cause processing difficulties, which is not predicted by the original form of the DLT, but by the assumption in Warren and Gibson (2002) that the processing costs of an element introducing a new discourse referent depends on its givenness, also indicated by its

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<sup>1</sup> The Givenness Hierarchy draws a connection between the discourse status or accessibility of a referent and the referential expression which is used. This connection holds the following way:

Central					Peripheral			
in focus	<	activated	<	familiar	<	uniquely identifiable	<	referential
{it}		{this, that}		{that N}		{the N}		{a N}

(Gundel et al. 1993, cf. also Warren and Gibson 2002, p. 86)

referential form. However, when Gordon et al. (2001) also varied the noun that has to be integrated (cf. (9), in this experiment they investigated cleft constructions), they found that it was rather the match or mismatch of the two DPs that affected whether integration was more costly.

- (9) a. It was the banker / Sue that praised the **barber** / **Dee** just outside of town.  
b. It was the banker / Sue that the barber / Dee **praised** just outside of town.

An effect of similarity is also part of the ACT-R model (Lewis and Vasishth, 2005). Here, in general, the activation of an element in memory decreases over time, which can lead to processing difficulties, when this element has to be retrieved at a later point. On the one hand, when an element with similar features competes with it, retrieval becomes more difficult. On the other hand, cues that reactivate the upcoming dependent facilitate its retrieval.

To sum up, memory-based accounts are considered as mainly backward looking (Futrell et al., 2020): processing difficulties arise because the comprehender loses track of the previous material. The storage cost component, however, can be considered as an exception to this because here the costs would arise at the beginning of a complex structure.

Evidence for memory-based accounts has been provided by studies on the well-established processing difference between subject and object RCs, with processing load for object RCs due to the increased distance to the head noun in languages with postnominal RCs (e.g. Ford, 1983; King and Just, 1991; Gordon et al., 2001; Grodner and Gibson, 2005) and the opposite pattern for prenominal RCs in Chinese (Gibson and Wu 2013, but cf. Wu et al. 2018; Vasishth et al. 2013 for conflicting results). Furthermore, Fedorenko et al. (2013) provide direct evidence for the involvement of memory in the processing of object cleft structures by adding an additional task: while processing the sentence, participants had to remember a proper name that is either identical with the object (i.e. the word that needs to be accessed when the comprehender arrives at the verb), the subject or a different name. They found a processing ease at the verb when the participant had to remember the name identical with the object, showing that a direct manipulation of the memory can affect processing.

More findings will be discussed in detail in Section 3.2, 3.3 and 3.4. However, memory-based effects alone do not suffice to explain all effects that have been observed in language processing and sometimes the empirical evidence even contradicts the prediction. In the following section, I will describe a further processing mechanism.

#### 3.1.2 Expectation-based accounts

Different from the memory-based accounts, expectation-based processing theories focus on the anticipation of certain elements during incremental processing. Evidence for anticipation in processing has been found in shadowing experiments (Marslen-Wilson, 1975), eye-tracking (e.g. Ehrlich and Rayner, 1981), and EEG (Kutas and Hillyard, 1980, 1984; Van Berkum et al., 2005; DeLong et al., 2005; Wicha et al., 2004). The general assumption is that hearers predict upcoming words based on their language experience. Therefore, they are forward-looking in the sense that processing ease or difficulty arises when upcoming material does or does not match the predictions. (10) shows an example: in (10-a), the noun at the end of the sentence is quite predictable by world knowledge, therefore it will be processed rather quickly. In (10-b), in contrast, the noun is less expected and processing would therefore take longer, which could be reflected in higher reading times.

- (10) a. The cat is sleeping on the *couch*.  
b. The cat is sleeping on the *balloon*.

Surprisal theories (Hale, 2001; Levy, 2008a) formalize this idea: “Surprisal [...] is defined simply as the log of the inverse of the probability of an event; in the case of a word  $w_i$  in a sentence following words  $w_1, \dots, w_{i-1}$  and in extra-sentential context  $C$ ” (Levy, 2013, p. 152). (11) shows the calculation. This formula means that more predictable words, i.e. words that occur more frequently in the input after the same sentential context, are less surprising and vice versa.

$$(11) \quad \textit{Surprisal} = \log \frac{1}{P(w_i | w_1 \dots w_{i-1}, C)}$$

So far, the definition of surprisal captures how expected a certain word is. However, it is important to note that this can apply to the exact lexical content as well as to a syntactic category or the probability of a whole construction to follow the previous string of words (cf. Levy, 2008a, p. 24–25).

Surprisal also explains *garden-path effects* (e.g. Frazier, 1978; Frazier and Rayner, 1982): in (12), the reader parses the coordinated DPs *the vet and his new assistant* as the direct object of the verb *scratch* (the example is taken from Staub 2007). However, when she or he arrives at *removed*, the structure that the parser built does not match anymore and needs to be reanalyzed with an intransitive use of *scratch*. As the occurrence of *removed* with the initial analysis is highly unexpected, surprisal costs at this point are very high. Furthermore, the preferred initial analysis as a transitive structure is based on the frequencies of transitive or intransitive use of that verb in the input (Levy, 2013; Staub, 2007).

(12) When the dog scratched the vet and his new assistant removed the muzzle.

Surprisal theory, as an experience-based account, has two consequences for experimental studies like those discussed in the following sections: on the one hand, higher surprisal leads to processing difficulties. Therefore, words or constructions that are unexpected have higher surprisal costs at their beginning, which is reflected for example in higher RTs. One reason for a lower expectation could be an overall low frequency of the construction in the input. On the other hand, increasing the predictability of an upcoming word by narrowing down possible alternatives can ease processing. Like for memory-based accounts, there is also plenty of empirical evidence for the role of expectation in processing (e.g. Konieczny, 2000; Vasishth and Lewis, 2006; Nakatani and Gibson, 2008; Wu et al., 2018).

### 3.1.3 Combinations of memory- and expectation-based theories

Memory- and expectation-based processing accounts provide quite different explanations for well established findings like the higher difficulty for object RCs compared to subject RCs in English (e.g. Ford, 1983; King and Just, 1991; Gordon et al., 2001; Grodner and Gibson, 2005). However, the following sections, especially Section 3.2 will show that there are cases in which they make opposite predictions. In general, the support for both accounts has been mixed, which suggests that they are not mutually exclusive. Furthermore, some studies have been able to show both memory and expectation effects at the same time. The effects depended on the construction that was investigated (Levy and Keller, 2013; Vasishth and Drenhaus, 2011) or on the method (Price and Witzel, 2017). An eye-tracking experiment by Staub (2010)

suggests that both mechanisms are reflected in different kinds of measures. Given these mixed findings, Demberg and Keller (2008) suggested that memory effects are overridden by the processing ease through higher predictability. Infrequent structures and overall higher memory load might then favor memory-based effects (cf. also Husain et al., 2014).

Another possibility for a co-existence of both is that individual working memory differences matter: Chen et al. (2008) and Nicenboim et al. (2015) showed that participants with a low working memory span are more susceptible for memory-based effects, whereas high working memory span participants benefit from a higher predictability.

An attempt to combine both accounts is *lossy context surprisal* proposed by Futrell et al. (2020). Assuming an expectation-based framework, they include a memory component: as described in Section 3.1.2, surprisal theory calculates the surprisal costs based on the probability for a word to occur next given the sentential (and extra-sentential) context. The model by Futrell et al. (2020) assumes that this context is lossy, which means that not all the previous words can be taken into account when the next word is predicted. By increasing the likelihood of a previous word to get lost when it is further away from the to-be-predicted word, memory effects can be integrated in this processing model.

## 3.2 Locality and anti-locality

The memory-based processing accounts described in Section 3.1.1 make clear predictions about the effect of greater distance between two dependent elements: when they are further apart, processing becomes more difficult, which can be observed in lower acceptability ratings and higher RTs on the second dependent. This so-called *locality effect* was observed in several studies.

Grodner and Gibson (2005) found evidence for a locality effect with argument-verb dependencies. With different kinds of modification (cf. (13)), they tested how an increase of the distance between a verb and the noun that is the verb's argument affected online RTs in self-paced reading. Furthermore, they increased memory costs by embedding the modified subject in an object RC ((13-d)–(13-f)).

- (13) a. Matrix—unmodified subject

*The nurse supervised the administrator while...*



- b. Matrix—PP-modified subject  
*The nurse from the clinic supervised the administrator while...*
- c. Matrix—RC-modified subject  
*The nurse who was from the clinic supervised the administrator while...*
- d. Embedded—unmodified subject  
*The administrator who the nurse supervised scolded the medic while...*
- e. Embedded—PP-modified subject  
*The administrator who the nurse from the clinic supervised scolded the medic while...*
- f. Embedded—RC-modified subject  
*The administrator who the nurse who was from the clinic supervised scolded the medic while...*

(Grodner and Gibson, 2005, p. 273; the critical verb and its arguments are highlighted)

In the non-embedded unmodified condition, (13-a), the verb and its arguments are adjacent and therefore they predict it to be the easiest one. With increasing distance, RTs at the critical verb (*supervised*) should increase because more new discourse referents occur between the verb and its arguments (*nurse* and *administrator*), leading to higher integration costs. Their results are basically in line with the predictions of the DLT, showing that higher distance leads to higher RTs on the critical verb. However, the locality effect occurred mainly in the embedded condition, therefore it is unclear whether locality or embedding causes the processing difficulties (cf. Bartek et al., 2011)

By replicating the experiment of Grodner and Gibson (2005) with SPR and eye-tracking, Bartek et al. (2011) showed that it is in fact the mere distance that affects processing: the eye-tracking measures showed the same locality effect in the embedded conditions as in SPR, which was reflected in late measures. In addition, a locality effect in the matrix clause conditions could be observed in early measures. In an additional SPR- and eye-tracking experiment they reduced the overall processing load by the use of short and frequent lexical material. Interestingly, they also found locality effects in the matrix conditions for SPR in this experiment.

Locality has also been suggested to play an important role in grammar and in production (Hawkins, 1983, 2003, 2004; Temperley, 2008; Temperly and Gildea, 2018). Therefore, it is not surprising that corpus data (Futrell et al., 2015; Rajkumar et al., 2016) supports the prediction that dependent elements tend to occur close to each other.

There are, however, studies that contradict a processing difficulty for non-local dependencies (Konieczny, 2000; Vasisht and Lewis, 2006; Nakatani and Gibson, 2008). Konieczny (2000) tested the acceptability and online processing of RC extraposition. Manipulating the length of the RC and the length of the VP (14)<sup>2</sup>, he found that the acceptability judgments were slightly affected by locality, as predicted by memory-based theories, although the adjacent conditions were always preferred to the extraposed variant. However, the results differed for online processing: contrary to the expected locality effect, RTs on the main clause verb were actually lower when it was preceded by a RC than when the RC was extraposed. The length of the RC or additional material in the VP did not show a significant effect, although the latter numerically lead to faster RTs on the verb.

(14) a. adjacent RC

*Er hat die Rose, die wunderschön war / die auffällig schön  
he has the rose that beautiful was / that remarkably beautifully  
gewachsen und ganz besonders farbenprächtigt war, hingelegt / auf  
grown and quite especially colorful was laid\_down / on  
den kleinen runden Tisch gelegt.  
the small round table laid*

b. extraposed RC

*Er hat die Rose hingelegt / auf den kleinen runden Tisch gelegt,  
he has the rose laid\_down / on the small round table laid  
die wunderschön war / die auffällig schön gewachsen und  
that beautiful was / that remarkably beautifully grown and  
ganz besonders farbenprächtigt war.  
quite especially colorful was*

‘He has laid (down) the rose that was beautiful / that was remarkably  
beautifully grown and especially colorful (on the small round table).’

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<sup>2</sup>This is a simplified version of the material in Konieczny (2000). The actual experiment had a 2×3×3-design, with a short, middle and long version of the RCs and VPs.

According to Konieczny (2000), it is not clear whether these results can be explained by anticipation of the main clause verb due to preceding arguments and hence narrowing down the set of possible verbs or whether the increase of distance alone facilitates processing. The latter could be the case because the comprehender knows that a verb is necessary to complete the sentence and the longer he or she waits for it, the more likely it is to be the next word and the faster it is processed. This is supported by the fact that no such *anti-locality effect* was observed for the relative pronoun in the extraposed conditions, but rather an increase in RTs. As the relative pronoun is not an obligatory element of the sentence, this explanation is in line with expectation-based theories. Further evidence for anti-locality effects has been found in other head-final languages as well (e.g. Vasishth and Lewis, 2006; Nakatani and Gibson, 2008).

### 3.3 Processing of arguments and adjuncts

Another aspect that might affect the processing of nominal modifiers that have a rather complex, sentence-like structure is the presence of arguments compared to adjuncts. This is particularly interesting for present participle constructions because in most cases adjectival elements occur without arguments and even though some adjectives can take PP or dative arguments, accusative objects are restricted to present participles. In order to find out whether the presence of an argument affects present participle phrases in the same way as finite clauses, general findings about the processing of arguments and adjuncts will be reviewed in this section.

For English, there are several studies on argument processing which show that an argument is in itself processed faster than an adjunct, due to the fact that it is an obligatory element and therefore highly expected (Clifton Jr et al., 1991; Schütze and Gibson, 1999; Speer and Clifton, 1998). This is the case in particular when verbs are biased towards a transitive use (Kennison, 2002), which provides additional evidence that predictions are an important factor for this processing facilitation. In these studies the argument follows the verb and is predicted by the subcategorical frame of the verb. As present participles in German are head final (as well as RCs), it is more useful to take verb-final structures into account.

If the argument or adjunct precedes the verb, the focus is rather on the effect that it has at the point when the verb is processed. Konieczny and Döring (2003) investigate head-final subordinate clauses in German, using a recurrent neu-

ral network and an eye-tracking experiment. They discuss two possible effects of the presence of arguments compared to adjuncts, which are based on the approaches discussed in Section 3.1: according to memory-based accounts like DLT, any additional argument needs to establish its relation with the verb, which leads to higher structural integration costs (especially when the argument and verb are not adjacent), therefore the verb is processed more slowly. Expectation-based accounts predict the opposite because the presence of an argument already gives information about the kind of verb that will appear and when it will appear. At the point which the comprehender has only encountered the subject, it is possible for the next word to be an intransitive verb (for this illustration, adjuncts are not taken into account). However, it is also possible that an argument is going to occur next, followed again by another argument. When the comprehender has seen an accusative object, this narrows down the possible verbs to transitive and ditransitive verbs. Furthermore, the arguments can also carry more information about the kind of verbs to appear, e.g. with respect to animacy. Hence, after having seen several arguments, the kind of verb becomes more predictable and the probability for the next word to actually be the verb, and not an additional argument, rises. This leads to faster processing of the clause final verb.

The prediction of expectation-based accounts was borne out in the recurrent neural network model and the eye-tracking experiment: testing sentences like in (15), they found that the RTs at the verb are lower when it is preceded by a dative object (*dem Kunden* ‘the<sub>DAT</sub> client<sub>DAT</sub>’) compared to a genitive DP modifying the subject (*des Kunden* ‘the<sub>GEN</sub> client<sub>GEN</sub>’).

(15) a. 2nd NP: Dative

*Die Einsicht, dass der Freund dem Kunden das Auto aus  
 The insight, that the friend the client<sub>DAT</sub> the car (made) from  
 Plastik verkaufte, erheiterte die Anderen.  
 plastic sold, amused the others.*

‘The insight that the friend sold the car made from plastic to the client amused the others.’

b. 2nd NP: Genitive

*Die Einsicht, dass der Freund des Kunden das Auto  
 The insight, that the friend (of) the client<sub>GEN</sub> the car  
 aus Plastik verkaufte, erheiterte die Anderen.  
 (made) from plastic sold, amused the others.*

‘The insight that the friend of the client sold the car made from plastic amused the others.’

(Konieczny and Döring, 2003)

### 3.4 Double center embedding

In the early approaches of memory limitations in language processing (cf. Section 3.1), multiply center embedded structures are shown as a classic example of sentences that are syntactically well-formed but unacceptable due to processing complexity. This can be seen in the embedded structure in the example by Miller and Chomsky (1963) (repeated in (16) for convenience), which is difficult to process.

(16) This is the malt that the rat that the cat that the dog worried killed ate.

According to the DLT, there are two sources for this complexity. On the one hand, at the beginning of each level of embedding, storage costs rise. At the beginning of the first RC (after *the malt*), only the RC verb is necessary to complete the sentence. However, as it is an object RC, the parser is still waiting for the verb when the RC subject (*the rat*) is encountered. When this RC subject in turn is modified by an RC, two syntactic heads are predicted and need to be stored in memory. The highest storage costs then arise at the third level of embedding, when the parser is waiting for three verbs to complete the sentence.

On the other hand, the integration costs according to DLT are also high, due to the long distance between *ate* and its arguments *malt* and *rat*. This would predict the highest processing load at the end of the sentence.

An interesting phenomenon in connection with center embedding is the so-called ‘missing VP effect’ or ‘VP illusion’ (Frazier, 1985; Gibson and Thomas, 1999): multiply center embedded structures as in (2-a) seem to be perceived as grammatical when one of the obligatory VPs is missing. However, this only applies to the VP in the middle. The actually grammatical version of the sentence (2-b) tends to be perceived as less well-formed than the one with the missing verb.

- (17) a. \*The patient who the nurse who the clinic had hired met Jack.  
b. The patient who the nurse who the clinic had hired admitted met Jack.

(cf. Gibson and Thomas, 1999, p. 226f)

The effect seems to be stable for English (Gibson and Thomas, 1999; Christiansen and MacDonald, 2009; Vasishth et al., 2010) and French (Gimenes et al., 2009). For German, however, the evidence is mixed: Vasishth et al. (2010) found no missing VP effect and attributed this to the SOV word order in German, compared to English SVO. However, Häussler and Bader (2015); Bader (2016) found a missing VP effect for German.

As discussed before, high memory load, due to storage costs, integration costs and interference (e.g. Bader, 2016) could be the reason why readers simply forget that one more VP is necessary for the sentence to be grammatical. With the *lossy context model* as a combination of memory and expectation-based processing, Futrell et al. (2020) provide an explanation for the missing VP effect: as the comprehender predicts upcoming words based on a lossy memory representation of previous context, rare structures as multiply center embedded structures (especially in English) tend to be remembered incorrectly more often. Given a structure in memory without the second level of embedding, the actually correct sentence with three verbs will be highly surprising, whereas the incorrect sentence is considered as grammatical.

Although missing VPs are not going to be investigated in the course of this thesis due to the difference in positions of prenominal present participles, the effect indicates that multiple embedding leads to processing difficulties. Higher levels of embedding are not considered as acceptable, even though the sentence is in theory grammatical. Furthermore, the acceptability of sentences missing a VP suggests that high memory load causes the reader to forget parts of the parse.

## 3.5 Summary

This chapter discussed that memory and expectation constitute two processing mechanisms that explain empirical findings. The DLT (Gibson, 1998, 2000) was introduced as a memory-based theory that predicts processing difficulties with increasing distance of two dependent elements. Surprisal theory (Hale, 2001; Levy, 2008a) can predict the opposite, namely lower RTs on a second dependent, when the intervening material leads to a stronger expectation. Experimental studies, often focusing on RC processing, found mixed evidence and suggest that both mechanisms play a role, which is also captured in recent theories (Futrell et al., 2020). Those

two mechanisms are able to explain previous findings for (anti-)locality effects, differences between arguments and adjuncts in processing and difficulties caused by multiple layers of center embedding.

## Chapter 4

# Research questions and predictions

After reviewing the properties of prenominal attributes, with the focus on present participles and RCs in Chapter 2, and providing an overview of several processing theories and findings in Chapter 3, I will now apply the described processing mechanisms to the phenomenon. Overall, it is the aim of this thesis to investigate the processing of present participle phrases in comparison to RCs. Present participles are especially interesting because they have verbal and adjectival properties, but the findings might also shed light on the processing of adjectival phrases in general. Note that even though participle phrases are compared to RCs, the findings for the participles are the main focus because their processing has not been investigated as extensively as for RCs.

For the following hypotheses, several theories and findings that are mainly based on finite (verb-final) clauses will be taken into account. For processing, it is important to consider the differences of both constructions, especially the position in the DP. Therefore, the aim is not to test whether the same effects occur for both constructions, but rather whether the theories can be applied in the same way, taking particular differences into account. Furthermore, the hypotheses need to take into account that the processing of (extended) attributive present participles is interesting from two perspectives: from a phrase-internal view, it is interesting to investigate whether certain factors affect the participle phrase in the same way as other verb-final clauses like RCs. From a phrase-external view, i.e. focusing on the whole DP, the question is whether the properties, especially the prenominal position of the participle, lead to higher processing costs under certain circumstances.



This chapter starts with a review of previous literature that directly compares present participles, and prenominal attributes in general, with RCs. In this part, I will summarize suggested factors for the choice of the constructions and present research on comprehension of the constructions. After that, I will provide data from a small corpus analysis that focuses on prenominal present participles and their frequencies depending on the factors that will be investigated in the acceptability and comprehension studies in the following chapters. Based on processing theories, previous assumptions and production data, I will then formulate hypotheses for the factors investigated in the experimental part: modifier length, internal structure and multiple embedding. In addition, the predictions will be refined for the different methods used in the experimental part of this thesis.

## **4.1 Previous assumptions about the occurrence of present participles and the alternation with RCs**

In order to formulate hypotheses about the effect of different factors for attributive participle phrases, I will first review previous research that is concerned with the alternation of prenominal modifiers, in particular attributive present participles, and RCs. Besides mainly theoretical approaches (Brandt, 1993; Fabricius-Hansen, 2016), comparisons of prenominal modifiers and RCs in German are mainly based on comparative approaches (Doherty, 2010; Fabricius-Hansen, 2010). The only experimental approach, to my knowledge, is provided by Sikos et al. (2017), who investigated participles and RCs in order to find effects of the uniform information density (UID) hypothesis in language comprehension. In the following I will summarize factors that have been found to affect the choice of prenominal or post-nominal modification for production or factors affecting the comprehension of both constructions. As my experimental focus is on comprehension and as not all suggested factors will be taken into account, I will summarize the suggestions and refine certain factors relevant for the experiments later in this chapter.

### 4.1.1 Production of pre- vs. postnominal attributes

Based on Doherty (2010), Fabricius-Hansen (2016) discusses the distribution of prenominal attributes and RCs. She suggests a number of factors that can affect the choice of one of the constructions: the properties of the modifier head, the length or weight of the modifier, multiple modification, information structural and prosodic factors, the information status of the modifier and the contextual accessibility of the content of the modifier.

When all kinds of attributes that can occur pre- and postnominally are considered, certain modifier heads seem to be preferred in prenominal position and others are more likely to be expressed as RCs (Fabricius-Hansen, 2016). Regular adjectives are usually realized prenominally. Furthermore, there could be a connection between the realization closer to the noun in the case of multiple modification and the likelihood of being expressed in an RC, based on the subtype of the adjective (see e.g. Rijkhoff, 2001, 2008). It is unclear, however, how this relates to participles, but I would assume that they are usually realized further away from the noun when there are additional adjectives and that they are therefore more likely to be realized as an RC than certain adjectives (cf. also Cinque, 2010, p. 64f). The focus of this thesis is on participles only, hence there should be no differences based on the subtype of the modifier head. Instead, I will manipulate the internal structure of the modifier.

A potential reason for the realization of a modifier in pre- or postnominal position is its length or weight. Fabricius-Hansen (2016) and Weber (1994) discuss this as a factor, based on e.g. Behaghel (1932)'s "Gesetz der wachsenden Glieder" ("law of increasing constituents"). The assumption is that a modifier that consists of a longer phrase will more likely be realized as a postnominal RC, due to the disruption of the noun phrase that is caused by the mixed word order of German. As modifier length will be tested in the experimental part of this thesis, I discuss potential effects of modifier length on comprehension in more detail later in this chapter.

As a further influence on the choice of modifier position, Fabricius-Hansen (2016) mentions multiple modification, as in (1). In this case, both pre- and postnominal modification are used to establish a certain balance.

- (1) *...eine junge, gerade flügge gewordene Krähe, die der Fuchs erbeutet*  
a   jung   just   fledged become   crow   which the fox   captured  
*hatte*  
had  
'a young crow just fledged that the fox had captured'

(Cord Riechelmann, Krähen Berlin. 2013. S. 16; cit. from Fabricius-Hansen 2016, p. 14, gloss added)

Information structure and focus are also relevant factors for the alternation of prenominal attributes and RCs in production. Prenominal attributes are prosodically fully integrated into the DP (Fabricius-Hansen, 2016). As prosody plays an important role not only for spoken language but also for written language due to silent reading (Féry, 2005), a difference in the information structure could affect the realization as a prenominal attribute or RC. According to Fabricius-Hansen, prenominal attributes occur when the focus is on the head noun, due to the corresponding stress pattern, whereas RCs are less marked with focus on the modifier. She also acknowledges that the effect of information structure alone does not suffice as the actual realization results from an interplay of all factors.

The information status of non-restrictive modifiers of definite DPs might also play a role: for RCs, the information should not be trivial, i.e. known to the reader, whereas this is accepted for prenominal attributes (cf. also Potts, 2005).

Fabricius-Hansen (2016) shows this with the example in (2).

- (2) context: Um etwas über die Wohnwünsche von jüngeren Menschen zu erfahren, ließ der Sozialpsychologe R. Steven Schiavo [...] 1990 Kinder und Jugendliche zunächst die wirkliche Aufteilung ihrer Wohnung skizzieren. Anschließend sollten sie den Grundriss aufmalen, den die sich selbst wünschen.  
'In order to learn something about the housing wishes of younger people, in 1990, the social psychologist R. Steven Schiavo [...] had children and adolescents first of all sketch the actual layout of their home. Then they were asked to draw the the floor plan they would like for themselves.'

- a. *Wie sich zeigte, teilten die jungen Versuchspersonen in ihrer*  
As REFL showed divided the young participants in their  
*Idealvorstellung die Wohnfläche häufig anders und*  
ideal conception the living space often differently and  
*differenzierter auf.*  
more differentiated  
'As it turned out, the young participants often divided the living space  
differently and in a more differentiated way in their ideal conception.'
- b. *#Wie sich zeigte, teilten die Versuchspersonen, die jung waren,*  
As REFL showed divided the participants who young were  
*in ihrer Idealvorstellung die Wohnfläche häufig anders und*  
in their ideal conception the living space often differently and  
*differenzierter auf.*  
more differentiated  
'As it turned out, the participants, who were young, often divided the  
living space differently and in a more differentiated way in their ideal  
conception.'

(GuG 9/2006: 23, citation from Fabricius-Hansen 2016; gloss added)

In this case, the introduction of the referent as *children and adolescents* indicates that the participants are young. Hence, a non-restrictive RC as in (2) is less likely to be used and less acceptable than an adjective as in (2).

The writer of a text might make use of the ambiguity for prenominal attributes in order to leave it to the reader whether the information conveyed in the modifier is new and 'non-trivial' to them or not (see also Brandt, 1993).

Furthermore, there is a difference in accessibility between prenominal attributes and non-restrictive RCs: for the RCs, it is possible under certain circumstances to resume the content of the modifier, e.g. with a pronoun (*das* 'that'), whereas it is more difficult to refer to the content of a prenominal attribute. Hence there might be cases when an RC is used for that reason.

While information structure and further contextual aspects undoubtedly play a role in the realization and presumably also in the processing of prenominal attributes, including participles, and RCs, I will not consider those factors in the experimental part. The experimental stimuli will all be presented without context, hence there will not be any manipulation in this respect.

Table 4.1: Material from the experiment in Sikos, 2017, p. 3169

Context	Encoding	Example
Predictive	Post-nominal	Der Journalist veröffentlichte den Essay, der sorgfältig verfasst worden war, unter Einbeziehung des größeren Kontextes. “The journalist published the essay that was carefully written, taking into account the larger context.”
Predictive	Pre-nominal	Der Journalist veröffentlichte den sorgfältig verfassten Essay unter Einbeziehung des größeren Kontextes. “The journalist published the carefully written essay, taking into account the larger context.”
Non-predictive	Post-nominal	Der Mann bewertete den Essay, der sorgfältig verfasst worden war, unter Einbeziehung des größeren Kontextes. “The man evaluated the essay that was carefully written, taking into account the larger context.”
Non-predictive	Pre-nominal	Der Mann bewertete den sorgfältig verfassten Essay unter Einbeziehung des größeren Kontextes. “The man evaluated the carefully written essay, taking into account the larger context.”

#### 4.1.2 Comprehension of pre- vs. postnominal attributes

Sikos et al. (2017) also investigated the alternation of prenominal modifiers and RCs. Based on the UID hypothesis (e.g. Jaeger, 2010), which states that evenly distributed information facilitates processing, they show that the comprehension of prenominal attributes and the corresponding RCs is affected by the preceding context. They used a maze task and manipulated the kind of modification (prenominal attribute or RC) and the predictability of the head noun, as shown in Table 4.1.

The UID hypothesis predicts the following pattern: If the noun is easier to predict from the beginning of a sentence, a prenominal modifier would give additional information that makes the noun even more predictable, leading to a low information density, whereas the information is more evenly distributed in the case of an RC. If the context does not make the noun predictable, the additional information of a prenominal modifier leads to a more balanced distribution of information. The results are in line with their predictions: although the head nouns were always pro-

## 4.2. Corpus data

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Table 4.2: Instances of extended prenominal modifiers by modifier head, only contemporary German (from Weber, 1971, p. 214)

TOTAL	present participle	past participle	gerund	adjective
1.805	356	767	41	640

Table 4.3: Distribution of the kinds of extension (see Weber 1971, p. 215; note that multiple elements can occur inside one attribute)

TOTAL	accusative	dative	PP	adverbial
1.805	91	94	763	1.191

cessed faster in the predictive condition, the difference between the predictive and the non-predictive conditions was greater for RCs than for prenominal modifiers. The pattern suggests that the information added by the prenominal modifier balances out the lack of predictability in the non-predictive condition. As I will not manipulate the predictability of the modified noun, the general difference between pre- and postnominal modification is of even higher interest in this thesis. In their study, there was a complementary pattern for the head nouns and for the modifier region: while the head nouns were read faster if they followed a prenominal modifier in both the predictive and non predictive condition, the RTs on the modifier region were overall higher for the prenominal modifiers compared to the RCs.

## 4.2 Corpus data

In Chapter 2, I showed Weber’s (1971) corpus data about extended prenominal modifiers (see Table 4.2 and Table 4.3 repeated below for an overview). Here, I will focus on contemporary German only. His corpus data were taken from court decisions, law texts, official certificates and biographies, which were written between 1912 and 1966.

Table 4.2 shows that there are less cases of extended present participles compared to adjectives and past participles. Furthermore, accusative and dative objects occur less often than PPs (objects or adjuncts) or adverbs (Table 4.3). It is important that all the attributes shown in Table 4.2 are considered and not all of them can take accusative objects. However, Weber mentions that the number of accusative

Table 4.4: Number of attributes containing more than one constituent by modifier head (see Weber, 1971, p. 215)

TOTAL	present participle	past participle	gerund	adjective
322	87	155	8	322

objects is rather rare given the fact that transitive sentences occur frequently overall and that they can productively be transformed to a prenominal attribute.

He provides further data about the length of the modifier. Table 4.4 shows the number of attributes that contain more than one constituent that are direct dependents of the modifier head.<sup>1</sup>

A comparison of Tables 4.2 and 4.4 shows that he found 356 extended present participle phrases, but only 87 of them contained more than one constituent.

In his research, Weber focuses on several kinds of modifiers at once. This makes it difficult to determine frequencies of present participle phrases alone based on certain properties like modifier length or internal structure. Therefore, I will provide further data about the distribution for prenominal present participles only. Furthermore, part of his data is from the early 20th century and the sources include many legal texts. He states that extended attributes are more likely to occur in this specific register.

As the main focus of this thesis is on comprehension experiments, I will only provide a small corpus analysis based on a randomly created sample of 1000 occurrences. I will leave more a extensive analysis and a direct comparison with RCs for future research.

In order to provide an overview of the occurrence of present participles in German, I used the TAGGED-T2 corpus, which is part of the DeReKo archive of the Institute for the German Language (IDS) in Mannheim ([www.ids-mannheim.de/kl/projekte/korpora/](http://www.ids-mannheim.de/kl/projekte/korpora/)). The corpus comprises newspaper texts from 2010 to 2014 and is tagged for morphosyntactic properties. I extracted 1000 randomly chosen instances of present participles followed by a noun using the analysis system engine COSMAS II (<https://www.ids-mannheim.de/cosmas2/>). This was achieved with the following search query (a combination of regular expressions and the functions of COSMAS II): `#REG(^[a-z][^[:upper:],zu]*en(de$|den$)) /+1:1w,Max`

<sup>1</sup>He also includes reflexives or degree adverbs as constituents. Modifiers of internal DPs, e.g. prepositional attributes, are not counted as constituents in this analysis (see Weber, 1971, p. 204).

Table 4.5: Extended vs. non-extended prenominal present participles. n=912

only participle	extended
690	222

Table 4.6: Number of words inside the participle phrase, between determiner and noun. One word means that there is only the participle. n=912

word number	1	2	3	4	5	6	7	8	9	10
instances	690	97	64	29	15	6	6	2	2	1

#ELEM(ANA='N' ANA='nn'). The results were further investigated with a Python script which extracted the modifier phrase and determined whether it was extended and what kind of phrases and how many words it contained. The results were checked manually.

Cases which were erroneously detected and did not contain a present participle were removed, leaving 912 instances.<sup>2</sup> Out of those, 222 were extended (see table 4.5). None of the extended participles found contained another extended modifier.

Note that the non-extended present participles in this search also included cases that are likely lexicalized as adjectives, like *kommende Woche* ‘upcoming week’ or *entsprechend* ‘corresponding’ (cf. Chapter 2 for a discussion of these cases). Furthermore, there were complex participles, e.g. *machbarkeitsliebende Politiker* ‘feasibility-loving politicians’. These cases also deserve further investigation, which I will leave to future research.

Table 4.6 shows the number of words between the determiner and noun. Table 4.7 shows which elements occurred (at least once) in an extended prenominal participle phrase.

In Weber’s 1971 data, 91 out of 356, hence 25.6% of extended modifiers contained accusative DPs and given that only present participles can take accusative objects, these cases can be directly compared to the present search. In my data, only 18 of 222, i.e. 8.11% of extended present participles contained an accusative object. It is possible that this difference indicates a change in the use of modifier phrases from the early and mid 20th century to the beginning of the 21st century.

<sup>2</sup>Note that participles are tagged as adjectives in the corpus, hence I used the morphological marker *-nde/-enden* in the query. The few instances which were not intended were filtered out by hand afterwards. Those were mainly regular adjectives, in particular *spannend* ‘exciting’, or gerunds formed with *zu* ‘to’.



Table 4.7: Different kinds of extensions for the 222 extended participle phrases and 275 RCs. Note that multiple elements can occur in one modifier. If two identical phrases, e.g. two PPs are contained in a modifier phrase, they are counted only once.)

construction	accusative	dative	PP	adverb/adjective
present participle	18 (8.11%)	3 (1.35%)	85 (36.29%)	121 (54.50%)
RC	123 (44.73%)	14 (5.09%)	165 (60.00%)	74 (26.91%)

Table 4.8: Number of words inside the RC (without the relative pronoun). n=275

word number	1	2	3	4	5	6	7	8	9	≤10	≤20
instances	2	4	27	38	41	40	32	23	15	49	4

However, there could also be a difference in the kinds of texts, with legal texts being more likely to express transitive clauses as prenominal attributes. As the number of occurrences of extended participle phrases is quite small, a more extensive corpus analysis, ideally of different kinds of texts, would be necessary to make conclusions about diachronic changes.

Nevertheless, Table 4.7 shows that accusative objects are less frequent than PPs (adverbial or objects, although most cases can be considered as adverbials) and adverbs. There were only three instances with dative DPs, which is probably due to the overall rarer occurrence of dative objects (Weber, 1971).

For a comparison, I obtained similar data for RCs. I searched for a common noun followed by a comma and a relative pronoun. Out of a random sample of 500 RCs from the same corpus, I extracted subject RCs with a head noun (i.e. no free RCs). In order to keep the data comparable to the participle phrases, only active RCs were considered and I also excluded RCs with predicative adjectives and copula constructions, leaving 275 instances. Table 4.8 shows the number of words inside the RCs.<sup>3</sup>

With a mean length of 6.94 words, RCs are longer than participle phrases, which on average contain 1.52 words – or 3.14 words, if only extended participle phrases are considered. A Wilcoxon rank-sum test showed a significant difference

<sup>3</sup>If there was a coordinated structure with two finite verbs, I only took the part up to the end of the first verb into account because for the participle data, I also only counted the second participle phrase when there were two coordinated participles before a noun.

between the length of extended present participles<sup>4</sup> (median = 3) and RCs (median = 6),  $W = 7000$ ,  $p < .001$ ,  $r = -0.68$ .

Note that RC verbs are finite, hence there is often an additional auxiliary which affects the number of words. Furthermore, some of the RCs contain a subordinate clause, leading to a high number of words. There were two cases of double embedded RCs, as in (3).

- (3) *Zum Beispiel angesichts eines Bären, der sich aus dem Abfall ernährt, den zu viele Touristen auf ihren Wanderungen zurückgelassen haben.*  
for example in the face of a bear that REFL from the garbage feeds that too many tourists on their hikes left behind  
haben.  
have  
'For example, in the face of a bear that feeds on the garbage left behind by too many tourists on their hikes.'

Although these cases affected the average number of words, the kinds of the phrases inside the RC also differ from the extensions of prenominal modifiers. Table 4.7 also shows the elements inside the RCs in comparison to attributive participles.

44.73% of RCs contained accusative objects, compared to only 8.11% of participles. Dative objects are also more frequent (5.09% compared to 1.35%). Although PPs are more frequent with participles than accusative or dative DPs, they occur more often inside RCs (60.00% vs. 36.29%), indicating that DPs are in general more frequent inside RCs. Only adverbs and adjectives were found more frequently with extended prenominal modifiers (54.50%) than with RCs (26.91%). A chi-square test confirms the difference in the distribution of modifier-internal elements ( $\chi$ -squared = 90,  $df = 3$ ,  $p$ -value  $< .001$ ). A residual analysis (see Figure 4.1) shows that the distribution of accusative objects differs highly for participles and RCs: the frequency is above the expected value (based on the chi-square distribution) for RCs, whereas accusative objects occur less frequently than expected with participles. Adverbs or adjectives occur more frequently with participles than inside RCs. The corpus data are in line with the assumptions stated in the previous sections that prenominal attributes are in general shorter than RCs.

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<sup>4</sup>I only included extended present participles in the analysis in order to avoid a bias due to the high number of cases with only the participle, i.e. one word, in the modifier. As certain present participles are used frequently in prenominal position, it cannot be ruled out that they are lexicalized as adjectives (see e.g. Dudenredaktion 2016, p. 431; Chapter 2).

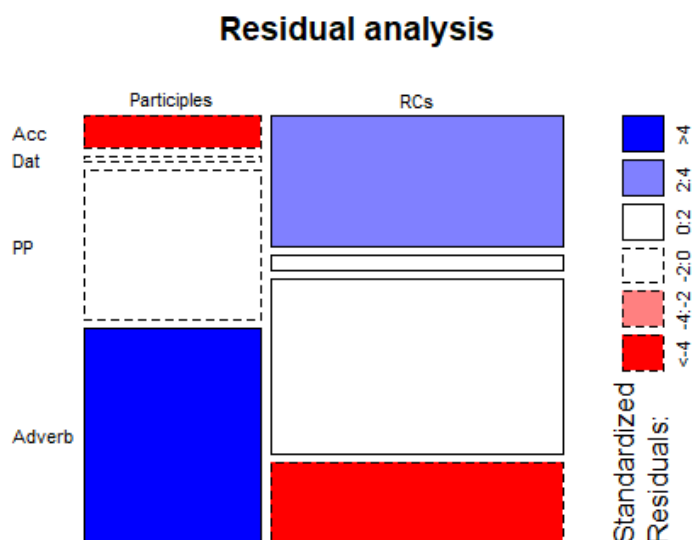


Figure 4.1: Residual analysis for the comparison of the elements inside a participle phrase or RC. The colors indicate the deviance from the expected value, red means that an element occurs less frequently than expected and blue shows a frequency above the expected value.

### 4.3 Different kinds of complexity

After discussing several effects on the alternation of a modifier as a prenominal attribute or RC, I will now focus on language comprehension and hypothesize which circumstances could affect the processing of prenominal participles compared to RCs. Based on the observation that extended participle phrases are mainly restricted to written language, Weber (1994) suggests that they might pose certain challenges to the parser, as it is only possible to read slower or reread parts of a sentence in written language (see also Chapter 2). In the experimental studies of this thesis, I will explore potential causes of this challenge, namely certain kinds of complexity that could affect language processing: modifier length, internal structure and the level of embedding.

Investigating these factors can contribute to the processing theories discussed in Chapter 3, as certain predictions will be formulated based on the different word order configurations of prenominal modifiers and RCs. This applies in particular to the DP, as both constructions differ in whether the noun appears before or after the modifier.

Participle phrases have the advantage over other prenominal attributes in that they behave like verbs in terms of their internal structure, hence comparing both constructions in experimental studies can also shed light on the processing of infinite versus finite clauses. Here the question is whether certain manipulations affect the modifiers themselves in the same way, which should be the case if only the dependency relations matter. However, in order to rule out other differences like e.g. the positions, predictions for the internal processing of the modifier need to be formulated precisely.

### 4.3.1 Memory load due to modifier length

As the corpus data from Weber (1971) show, extended prenominal participle phrases are rather rare compared to the occurrence of only the participle. Together with the observations of Fabricius-Hansen (2016), Doherty (2010) and Weber (1971, 1994), this suggests a length effect for production. Fabricius-Hansen (2016) discusses the word-ratio, namely that an RC contains at least one word more than a prenominal attribute, the relative pronoun. In the case of adjectives or past participles, a copula or passive auxiliary is additionally necessary, which does not need to be the case for present participles. She claims that this difference in the number of words might lead to a preference for short modifiers to be realized as prenominal attributes because it might be more economic. A longer modifier would more likely justify the insertion of an additional word.

Furthermore, the dependency between determiner and noun is interrupted by a prenominal modifier, as in (4), whereas there is no intervening material in the case of the RC, as in (5).

(4)  $\overbrace{\text{die das Sofa zerstörende Katze}}$   
the the couch destroying cat  
'the cat destroying the couch'

(5)  $\overbrace{\text{die Katze, die das Sofa zerstört}}$   
the cat that the couch destroys  
'the cat that is destroying the couch'

This suggests that extended prenominal modifiers in general pose a certain difficulty for processing and that an increase of the modifier length affects the pro-

cessing of the DP in the case of the participle phrase, but not for the RC because the noun occurs before the modifier.

In addition to the determiner-noun dependency, further dependency configurations are relevant: the modifier internal dependency and the dependencies in the main clause, e.g. between the modified DP, if it is an argument, and the verb.

First of all, the situation is somewhat unclear when it comes to the argument-verb dependencies in the case of the participle, which can be considered as a verb from a modifier internal perspective. Whereas the subject of the RC is overtly realized as a relative pronoun (see (7)), there is no (overt) subject inside the participle phrase (6).

- (6)  $\overbrace{\text{die [das Sofa]}_{\text{ACC.-OBJ.}} \text{zerst\"orende} \text{Katze}}$   
 the the couch destroying cat  
 ‘the cat destroying the couch’

- (7)  $\overbrace{\text{die Katze, die [das Sofa]}_{\text{ACC.-OBJ.}} \text{zerst\"ort}}$   
 the cat that the couch destroys  
 ‘the cat that is destroying the couch’

Therefore, this dependency can be assumed rather between participle and head noun, which are adjacent. Hence, more material inside the modifier might also affect the RC more than the participle from a phrase internal perspective.

Secondly, both prenominal modifiers and RCs could disrupt the main clause under certain circumstances, e.g. if the subject or a fronted DP is modified or if it is a verb-final clause. In this case, there might even be an advantage for an extended prenominal modifier, as shown in (8) and (9).

- (8)  $\overbrace{\text{Die das Sofa zerst\"orende Katze hat Hunger}}$   
 the the couch destroying cat has hunger  
 ‘the cat destroying the couch is hungry’

- (9)  $\overbrace{\text{die Katze, die das Sofa zerst\"ort, hat Hunger.}}$   
 the cat that the couch destroys has hunger  
 ‘the cat that is destroying the couch is hungry’

Here it also has to be noted that RCs can be extraposed, as shown in Chapter 2 and in (10).

- (10) a. *Peter ist von der Katze, die gerade schon wieder das Sofa zerstört,*  
Peter is by the cat that now yet again the sofa destroys  
*genervt.*  
annoyed
- b. *Peter ist von der Katze genervt, die gerade schon wieder das Sofa*  
Peter is by the cat annoyed that now yet again the sofa  
*zerstört.*  
destroys  
‘Peter is annoyed by the cat that destroys the sofa yet again’

This possibility shows that speakers can make use of extraposition in order to reduce the distance between subject noun and main clause verb. It is unclear, however, how much extraposition facilitates comprehension, as Konieczny (2000) found a general preference for adjacent RCs in an acceptability task and lower RTs on sentence final verbs preceded by longer RCs.

In the experimental part of this thesis, however, I am focusing on the processing of the DP. I will reflect on potential influences of the different constructions on the main clause in the general discussion (Chapter 7).

A potential effect of the distance between determiner and noun could be calculated using the DLT (Gibson, 1998, 2000). As described in Chapter 3, the DLT assumes two kinds of processing costs: storage costs that arise for open dependencies and integration costs that arise when new discourse referents (which can be simplified as heads of DPs or VPs without previous context) intervene between the first and the second dependent. Table 4.9 and 4.10 show how the theory can be applied to DPs modified by participle phrases and RCs respectively.

For the example with the present participle (Table 4.9), storage costs are highest at the second determiner because at this point, the structure of the first DP needs to be completed, a participle (or adjectival)<sup>5</sup> head is predicted and the DP indicated by the second determiner (*the couch*) needs to be completed. As the storage costs play a more important role for multiple embedding than for a difference in the modifier length, I will come back to them in Section 4.3.3.

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<sup>5</sup>Due to the hybrid nature of the participle (see Chapter 2), it is unclear whether it should be represented as an adjective or a verb in the structure. I chose *A* because the reader is more likely to predict any adjectival element at the beginning of the modifier phrase, especially if it begins with a preposition or adverb.

Table 4.9: Storage and Integration Costs for extended prenominal modifiers according to DLT (Storage Costs including the MC verb are in parantheses)

		die the	das the	Sofa couch	zerstörende destroying	Katze... cat
Storage costs	Predicted heads	N (V)	ANN (V)	AN (V)	N (V)	– (V)
	Memory Unit	1 (2)	3 (4)	2 (3)	1 (2)	0 (1)
Integration costs	New DR	0	0	1	1	1
	Integration	0	0	0	0	2
	Energy Unit	0	0	1	1	3

Table 4.10: Storage and Integration Costs for postnominal RCs according to DLT

		die the	Katze, cat	die that	das the	Sofa couch	zerstört... destroys
Storage costs	Predicted heads	N (V)	– (V)	V (V)	NV (V)	V (V)	– (V)
	Memory Unit	1 (2)	0 (1)	1 (2)	2 (3)	1 (2)	0 (1)
Integration costs	New DR	0	1	0	0	1	1
	Integration	0	0	0	0	0	1
	Energy Unit	0	1	0	0	1	2

The integration costs are highest at the noun because when the DP is completed, i.e. the dependency with the determiner is resolved, there are two new discourse referents crossed: the entity introduced by the DP (*the couch*) and the event introduced by the participle (*destroy*). With the introduction of a further discourse referent, e.g. by the insertion of an additional DP in an adjunct, the integration costs rise at the noun. When there is no DP inside the modifier, e.g. if the participle phrase is not extended (*the sleeping cat*), only one new discourse referent is crossed, namely the event introduced by the participle, when the parser arrives at the noun. In this way, the DLT would predict that longer prenominal modifiers are more difficult to process than shorter ones.

The picture is different for the RC. Here, the maximal storage costs occur again at the determiner of the RC internal DP. However, they are lower because the modifier is not embedded in the DP. Again, I discuss these costs in more detail later in this chapter. The highest integration costs do not occur at the noun but at the RC verb, where a dependency relation with its arguments is resolved. As the object argument in this case is adjacent, only the dependency with the subject crosses a new discourse referent, namely *the couch*. Overall, the highest integration

costs are lower for the RC than for a participle phrase, given the same content. Inserting additional DPs therefore matters for the dependency resolution at the RC verb, but contrary to the participle phrase it should not affect processing at the noun. Therefore, in this case, the noun serves as a control.

Note, however, that there might be different approaches to the status of the participle and the whole prenominal modifier. On the one hand, it has the modifier internal verbal function and, as I am assuming a sentential structure of the modifier (Fanselow 1986; Struckmeier 2007, 2010; Cinque 2010, see Chapter 2), it can be considered as the head of a VP, therefore introducing the event as a discourse referent. On the other hand, it is also part of the DP and serves as an adjectival element and the modified DP itself has the noun as its head, which would mean that from this perspective the whole DP introduces only one discourse referent. This is in turn complicated when there is a DP inside the modifier. Hence, it is debatable how exactly the DLT could be applied to the structure. In my opinion, however, the parallel to the costs in an RC makes sense because otherwise the DLT would predict that the prenominal modifier poses much less processing costs, which is counter intuitive.

To sum up, the DLT predicts that a longer modifier should affect both participle and RC, but at different points. Furthermore, integration costs are in general higher for participles than for RCs. In addition, the DLT provides predictions for the location of potential effects: an increase of modifier length should be visible at the head noun in the form of a locality effect in the case of the participle, but for the RC at the verb.

There is, however, another possibility that might affect online processing in particular: as described in Chapter 3, participants anticipate upcoming material based on the predictions they make during online processing. This is captured e.g. in the *Surprisal Theory* (Hale, 2001; Levy, 2008a). Surprisal Theory and other expectation-based accounts have been used to explain anti-locality effects that have been found in particular in head-final languages (Konieczny, 2000; Vasishth and Lewis, 2006; Nakatani and Gibson, 2008), i.e. faster reading times on the final head when it is preceded by more material. In the case of a participle phrase, the fact that the modifier precedes the noun could also provide the reader/listener with more information about the noun, so he or she can make more precise predictions. These predictions could be about the word class, as it is expected that a noun will appear at one point to complete the DP, but there might also be further information



that help predict lexical properties of the noun. Konieczny's (2000) study showed that an anti-locality effect does not necessarily require information that contributes to the predictability, as an RC between subject and verb also lead to faster RTs, even though the RC does not provide further information about the verb. The results from Sikos et al. (2017) suggest that the a prenominal modifier leads to an anti-locality effect at the noun, as it is read faster compared to the RC conditions. Furthermore, their initial hypothesis assumes that the prenominal modifier leads to a lower information density of the noun, or in other words contributes to its predictability.

An anti-locality effect could also be possible at the modifier verb, i.e. the participle or RC. More material inside the modifier could also contribute to the predictability of the verb, as it was observed in other verb-final clauses in previous studies. This applies in particular for the presence of arguments which enable the reader or listener to predict whether a transitive or intransitive verb will follow (see Konieczny and Döring 2003; Levy and Keller 2013; Chapter 3). I will come back to this point in the next section. In general, it is interesting to see whether participle phrases or RCs differ from a modifier internal perspective in whether they show a locality or an anti-locality effect.

As described in Chapter 3, recent processing theories (e.g. Futrell et al., 2020) assume that both memory and expectation affect processing and previous studies found mixed evidence, also based on the methods or constructions (Staub, 2010; Vasishth and Drenhaus, 2011; Levy and Keller, 2013; Nicenboim et al., 2015; Price and Witzel, 2017). Therefore, it is very well possible that the data obtained in the experimental part can only be explained by an interplay of expectation and memory. I will come back to these mixed theories in the General Discussion (Chapter 7).

### 4.3.2 Argument structure

Another factor that will be investigated in the experimental part is the argument structure of the modifier, or more precisely whether the modifier is extended by an (accusative) object or an adjunct. Unlike modifier length, the previous literature about the alternation of prenominal modifiers and RCs did not discuss this difference. However, the corpus data in Section 4.2 suggest that intransitive prenominal participles are more frequent than transitive ones. As Weber states, this difference does not reflect the distribution of transitive and intransitive verbs in main clauses.

The occurrence in dialects of German might also indicate a difference due to transitivity, although Weiß (2017) explains the ungrammaticality of present participles formed from transitive (or ditransitive) verbs by the ungrammaticality of extended participles because they would need to take an object.

But why could there be a difference between the participle form and the finite form of a verb? Assuming that the present participle does not undergo a change of the grammatical class, but is a verbal form (e.g. Bech, 1955; Fuhrhop and Teuber, 2000; Struckmeier, 2007, 2010), does this mean that the presence of an argument affects processing in the same way?

Based on the studies by Konieczny and Döring (2003); Levy and Keller (2013) described in Chapter 3, it then can be expected for finite verbs in verb final sentences that the predictability increases with argument. For the participle, the predictability should then also increase because when the reader arrives at the modifier internal DP, there needs to be a participle from a transitive verb to complete the phrase. Hence, the argument might facilitate the processing of the participle and of a verb in finite clauses. Note that there is also the possibility that the determiner could be interpreted as a d-pronoun or, if followed by an indefinite as *die einen* ‘the ones/those’. However, when sentences are presented without context and therefore without a potential antecedent, a d-pronoun would probably be quite unnatural.

There are also reasons why an argument might affect the processing of prenominal modifiers differently than in the studies on finite clauses (Konieczny and Döring, 2003; Levy and Keller, 2013). Firstly, as accusative and dative objects seem to occur not as frequently inside a prenominal modifier as prepositional phrases, it is possible that e.g. a determiner following another determiner causes high surprisal, which could lead to higher reading times in online processing. While this is a possible outcome for comprehension of prenominal participles, this would not explain why arguments are less frequently produced with a prenominal participle.

It is, however, also possible that the participle itself causes more difficulty if combined with an argument. Although I am not aware that this has been discussed in the previous literature about participles, a potential difference to finite verbs could be the double role as verb and adjective. When the parser needs to establish the modifier internal verbal dependencies, but also the grammatical and semantic properties connected to its adjectival function with respect to the noun, a richer argument structure could slow down processing. Support for this idea comes from event nominals, i.e. nouns that are derived from verbs that keep verbal arguments.

Although most of the literature discusses cases in which the arguments follow the event nominal and which are therefore not comparable to participle phrases (e.g. Kennison, 2002), the studies by Manouilidou (2006) suggest that the processing of nouns is more difficult if they have a more complex event structure. Hence it could be possible that a more complex structure of the participle, syntactically or semantically, could result in slower processing.

If there is a difference between participles and finite verbs with respect to an effect of argument structure and if the presence of arguments leads to slower processing, both surprisal and the double function of the participle could be a reason. However, both explanations make different predictions for online processing: surprisal would occur directly at the argument, whereas an effect of the verbal structure itself would more likely be visible at the participle.

### 4.3.3 Embedding

The third potential factor in the processing of prenominal participles (and RCs) is recursive embedding, as in (11).

- (11) a. *der die eine Maus jagende Katze anbellende Hund*  
the the a mouse chasing cat barking-at dog  
'the dog barking at the cat chasing a mouse'
- b. *der Hund, der die Katze, die eine Maus jagt, anbellt*  
the dog that the cat that a mouse chases barks-at  
'the dog that is barking at the cat that is chasing a mouse'

In (11-a), the modifier-internal DP (*cat*) is in turn modified by an extended present participle. With accusative DPs, this leads to stacking of determiners at the beginning of the DP and a complex structure intervening between determiner and noun. In contrast, multiply embedded RCs as in (12) also pose difficulties, but rather due to the stacking of RC verbs. Note that there are further possibilities to express the content in (11): for RCs, the most deeply embedded RC could be extraposed, as in (12), which prevents the stacking of verbs.

- (12) *der Hund, der die Katze anbellt, die eine Maus jagt*  
the dog that the cat barks-at that a mouse chases  
'the dog that is barking at the cat that is chasing a mouse'

Furthermore, there could be a combination of both pre- and postnominal modification as in (13). As this will not be investigated further, I leave it to future research to determine how mixed modifiers affect the processing of this construction and whether they are acceptable at all.

- (13) a. *?der Hund, der die eine Maus jagende Katze anbellt*  
the dog that the a mouse chasing cat barks-at that  
'the dog that is barking at the cat chasing a mouse'
- b. *?der die Katze, die eine Maus jagt, anbellende Hund*  
the the cat that a mouse chases barking-at dog  
'the dog (that is) barking at the cat (that is) chasing a mouse'

As the effect on (multiple) embedding on sentence processing has been discussed and investigated in previous literature (see Chapter 3), this is a good way to compare the two kinds of modifiers and to identify differences based on their position or other structural differences. Furthermore, it might help to explain why extended prenominal attributes are rather rare and restricted to written language: with their position between determiner and noun, they are already center embedded within the DP. If this causes difficulties, an additional level of embedding might be more problematic for participle phrases than for RCs. The possibility for recursive embedding of prenominal attributes is mentioned by Weber (1971), p. 212f, and he claims that these attributes mainly occur in official texts.

As in the case of modifier length, the DLT can be used to hypothesize how a difference between single and double embedding might affect prenominal participles in comparison to RCs. Table 4.11 shows the storage costs for a double embedded RC and Table 4.13 double embedded prenominal participle. Tables 4.12 and 4.14 show an example of a corresponding single embedded modifier, which matches in the number of words and DPs. As explained in Chapter 3, storage costs arise when a structure is opened and needs to be stored in memory, i.e. for each predicted head one memory unit is assumed (Gibson, 1998, 2000; Nakatani and Gibson, 2008). I am focusing on the maximal storage costs in order to determine the overall complexity of the modifier (see Bader, 2018).

For the RC, the difference between double embedded (Table 4.11) and single embedded (Table 4.12) shows that the maximal storage costs are higher when there are two embedded RCs. The point where the highest costs arise is at the beginning of the third DP (*a mouse*). At this point, two verbs and a noun are predicted.

Table 4.11: Storage Costs for double embedded RCs according to DLT

	der the	Hund dog	der that	die the	Katze cat	die that	eine a	Maus mouse	jagt chases	anbellt barks-at
Storage	N	–	V	VN	V	VV	VVN	VV	V	–
costs (MU)	1	0	1	2	1	2	3	2	1	0

Table 4.12: Storage Costs for single embedded RCs according to DLT

	der the	Hund dog	der that	die the	Katze cat	im in-the	kleinen small	Garten garden	anbellt barks-at
Storage	N	–	V	VN	V	V	VN	V	–
costs (MU)	1	0	1	2	1	1	2	1	0

As discussed in Chapter 3, higher levels of embedding of RCs have been found to cause a missing-VP effect, i.e. participants forget part of the structure when they arrive at the final VPs and therefore accept ungrammatical sentences that lack a VP (Gibson and Thomas, 1999; Christiansen and MacDonald, 2009; Gimenes et al., 2009; Vasishth et al., 2010; Häussler and Bader, 2015; Bader, 2016). Although it is debated whether this effect occurs in German or not (cf. Vasishth et al., 2010; Häussler and Bader, 2015; Bader, 2016), it indicates that the processing load induced by these structures is quite high.

For participles, the position between the determiner and noun already embeds the modifier inside the DP. Under the assumption that the noun and the participles are both predicted heads at the beginning of the modifier, this additional level of embedding causes higher maximal storage costs for a double embedded participle than for a double embedded RC. A comparison between double (Table 4.13) and single embedded participles (Table 4.14) shows that the maximal storage costs are again higher. As in the case of the RC, they peak at the beginning of the third DP (*a mouse*). However, in addition to the adjective or participle, the nouns for the first two DPs are also predicted heads at this point, therefore the storage costs are higher than for a RC. The embedding in the DP also causes a greater difference between single and double embedded participles.

When integration costs are compared between a single and double embedded modifier, the overall modifier length – or the number of intervening new discourse referents inside the modifier for the DLT metric – needs to be taken into account

#### 4.4. Predictions for offline and online processing

Table 4.13: Storage Costs for double embedded present participle phrases according to DLT

	der the	die the	eine a	Maus mouse	jagende chasing	Katze cat	anbellende barking-at	Hund dog
Storage	N	ANN	AANNN	AANN	ANN	AN	N	–
costs (MU)	1	3	5	4	3	2	1	0

Table 4.14: Storage Costs for single embedded present participle phrases according to DLT

	der the	die the	Katze cat	im in-the	kleinen small	Garten garden	anbellende barking-at	Hund do
Storage	N	ANN	AN	ANN	ANN	AN	N	–
costs (MU)	1	3	2	3	3	2	1	0

in the experimental design. I will focus on these costs in more detail in Chapter 6, when the material for the corresponding experiment is introduced.

## 4.4 Predictions for offline and online processing

Modifier length and argument structure will be investigated with offline and online methods; the role of embedding is tested in an offline study only. Offline data is obtained with acceptability judgment experiments, whereas SPR experiments are used as online measures. Modifier length is additionally investigated in an eye-tracking experiment. In the following, I discuss how the hypotheses described in the previous sections relate to experimental methods.

In the case of acceptability judgments, participants see the whole sentence and judge its overall acceptability on a scale from 1–7 (Schütze and Sprouse, 2014). Therefore, the ratings reflect the overall complexity of a sentence. In terms of processing costs, I assume that the maximal costs will best reflect the complexity, i.e. a sentence will be perceived as less acceptable when there is a peak in memory load rather than when they have several lower peaks (see Bader, 2018).

As described above, for a manipulation of modifier length I would assume that the results show either locality effects as predicted by memory-based accounts or anti-locality effects, as predicted by expectation-based accounts. The study by Konieczny (2000) suggested that acceptability judgments are more sensitive to mem-

ory effects than online methods. Hence, I would expect that a longer modifier is rated rather low in prenominal position. For the RC as comparison, however, it needs to be taken into account that the whole sentence is judged. If the RC is center embedded in the matrix clause and not extraposed – as it is the case in the experiment –, more material might also lead to lower ratings. Nevertheless, based on previous assumptions about the alternation of prenominal attributes and RCs, I hypothesize that an interruption of the DP will be more problematic. With online measures like SPR, the predictions for individual regions can be tested. The modifier noun can provide evidence for either locality or anti-locality effects for participles and the comparison with RCs has the advantage that the noun is not affected by a manipulation of the modifier in the latter case due to its position. The data from Sikos et al. (2017) suggests an anti-locality effect, but they use a different method (maze task). Another region that will be interesting for online processing is the participle or RC verb respectively: a comparison could show whether (anti-)locality affects participles and RCs in the same way.

If there is a difference between the presence of arguments and adjuncts for the prenominal modifier, due to the mix of adjectival and verbal properties, it should be reflected in the acceptability ratings. Online processing can then determine the location of this effect. Surprisal due to the presence of an argument in an unexpected position would be visible in an increase of RTs at the argument, whereas processing difficulty due to more verbal structure would presumably rather occur when the participle is processed. If the presence of an argument actually contributes to the predictability of the participle and/or RC verb, the reading times at the participle will be faster when an argument is present.

For the last factor investigated, the role of embedding, I will only provide offline data in this thesis. The predictions will be based on the maximal processing costs, as described in the previous section.

## 4.5 Summary

This chapter showed previous theoretical assumptions about the alternation of prenominal participles and RCs. Furthermore, corpus data was taken into consideration. The aim of the experimental part of this thesis is to determine how certain factors affect the comprehension of participle phrases and corresponding RCs. On the one hand, the results will shed light on the question why both con-

structions coexist in German and how similar they are. On the other hand, the results can provide evidence for certain processing theories as different predictions can be formulated due to the difference in position.

While it is not possible to investigate all possible factors in the scope of this thesis, I will focus on the following three: modifier length, argument structure and additional embedding. By applying processing theories to the constructions, I have formulated predictions for each of these factors. In the following two chapters, I will test these predictions experimentally, using offline and online methods.



# Chapter 5

## Length and argument structure

This chapter investigates some of the factors discussed in Chapter 4, namely the length of the modifier and the presence of a direct object of the participle. Although these are distinct factors, they are discussed together in one chapter because they are jointly tested in the first two experiments.

The length of the modifier might affect the results in the following way (for a more detailed discussion cf. Chapter 4): looking at the DP as a whole, a longer modifier means that the determiner (if present) and the noun are separated by more material. Memory-based theories like the DLT (Gibson, 2000) predict processing difficulties for a non-local dependency. Given the fact that prenominal participle constructions have an alternative way of being expressed, namely as an RC, a comparison of the acceptability of both constructions can show how modifier length affects the choice of the construction. For the determiner-noun dependency, memory-based theories predict that longer modifiers are preferred to be expressed as RCs because here these two elements are always adjacent. Word-by-word reading experiments have the advantage that it is possible to see effects on specific regions. According to the DLT, a *locality effect* should be observed at the second dependent, i.e. the noun: when there is more material inside the participle phrase, RTs on the noun should be higher. Note that the kind of material that leads to an increase of distance differs depending on the theory, e.g. new discourse referents in DLT or number of word for EIC. In the following experiments, the number of words and the number of new discourse referents are both taken into account. Previous studies on other constructions, however, found *anti-locality* effects (e.g. Konieczny, 2000; Konieczny and Döring, 2003; Demberg and Keller, 2008), which are explained by experience-based processing accounts (e.g. Hale, 2001; Levy, 2008a). For prenominal

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participles the noun is highly expected after the participle and this effect might be even stronger with more material inside the modifier. In addition, a longer modifier possibly also allows predictions about the lexical identity of this noun, which would result in lower RTs.

From a modifier internal perspective, there is the dependency of the verbal element of the modifier (participle or RC verb) and the head noun. For RCs it is assumed that there is a gap connected with the head noun. As the modified noun is always the subject of present participles, the corresponding RCs in the following experiments are all subject RCs. Hence, for RCs an internal dependency holds for this subject gap and the RC verb and an increase of the material inside the modifier could lead to a *locality effect* for RCs as well. For participle phrases, it is unclear whether there is an element corresponding to a gap inside the modifier (cf. Fanselow 1986; Struckmeier 2010, who assume a sentential structure). If not, the head noun follows the participle. Depending on theoretical assumptions about the structure, there are three possibilities: (i) participle phrases and RCs behave the same way, with either *locality* or *anti-locality effects* on the verbal element for both constructions. (ii) There is a *locality effect* for the RC verb and none or the opposite for the participle. This could indicate that there is a dependency relation for the RC, but not in the same way for the participle phrase, or that prediction-based effects are stronger for participles and override the memory-based effects. (iii) There is an *anti-locality effect* for the RC verb, which has been found before for verb-final sentences in German (Konieczny, 2000) and none or the opposite for the participle. If this is the case, memory-based effects would be stronger for participles.

The other factor investigated in the following experiments is the structure of the modifier. Present participles have the property that they can keep their verbal arguments (cf. Chapter 2), including accusative objects. Those do not occur with other adjectival elements, which might lead to surprisal effects in online processing or to a preference for RCs, when the modifier contains a direct object. If there is a difference for accusative objects compared to PP-adjuncts, it is also possible that the transitive structure is more complex and therefore easier to process in a finite RC. This could be the case because the participle has verbal and adjectival properties. However, participle phrases with an accusative object are grammatical, so obviously accusative objects can be part of the syntactic structure of a participle phrase.

The opposite effect of the presence of a direct object compared to an adjunct is also possible: previous research showed that the presence of arguments facilitates processing of the verb in verb-final structures (Levy and Keller, 2013; Konieczny and Döring, 2003). This can be explained by expectation-based processing theories: when the argument is encountered, it narrows down the possible verbs to transitive verbs. Therefore the prediction for the lexical identity of the verb becomes more precise. If this is the case, an accusative object should facilitate the processing of both participles and RC verbs.

Experiment 1 and 2 are acceptability judgment experiments which investigate how a difference in modifier length and the presence of an accusative object or an adjunct affects ratings for participle phrases and RCs. They are followed by two self-paced reading experiments that tease apart the factors argument structure (Experiment 3) and length (Experiment 4). In Experiment 5, the factor length is further investigated using eye-tracking.

## 5.1 Experiment 1 – acceptability judgment experiment: modifier length and accusative object vs. adjunct

The first experiment investigates the acceptability of prenominal present participles compared to RCs, while manipulating the kind of material it contains and the length, i.e. the number of words of the modifier. With acceptability ratings, it is possible to see how these factors affect the acceptability of both constructions and whether or not there are differences. The constructed experimental sentences have the advantage that participle phrases correspond directly to the RCs, in contrast to a corpus analysis, which can show preferences, but one needs to take into account that the lexical content is not constant.

In order to test effects of length and the internal structure on participle phrases and RCs, the modifier contains either only the participle or RC verb (1), an adjunct (2), a direct object (3) or both adjunct and an object (4).

- (1) a. *die tanzende Cousine*  
the dancing cousin
- b. *die Cousine, die tanzt*  
the cousin who dances

## 5.1. Experiment 1 – acceptability judgment experiment

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- (2) a. *die bei der Hochzeit tanzende Cousine*  
the at the wedding dancing cousin  
b. *die Cousine, die bei der Hochzeit tanzt*  
the cousin who at the wedding dances
- (3) a. *die einen Walzer tanzende Cousine*  
the a waltz dancing cousin  
b. *die Cousine, die einen Walzer tanzt*  
the cousin who a waltz dances
- (4) a. *die bei der Hochzeit einen Walzer tanzende Cousine*  
the at the wedding a waltz dancing cousin  
b. *die Cousine, die bei der Hochzeit einen Walzer tanzt*  
the cousin who at the wedding a waltz dances

The hypotheses are the following: due to the non-local dependency between the determiner and the noun for the participle condition, the ratings for the sentences should be lower the longer the distance is. Hence, the condition without object or PP-adjunct should receive higher ratings than those with either one or the other and the sentences with both elements inside the prenominal modifier should receive the lowest ratings. In the RC condition, determiner and noun are adjacent to each other. Therefore, no such effect of length is expected for the dependency of determiner and noun. The dependency of noun (or RC gap) and RC verb, however, could be affected by an increase of distance. For the prenominal modifier, this depends on the syntactic analysis (cf. Chapter 2 and 4): participle and noun are superficially adjacent. However, if some kind of representation of the head noun is assumed inside the modifier, e.g. a gap or a co-referent empty category (cf. Fanselow, 1986; Struckmeier, 2010), more material could also lead to a non-local dependency. Unfortunately, this would be impossible to tease apart from an effect of the distance between determiner and noun for the acceptability judgments, because they only provide offline data.

Furthermore, the RCs serve as a control: it could be possible that the length of the modifier in general or the overall sentence length has an effect on the acceptability. If this is the case, it should affect the RCs in the same way as the prenominal modifier. If the ratings for the RCs do not become lower when the modifier is longer, this would suggest an effect of the position. For the RCs, it can also be the case that shorter modifiers are rated lower than long ones because for the RC a relative pronoun is necessary and therefore it contains more words overall. Hence, it is possible

that a prenominal modifier occurs more frequently and is more expected when it is short, but higher memory load caused by a longer modifier justifies the realization as an RC, even though it contains additional words (see Fabricius-Hansen, 2016).

As for the presence or absence of an accusative argument, three hypotheses for a potential effect were described in Chapter 4: the surprisal due to the fact that accusative objects occur rarely in an adjectival phrase, a higher structural complexity or a change in telicity which does not match with the aspectual properties of the participle. All three make the same prediction for the present experiment: when the sentences are modified by a participle phrase, the presence of a direct object should lead to lower ratings. This differs from a mere length effect because the ratings for PP-adjuncts and accusative objects should be the same when only words or discourse referents between determiner and noun are counted. Again, the RCs can be considered as a control condition. If the transitive use of a verb affects the acceptability in general, this effect should exist for both participle phrases and RCs. However, if there is only an effect for participles, this must have something to do with the position or with properties of this construction.

### 5.1.1 Method

#### 5.1.1.1 Material

The experiment consisted of 40 experimental items and had a  $2 \times 2 \times 2$ -design: Modifier (participle or RC)  $\times$  Accusative object (present or not)  $\times$  Adjunct (present or not), resulting in eight conditions. The experimental items always consisted of a main clause with a transitive verb. The accusative object was modified either by a participle or a RC. The verbs that were used as participles or relative clause verbs could all be used transitively or intransitively.<sup>1</sup> This made it possible to leave out or insert an accusative object as an extension of the modifier. In order to determine the effect of the number of words inside of the modifier and the effect of the realization of richer argument structure, the modifiers were extended in different ways. (5) shows an example of the materials (the modified DP is highlighted).

- (5) a. *Lisa hatte **die tanzende Cousine** irgendwie kaum beachtet.*  
 Lisa had the dancing cousin somehow little noticed

<sup>1</sup>Note that from a theoretic perspective, the verbs are not necessarily intransitive if the object is omitted. It is also possible that the object is implicitly present (see e.g. Rappaport Hovav and Levin 1998 for a discussion of optional arguments). I will come back to this issue in Chapter 7.

## 5.1. Experiment 1 – acceptability judgment experiment

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- b. *Lisa hatte **die bei der Hochzeit tanzende Cousine** irgendwie  
Lisa had the at the wedding dancing cousin somehow  
kaum beachtet.  
little noticed*
- c. *Lisa hatte **die einen Walzer tanzende Cousine** irgendwie kaum  
Lisa had the a waltz dancing cousin somehow little  
beachtet.  
noticed*
- d. *Lisa hatte **die bei der Hochzeit einen Walzer tanzende  
Cousine** irgendwie kaum beachtet.  
cousin somehow little noticed*
- e. *Lisa hatte **die Cousine, die tanzte**, irgendwie kaum beachtet.  
Lisa had the cousin who danced somehow little noticed*
- f. *Lisa hatte **die Cousine, die bei der Hochzeit tanzte**, irgendwie  
Lisa had the cousin who at the wedding danced somehow  
kaum beachtet.  
little noticed*
- g. *Lisa hatte **die Cousine, die einen Walzer tanzte**, irgendwie  
Lisa had the cousin who a waltz danced somehow  
kaum beachtet.  
little noticed*
- h. *Lisa hatte **die Cousine, die bei der Hochzeit einen Walzer  
tanzte**, irgendwie kaum beachtet.  
danced somehow little noticed  
'Lisa had somehow paid little attention to the cousin (who was) dancing  
(a waltz) (at the wedding).'*

In (5-a)–(5-d), the noun is modified by a prenominal participle, in (5-e)–(5-h), it is modified by an RC. The modifier either consisted only of the participle or RC verb respectively ((5-a), (5-e)), or it was extended by an adjunct (*bei der Hochzeit* ‘during the wedding’, (5-b),(5-f)), an argument (*einen Walzer* ‘a waltz’, (5-c),(5-g)) or both ((5-d), (5-h)). The full set of experimental items can be found in the Appendix A. There were 60 fillers, including 40 items from a different experiment. As the sentences for this experiment were all grammatical, 34 of the fillers were ungrammatical, 16 were fully grammatical and 20 could be considered as something in between (grammatical, but not fully acceptable). Using a Latin square design,

the experimental materials were divided into eight lists. Each participant rated each experimental item only in one condition.

There were further restrictions for the materials: the modified nouns all denoted persons. The gender of the modified noun might potentially play a role because of the syncretism of the feminine and plural determiner (*die*). In order to control for this, half of the nouns were masculine, the other half feminine.

In terms of restrictiveness, all the sentences were kept ambiguous, making sure that no (contextual) unique nouns (e.g. *bride*, *mother*, etc.) were modified. I chose this solution because it is difficult to distinguish between restrictive and appositive reading of RCs for stimuli presented in written form and therefore without intonation. For prenominal modifiers, the intonation does not even indicate restrictive or appositive reading (Fabricius-Hansen, 2009). A possible way to control for a certain reading would be to add context. As it is unclear how the distinction of restrictive vs. appositive reading and the corresponding syntactic positions could affect sentence processing; I leave it to future research to test such an effect.

The adjunct inside the modifiers were PPs consisting of 2–3 words. The direct objects were indefinite, inanimate NPs. In order to avoid an influence of the similarity of the accusative object and the head noun, the gender of both was always different.<sup>2</sup> In half of the items, the matrix clause was present tense, the other half was past tense. The whole materials can be found in the Appendix.

#### 5.1.1.2 Participants

There were 57 participants, all native speakers of German. 10 of them participated on a voluntary basis. I recruited the other 47 participants on the online platform Prolific (<https://www.prolific.co/>). They received £2,10 for their participation. Note that the participant recruitment via online platforms like Prolific poses certain challenges, as discussed in Sprouse (2011). One potential problem is the lack of control for the experimental setting. When Sprouse (2011) compared pen and paper questionnaires and questionnaires conducted via Amazon Mechanical Turk, he found slightly higher rejection rates for participants with the online recruitment. However, these were still in line with tolerable rejection rates and outweighed by the benefits,

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<sup>2</sup>Note that this was not the case for the adjuncts. However, if a processing effect due to similarity-based interference would be reflected in acceptability judgments, it would rather lead to lower ratings for similar NPs. The results will show that this is not the case for the conditions with (only) adjuncts present.

## 5.1. Experiment 1 – acceptability judgment experiment

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Basti hatte die einen Walzer tanzende Cousine irgendwie kaum beachtet.

(Völlig inakzeptabel)        (Völlig akzeptabel)

*Bitte Ziffer eintippen oder die entsprechende Box anklicken!*

Figure 5.1: Experimental item as it was presented during Experiment 1

like time saving in the recruitment process. On average, the experiment took about 10–20 minutes.

### 5.1.1.3 Procedure

The experiment was an acceptability judgment task: the participants were asked to rate the acceptability of sentences on a 1–7 Likert scale. I created an online questionnaire, using the online platform Ibox Farm (<http://spellout.net/iboxfarm/>). Prolific directed the participants to a website with the instructions, including a short consent form. They were also asked to fill in their age, whether they are a native speaker of German or not, to insert their second native language if they are bilingual and to insert the region (federal state) in which they grew up.<sup>3</sup> This was followed by two practice items and the actual experiment. The instructions asked the participants to answer intuitively and not to base their judgments on prescriptive rules. “Totally acceptable” (7 on the scale) was defined as “there is nothing wrong with the sentence”, whereas “totally unacceptable” (1 on the scale) would mean that the participant would never encounter a sentence in this form. Figure 5.1 shows how the sentences were presented to the participants.

The participants could give their ratings either by clicking on the numbers or by pressing the respective bar on their keyboard. The experiment could be done on different devices, e.g. desktop computer, notebook, tablet or smartphone. After rating the item, the following sentence appeared for a few seconds: *Bitte warten Sie auf den nächsten Satz.* ‘Please wait for the next sentence’. A progress bar indicated the status of the experiment.

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<sup>3</sup>The region and other native languages were not taken into account for the analysis of this experiment.



Table 5.1: Mean response for acceptability judgments in Experiment 1 (standard deviation in parantheses)

Adjunct ( <i>bei der Hochzeit</i> ) (‘at the wedding’)	Accusative object ( <i>einen Walzer</i> ) (‘a waltz’)	Modifier participle	RC
+	+	5.03 (1.84)	6.28 (0.97)
-	+	5.23 (1.73)	6.10 (1.21)
+	-	5.89 (1.39)	5.98 (1.32)
-	-	6.08 (1.26)	5.90 (1.37)

### 5.1.2 Analysis

The judgment data was analyzed in R (R Core Team, 2017). Due to a technical error, one item was not displayed correctly. Therefore this item had to be excluded from the analysis, leaving 39 experimental items.

Treating Likert scale data as interval data, using *linear mixed effect models*, has been criticized (Schütze and Sprouse, 2014), due to the fact that it is unclear whether participants treat the difference between two values as the same throughout the whole scale. A way to analyze the data as ordinal data is the use of *cumulative link mixed models*, which is part of the “ordinal” package (Christensen, 2019). Sum contrasts (-0.5,0.5) were created for the predictors Modification (participle or RC), Accusative object (present or not) and Adjunct (present or not). If interactions occurred, I used tukey tests as pairwise comparisons (part of the “lsmeans” package, Lenth 2016) to determine which conditions caused the interaction.

### 5.1.3 Results

Table 5.1 and Figure 5.2 show the mean acceptability ratings. The cumulative link mixed model (cf. Table 5.2) reveals a main effect of Modifier and of Accusative object. There is a significant interaction of Modifier and Accusative object. The interaction of Modifier and Adjunct is not significant. The three-way interaction of Modifier, Accusative object and Adjunct was also not significant.

As the significant two-way interaction of Modification and Accusative object does not provide information about where exactly the ratings differ, I used a pairwise test (tukey method), which considered only these two factors, leaving out the presence or absence of an Adjunct. The pairwise test (cf. Table 5.3) revealed signif-

## 5.1. Experiment 1 – acceptability judgment experiment

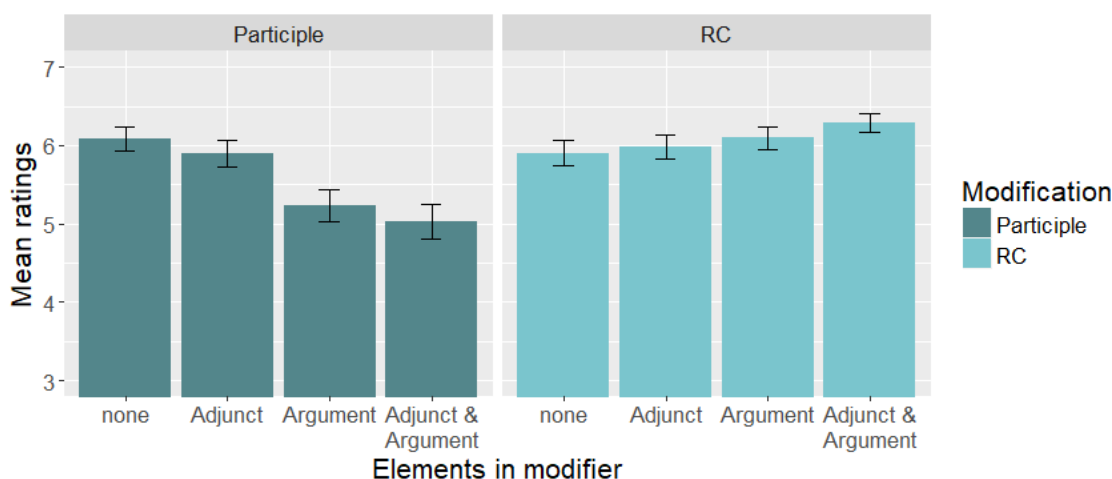


Figure 5.2: Mean acceptability ratings by condition for Experiment 1

Table 5.2: Cumulative Link Mixed Model (fitted with the Laplace approximation) for Experiment 1

formula:  $\text{response} \sim \text{Modifier} * \text{Acc. object} * \text{Adjunct} + (1 + \text{Modifier} * \text{Acc. object} * \text{Adjunct} | \text{participant}) + (1 + \text{Modifier} * \text{Acc. object} * \text{Adjunct} | \text{sentence})$

Coefficients	Estimate	Std. Error	z value	Pr(>  z )
Modifier	0.437	0.099	4.41	1.0e-05***
Acc. object	0.276	0.079	3.47	0.00052***
Adjunct	0.043	0.068	0.63	0.52646
Modifier:Acc. object	-0.475	0.079	-5.99	2.1e-09***
Modifier:Adjunct	-0.097	0.060	-1.61	0.10749
Acc. object:Adjunct	0.003	0.060	0.05	0.96300
Modifier:Acc. object:Adjunct	0.009	0.065	-0.13	0.89513

ificantly lower ratings for participles with an accusative object (mean: 5.13) than for participles without an accusative object (mean: 5.99). Participles with an accusative object were also rated significantly lower than RCs with an accusative object (mean: 6.19) and RCs without an accusative object (mean: 5.94).

### 5.1.4 Discussion

All the sentences received ratings higher than 5. The relatively high ratings suggest that all the conditions are in principle perceived as grammatical. This is expected because both constructions occur frequently and productively in written language. However, there are still systematic differences, which will now be discussed.

The presence or absence of an accusative object has an effect on the participle phrases: the sentences received lower ratings when an accusative object was present.

Table 5.3: Post-hoc (Tukey) test for the interaction of Accusative object and Modifier (Experiment 1)

Results are averaged over the levels of: Adjunct

P value adjustment: tukey method for comparing a family of 4 estimates

contrast	estimate	SE	z.ratio	p.value
Participle,withACC - RC,withACC	-1.825	0.275	-6.630	<.0001
Participle,withACC - Participle,noACC	-1.501	0.210	-7.130	<.0001
Participle,withACC - RC,noACC	-1.426	0.286	-4.990	<.0001
RC,withACC - Participle,noACC	0.323	0.218	1.480	0.4470
RC,withACC - RC,noACC	0.399	0.238	1.680	0.3360
Participle,noACC - RC,noACC	0.075	0.231	0.330	0.9880

No such effect holds for RCs, which indicates that it is not a general preference for an intransitive use of the verbs. The results are less clear as far as an effect of length is concerned: as shown in Figure 5.2, there seems to be a tendency for prenominal modifiers to be rated higher when they are shorter and for higher ratings for RCs when they include more words. However, the difference between participles with or without an adjunct failed significance in the post-hoc test, as well as the differences between the four RC conditions.

## 5.2 Experiment 2 – follow-up to Experiment 1

In the previous experiment, the nouns that were modified were accusative objects of the matrix clause. One possible explanation for an effect of an accusative object inside of the modifier could be similarity-based interference: Gordon et al. (2001) showed that for object RCs and clefts, the similarity of the element that has to be kept in memory and an intervening element can lead to higher processing load. In the ACT-R model of Lewis and Vasishth (2005), the similarity of intervening words and the element that has to be retrieved also causes interference. Although Gordon et al. (2001) concentrate on referential form, i.e. proper nouns or pronouns versus definite descriptions, case features might also affect dependency resolution. Therefore, the purpose of Experiment 2 is to rule out that the effect of an accusative object inside the modifier is caused by the similarity of the head noun and the noun inside the modifier. It is similar to Experiment 1, but instead of modifying the accusative object of the matrix clause, the subject is modified.

In the first experiment, longer prenominal modifiers – especially the condition with both, accusative object and adjunct – showed a tendency to be rated worse than shorter ones. The same is expected in this experiment. If the sentences with an accusative inside the prenominal modifier in Experiment 1 were rated worse because of similarity-based interference, the effect should not occur in this experiment, as the head noun does not have the same case. If it is due to the fact that a direct object inside the prenominal modifier makes it more difficult to process in general, the conditions with the accusative in the prenominal modifier should again be rated lower than all the other conditions.

### 5.2.1 Method

#### 5.2.1.1 Material

The experimental design is the same as in the previous experiment. It has a  $2 \times 2 \times 2$ -design, resulting in eight conditions: Modifier (participle or RC)  $\times$  Accusative object (present or not)  $\times$  Adjunct (present or not). The modified DPs are the same as in the previous experiment. Different from Experiment 1, the modified DP is the subject of the matrix clause. In order to manipulate only the syntactic function, but not the position in the sentence, the prefield, i.e. the position before the finite verb, is occupied by an adverb. The subject occurs directly after the finite verb. Note that this position means that the modified DP is directly followed by a proper name. For certain nouns, especially kinship nouns, this could lead to a garden path effect in the participle condition because the noun and the proper name might be interpreted as one DP (*die Tante Lisa* ‘aunt Lisa’). Therefore in the materials it was always the case that the DP and the proper name had different gender, in order to avoid such a garden-path effect and therefore potentially lower ratings for the conditions in which it occurs. (6) shows an example of the materials (all materials are in Appendix B). As in the previous experiment, there are 40 experimental items. I used the same fillers.

- (6) a. *Irgendwie hatte **die tanzende Cousine** Basti kaum beachtet.*  
Somehow had the dancing cousin Basti little noticed
- b. *Irgendwie hatte **die bei der Hochzeit tanzende Cousine** Basti  
kaum beachtet.*  
little noticed

- c. *Irgendwie hatte **die einen Walzer tanzende Cousine** Basti kaum beachtet.*  
 Somehow had the a waltz dancing cousin Basti little noticed
- d. *Irgendwie hatte **die bei der Hochzeit einen Walzer tanzende Cousine** Basti kaum beachtet.*  
 Somehow had the at the wedding a waltz dancing cousin Basti little noticed
- e. *Irgendwie hatte **die Cousine, die tanzte**, Basti kaum beachtet.*  
 Somehow had the cousin who danced Basti little noticed
- f. *Irgendwie hatte **die Cousine, die bei der Hochzeit tanzte**, Basti kaum beachtet.*  
 Somehow had the cousin who at the wedding danced Basti little noticed
- g. *Irgendwie hatte **die Cousine, die einen Walzer tanzte**, Basti kaum beachtet.*  
 Somehow had the cousin who a waltz danced Basti little noticed
- h. *Irgendwie hatte **die Cousine, die bei der Hochzeit einen Walzer tanzte**, Basti kaum beachtet.*  
 Somehow had the cousin who at the wedding a waltz danced Basti little noticed  
 ‘The cousin (who was) dancing (a waltz) (at the wedding) paid somehow little attention to Basti.’

### 5.2.1.2 Participants

47 participants were recruited with Prolific.

### 5.2.1.3 Procedure

The procedure is the same as in Experiment 1.

## 5.2.2 Results

Table 5.4 shows the mean ratings by condition. As in Experiment 1, there is a main effect of Modifier with overall lower ratings for participles compared to RCs (see Table 5.5). The interaction of Modifier and Accusative object is also significant. Furthermore, there is a significant interaction of Adjunct and Modifier. I inves-

## 5.2. Experiment 2 – follow-up to Experiment 1

Table 5.4: Mean acceptability ratings in Experiment 2 (standard deviation in parentheses)

Adjunct	Acc. Object	Modifier	
		participle	RC
+	+	4.87 (1.61)	6.01 (1.21)
–	+	5.01 (1.68)	5.93 (1.34)
+	–	5.34 (1.58)	5.78 (1.39)
–	–	5.65 (1.45)	5.61 (1.47)

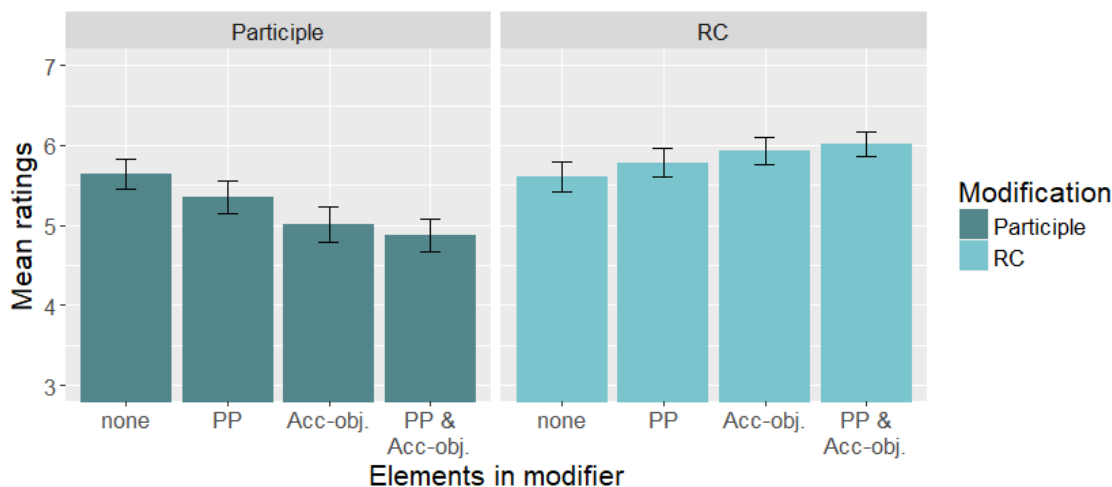


Figure 5.3: Mean acceptability ratings in Experiment 2

tigated both interactions further in order to determine where exactly the ratings differ.

The pairwise comparisons (Table 5.6) show that participles with an accusative object (mean: 5.50) received significantly lower ratings compared to participles without an accusative object (mean: 5.97), but also compared to RCs with an accusative object (mean: 5.97) and RC without an accusative object (mean: 5.70). Furthermore, RCs with an object were significantly more acceptable than participles without an object and RCs without an object.

For the interaction of Adjunct and Modifier, pairwise comparisons (Table 5.7) reveal significantly lower ratings for participles with an adjunct (mean: 5.11) compared to RCs with an adjunct (mean: 5.90) and RCs without an adjunct (mean: 5.77), as well as for participles without an adjunct (mean: 5.33). The ratings were also significantly higher for RCs with an adjunct compared to participles without adjunct and RCs without an adjunct compared to participles without an adjunct.

Table 5.5: Cumulative Link Mixed Model (fitted with the Laplace approximation) in Experiment 2

formula: response  $\sim$  Modifier \* Acc. object \* Adjunct + (1 + Modifier \* Acc. object \* Adjunct | participant) + (1 + Modifier \* Acc. object \* Adjunct | sentence)

Coefficients	Estimate	Std. Error	z value	Pr(>  z )
Modifier	0.612	0.105	5.83	5.57e-09 ***
Acc. object	0.077	0.070	1.10	0.27121
Adjunct	0.026	0.055	0.48	0.63325
Modifier:Acc. object	-0.403	0.062	-6.50	7.99e-11 ***
Modifier:Adjunct	-0.178	0.062	-2.90	0.00375 **
Acc. object:Adjunct	0.014	0.053	0.27	0.78615
Modifier:Acc. object:Adjunct	-0.050	0.064	-0.78	0.43564

Table 5.6: Post-hoc (Tukey) test for the interaction of Accusative object and Modifier in Experiment 2

Results are averaged over the levels of: Adjunct

P value adjustment: tukey method for comparing a family of 4 estimates

contrast	estimate	SE	z.ratio	p.value
Participle,withACC - RC,withACC	-2.029	0.264	-7.694	<.0001
Participle,withACC - Participle,noACC	-0.959	0.169	-5.665	<.0001
Participle,withACC - RC,noACC	-1.377	0.254	-5.416	<.0001
RC,withACC - Participle,noACC	1.070	0.250	4.285	0.0001
RC,withACC - RC,noACC	0.652	0.202	3.222	0.0070
Participle,noACC - RC,noACC	-0.418	0.222	-1.884	0.2348

Table 5.7: Post-hoc (Tukey) test for the interaction of Adjunct and Modifier in Experiment 2

Results are averaged over the levels of: Accusative object

P value adjustment: tukey method for comparing a family of 4 estimates

contrast	estimate	SE	z.ratio	p.value
Participle,withAdj - RC,withAdj	-1.580	0.265	-5.973	<.0001
Participle,withAdj - Participle,noAdj	-0.409	0.159	-2.576	0.0491
Participle,withAdj - RC,noAdj	-1.276	0.237	-5.393	<.0001
RC,withAdj - Participle,noAdj	1.171	0.237	4.932	<.0001
RC,withAdj - RC,noAdj	0.304	0.171	1.777	0.2842
Participle,noAdj - RC,noAdj	-0.867	0.220	-3.939	0.0005

### 5.2.3 Discussion

Like in Experiment 1, the ratings were all quite high, which means that all constructions are perceived as grammatical. The mean ratings in Experiment 2 were slightly lower than in the previous experiment. Apart from that, the overall pattern of the results is similar to those of Experiment 1.

In both Experiment 1 and Experiment 2, the presence of an accusative object affected the mean acceptability ratings insofar as the ratings are lower for participles phrases with an accusative object. For RCs, there is no difference in Experiment 1 and even the opposite effect, namely higher ratings with the presence of an accusative object, in Experiment 2. This result indicates that a transitive and therefore more sentential structure is less preferred with an adjectival element and in adjectival position than with a finite verb and to the right of the DP. Potential reasons for this were discussed in Chapter 4 and in the introduction of this chapter: either the syntactic and semantic complexity is higher and has an effect in this position or the infrequent combination of accusative with an adjectival element leads to a preference for a RC. The effect of the accusative object is especially interesting, as it has not been observed in previous literature about prenominal attributes. However, it is not possible to tease apart the two hypotheses from the acceptability judgment data alone, because the sentences are judged as a whole and the part where potential processing effects could occur cannot be determined. Therefore, a word-by-word reading experiment in this chapter provides more fine-grained data.

Investigating an effect of modifier length, as suggested by Fabricius-Hansen (2016), p. 11–13, was another aim of the experiments. The presence of an adjunct does not lead to significantly lower ratings for present participles in Experiment 1. However, the results still show the tendency for participles to be more acceptable when they are shorter and the opposite or at least no difference for RCs. In the second experiment, the presence of an adjunct leads to significantly lower ratings for participles, indicating that any kind of extension lowers the acceptability of participle phrases. The factor length should be further investigated, not only because of the tendency and mixed results, but also because it might contribute to general findings in processing literature, as shown in Chapter 3 and 4.



### 5.3 Experiment 3 – self-paced reading: accusative-object vs. adjunct

The aim of the following experiment is to further investigate, how the presence or absence of an accusative object affects processing. The acceptability judgment experiments show that the presence of an accusative object decreases acceptability. A word-by-word reading experiment can shed light on the question where this effect occurs. The experiment focuses only on the difference between modifiers containing arguments, as in (7), and adjuncts, as in (8).

- (7) a. *die ein Regal putzende Tante*  
the a shelf cleaning aunt  
b. *die Tante, die ein Regal putzt*  
the aunt who a shelf cleans
- (8) a. *die seit Stunden putzende Tante*  
the for hours cleaning aunt  
b. *die Tante, die seit Stunden putzt*  
the aunt who for hours cleans

Firstly, the question is whether the penalty for accusative objects inside participle phrases in Experiments 1 and 2 is also reflected in online reading. If this is the case, the location where an effect occurs allows the drawing of conclusions about its reason. If the RTs are higher for participles than for RCs at the beginning of the modifier, especially for the accusative object, this indicates a surprisal effect (see Hale, 2001; Levy, 2008a). This is possible, as the corpus data in Chapter 4 showed that accusative objects rarely occur with prenominal participles, but quite frequently inside RCs. If, however, the mixed status of the participle causes difficulties for processing, this will be reflected in higher RTs at the participle itself. I will come back to the relevant regions and predictions after introducing the materials, taking the whole sentence into account.

#### 5.3.1 Method

##### 5.3.1.1 Material

The experiment has a  $2 \times 2$  design: Extension (PP-adjunct vs. Accusative object)  $\times$  Modifier (participle phrase vs. RC), resulting in 4 conditions. It comprises 24

experimental items. The first factor is the kind of extension, i.e. whether the modifier is extended by an accusative object or a PP-adjunct. Different to Experiment 1, the participle was always extended, hence there is no length manipulation. The PP-adjunct and the accusative object also consisted of the same number of words, which is always two words. The second factor is the kind of modification, as in the previous experiment, i.e. attributive participle or RC. The RCs serve as a control condition and as comparison of processing effects in adjectival phrases and finite clauses, which will be discussed in Section 5.3.1.4. The sentence containing the modified DP is a subordinate clause with the DP as the subject. The main reason for this is that embedding the sentence with the modifier is necessary for the materials in Experiment 4, in Section 5.4, for reasons that will be explained later. In order to keep both self-paced reading experiments as similar as possible, this experiment was constructed in the same way. (9) shows an example of the materials (all experimental items are listed in Appendix C).

(9) a. *present participle, adjunct*

*Erik hat gesehen, dass **die seit Stunden putzende Tante** bereits  
Erik has seen that the since hours cleaning aunt already  
am Vormittag angerufen hatte.  
in the morning called has*

b. *present participle, accusative object*

*Erik hat gesehen, dass **die ein Regal putzende Tante** bereits  
Erik has seen that the a shelf cleaning aunt already  
am Vormittag angerufen hatte.  
in the morning called has*

c. *RC, adjunct*

*Erik hat gesehen, dass **die Tante, die seit Stunden putzt,**  
Erik has seen that the aunt who since hours cleans  
bereits am Vormittag angerufen hatte.  
already in the morning called has*

d. *RC, accusative object*

*Erik hat gesehen, dass **die Tante, die ein Regal putzt,** bereits  
Erik has seen that the aunt who since hours cleans already  
am Vormittag angerufen hatte.  
in the morning called has*

‘Erik has seen that the aunt (who is) cleaning for hours/ a shelf has already called in the morning’

In addition to the experimental items, there were 64 fillers, including 4 practice items. Half of the experimental items and half of the fillers were followed by control questions, cf. (10).

- (10) *Hat die Tante am Abend angerufen?*  
Has the aunt in-the evening called?  
‘Has the aunt called in the evening?’

These are used in order to make sure that the participants pay attention while reading. The materials were divided into four lists using a Latin square design.

### 5.3.1.2 Participants

I recruited 41 participants with Prolific. Only people who are native speakers of German and who did not participate in previous experiments were able to see the experiment, using the prescreening option of ‘Prolific’. All participants received £2.50 for completing the experiment. The time for completing the experiment was approximately 20 minutes. In Prolific, it is possible to define the device that the participants use to run the experiment and I restricted it to “Desktop”, in order to ensure that they have the possibility to press a key to proceed to the next word.

Two of the participants had to be excluded from the analysis: one person reported to be not a native speaker of German in the questionnaire on the first page, despite passing through Prolific’s prescreening. The second person had an overall question accuracy < 75%, therefore it is not clear whether enough attention was paid.

### 5.3.1.3 Procedure

As in the acceptability judgment task, I used Ibex Farm (<http://spellout.net/ibexfarm/>) to create an online experiment, which could be accessed by a web link. After clicking on this link, the instructions appeared. On the same page, the participants were asked whether they are native speakers of German, followed by a consent form. The experiment only started after the participants gave their consent. Before

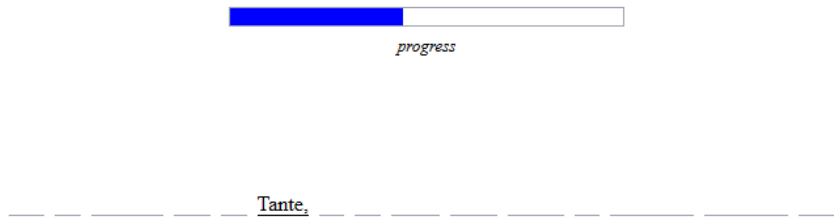


Figure 5.4: Experimental item as it was presented during Experiment 3

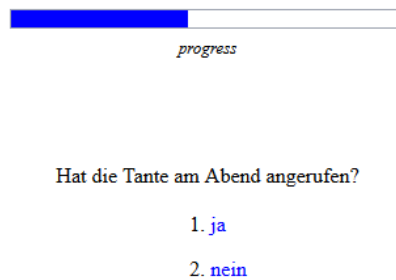


Figure 5.5: Control question as it was presented during Experiment 3

the actual experiment, four practice items were presented. A progress bar indicated the current status of the experiment.

The experiment was a self-paced reading, moving window experiment. The task of the participants was to read a sentence. In this sentence, only one word at a time is visible; the rest of the sentence is masked by dashes. Figure 5.4 shows how the stimuli were presented during the experiment.

In order to see the next word, the participants needed to press the space key. Measuring the reaction time, i.e. the time-span between pressing the key for the word to appear and pressing it again for the next word, allows to draw conclusions about the processing time for a certain word or sentence region.

Some of the sentences were followed by a control question, which was displayed as in Figure 5.5.

The question could be answered either by clicking on the *ja* ‘yes’ or *nein* ‘no’ or by pressing 1 or 2 on the keyboard. When the participant gave the wrong answer, they received the following feedback in red text color: *Falsch. Bitte warten Sie auf den nächsten Satz.* ‘Wrong. Please wait for the next sentence.’ If the answer was correct or if there was no control question, the following sentence appeared in black letters: *Bitte warten Sie auf den nächsten Satz.* ‘Please wait for the next sentence.’

## 5.3.1.4 Relevant regions and predictions

(11) a. *participle*

*dass die* seit Stunden / ein Regal<sub>BEGINNING OF MODIFIER</sub>  
 that the since hours / a shelf  
putzende<sub>MODIFIER VERB</sub> Tante<sub>HEAD NOUN</sub> *bereits am Vormittag*  
 cleaning aunt already in the morning  
*angerufen hatte.*  
 called has

b. *RC*

*dass die* Tante<sub>HEAD NOUN</sub>, *die* seit Stunden /  
 that the aunt who since hours /  
ein Regal<sub>BEGINNING OF MODIFIER</sub> putzt<sub>MODIFIER VERB</sub>, *bereits am*  
 a shelf cleans already in the  
*Vormittag angerufen hatte.*  
 morning called has

(11) shows the different regions that will be considered for predictions and the analysis. The acceptability judgments in Experiment 1 have shown that the presence of an accusative object lowers the acceptability of a participle phrase. If this is due to a processing difficulty, the location of its occurrence can help to shed light on the underlying cause. There are several possibilities: a surprisal effect could be reflected in higher reading times on the accusative object (*ein Regal* ‘a shelf’) in condition (9-b) because this element might be unexpected in this position (Levy 2008a). Therefore, there would be an effect at the beginning of the modifier. However, a direct comparison of PP adjunct and accusative object might be problematic because of the different lexical items. Furthermore, previous findings for head-final sentences (cf. 3.3; Konieczny and Döring 2003; Levy and Keller 2013) suggest lower reading times on the participle, because the verb becomes more predictable when the reader already has the information that it is transitive. The acceptability judgment experiment does not support this prediction, but it is also unclear if and how expectation effects can be reflected in judgment data.

A potential effect of similarity-based interference (Gordon et al., 2001; Lewis and Vasishth, 2005) could be found on the modified noun (*Schüler* ‘student’) when the integration to the DP occurs. Higher reading times for (9-b) at this region could indicate interference effects for the integration of the noun into the DP. What features might cause interference, however, would be less clear in this experiment: it

cannot be case because the modified noun is nominative and the accusative object inside the modifier is not more similar in terms of definiteness or animacy than the PP-adjunct.

Higher reading times on the participle (*essende* ‘eating’) indicate difficulties integrating the accusative object into the structure. These could be either due to higher syntactic complexity or for semantic reasons (cf. Chapter 4).

In this experiment, the RCs serve as a control: theoretically, there could be a general difference between the transitive or intransitive use of the verb. Furthermore, as the verbs all have an optional object, effects caused by the presence of an accusative object could be due to a preference for or difference in frequency of the (in-)transitive use of this verb and not due to effects of transitivity specific to a participle phrase. If this is the case, the same effects can be observed for the RC, i.e. I would expect higher reading times on modifier verb for the RC as well. If this is not the case, the result can be directly connected to properties of participle phrases. If there is an effect at the accusative object, the comparison with RCs can show whether this is a general property of a transitive structure or restricted to the participle phrase. As for the head noun, no differences for the kind of extension can be expected for the RC because at this point, the reader does not know what the modifier looks like.

A direct comparison of participles and RCs at the regions noun and participles has to be made with caution because of the different positions and different properties of the constructions. Especially a direct comparison of participles and RC verbs should be avoided because these elements have a different form. If there is a significant difference, it is not clear whether this is due to finiteness or differences in length or frequency. Note that RCs in German always have a comma at the beginning and the end. The comma following the RC verb might also lead to a wrap-up effect (see Hirotani et al., 2006).

However, it is expected that there is more processing difficulty at the noun in the participle condition because here the determiner and noun are separated, whereas the two elements are adjacent for the RC condition and the modifier has not even been seen at this point. The non-local dependency of the two elements, with a new discourse referent in the modifier intervening, leads to higher integration costs at the noun for the participle condition according to the DLT (Gibson, 2000). Hence, higher reading times at the noun would be expected for the conditions with participles compared to RCs. Furthermore, higher RTs are predicted at the begin-

ning of the participle phrase (i.e. the modifier internal DP or PP) by DLT and surprisal theory. For DLT, the storage costs are higher for the prenominal modifier at this point (c.f. chapter 4). Surprisal theory (Levy, 2013) predicts higher RTs because extended prenominal modifiers do not occur often and, having seen the determiner, the reader does not know whether there will be a modifier or a noun following. In contrast, the modifier internal DP or PP follows the relative pronoun, therefore the parser has already built the structure of the modifier.

### 5.3.2 Analysis

The reading data was analyzed in R (R Core Team, 2017). First, the accuracy for the control questions was checked: I decided to set the threshold for the accuracy to 75%. Any participant or item with an overall accuracy below that threshold is excluded from analysis. One participant with an accuracy of 58,3% had to be excluded. All items with control questions (half of the whole set of experimental items) were above the threshold.

For the reading times, I excluded all values higher than 1500ms and lower than 100ms from the analysis, assuming that these are extreme values that occur either because the participant did not pay attention or was interrupted during the experiment. 0.70% of the data was excluded from the analysis. The reading time data was log-transformed and linear mixed effects models were created for the relevant regions, using the lme4-package (Bates et al., 2015b). Sum contrasts (0.5,-0.5) were coded, with participle vs. RC for the factor Modification and adjunct vs. accusative object for the factor Extension. I first created maximal models, with full random slopes. The random slopes of the models were then simplified by removing variance components with estimated values that are zero or close to zero in order to obtain a parsimonious model and to ensure that the model converges, following (Bates et al., 2015a) and using the RePsychLing-package in R (Baayen et al., 2015). If there were significant interactions, I created a model with pairwise comparisons to analyze for which level the effect holds.

### 5.3.3 Results

*Question accuracy:* The overall accuracy for the control questions is 93%. Table 5.8 shows the proportion of correct answers for the control questions by condition. There were no significant differences.

### 5.3. Experiment 3 – self-paced reading: accusative-object vs. adjunct

Table 5.8: Proportion of correct answers for control questions in Experiment 3

Extension	Modifier	answer
adjunct	participle	0.94
acc. object	participle	0.89
adjunct	RC	0.94
acc. object	RC	0.95

Table 5.9: Mean reading times for the beginning of the modifier, the modifier verb and the head noun in Experiment 3; the standard error is given in parantheses

Modifier	Extension	PP / acc. object seit Stunden / ein Regal for hours / a shelf	modifier verb <i>putzende</i> / <i>putzt</i> 'cleaning' / 'cleans'	head noun <i>Tante</i> 'aunt'
Participle	PP	363 (7.98)	398 (13.7)	412 (13.0)
Participle	Acc-object	369 (8.82)	450 (15.5)	412 (11.8)
RC	PP	353 (6.51)	406 (15.0)	390 (14.1)
RC	Acc-object	353 (7.03)	401 (15.0)	401 (15.4)

*Results at the PP / accusative object:* The results for the two words at the beginning of the participle phrase or RC respectively can be found in Table 5.9. There are no significant effects for this region. A comparison at only the first word (article or PP depending on the condition) and only the second word (modifier internal noun) also showed no significant effects.

Seven of the experimental items were locally ambiguous at the beginning of the modifier because they started with *die einen...* ‘the<sub>FEM.SG</sub> a<sub>MASC.SG...</sub>’ which could also be understood as ‘those’ or ‘part of them’ due to the syncretism of feminine singular and the plural (for all genders) for the definite article and of masculine singular and plural (for all genders) for the indefinite article. (12) shows such a continuation with the plural forms, (13) shows the actual sentence used in the experiment.

(12) *Basti hat gehört, dass die einen gar nicht kommen wollten.*  
 Basti had heard that the ones at all not come wanted  
 ‘Basti had heard that part of them did not want to come at all’

(13) *Basti hat gehört, dass die einen Walzer tanzende Cousine eigentlich gar nicht kommen wollte.*  
 Basti has hear that the a waltz dancing cousin actually at all  
 nicht kommen wollte.  
 not come wanted



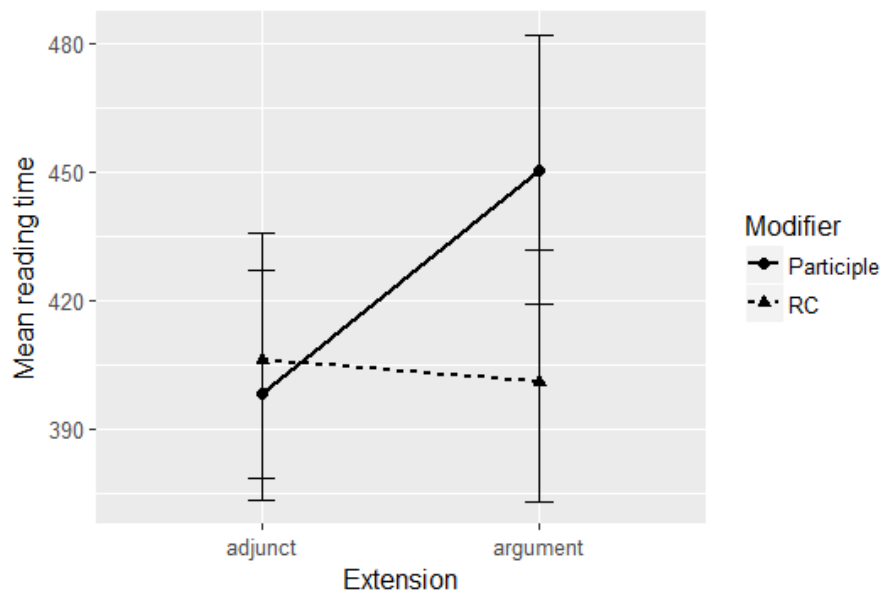


Figure 5.6: Mean reading times at the modifier verb (participle or RC verb) in Experiment 3

‘Basti has heard that the cousin dancing a waltz actually did not want to come at all.’

If this ambiguity lead to a garden-path effect, reading times would be higher for the condition with a participle phrase and an argument for those items. However, there is no significant difference and the overall results are the same as for those items only. It is possible that the ambiguity is too short to create processing difficulties or that the alternative construction is not frequent enough to be the preferred structure. Therefore, the results for all items are presented.

*Results (at participle / RC verb):* Figure 5.6 and 5.9 show the mean reading times at the verbal element of the modifier. The reading times for participles following an accusative object are higher than for those following a PP-adjunct. There is no such effect for the RCs. A linear mixed effects model (cf. Table 5.10) shows a main effect for the Extension and a significant interaction for Extension and Modifier. A model with pairwise comparisons (Table 5.11) reveals that this interaction is based on the difference between accusative object and PP-adjunct for the participle condition. Again, it is possible for some items that the ambiguity of *die einen...* affected the results. However, removing those items did not change the significant effects, therefore the results for all items are reported.

Table 5.10: Linear mixed effects model for the results at different regions (Experiment 3)

Region	Fixed effects:	Estimate	Std. Error	df	t value	Pr(>  t )
<b>PP / acc. object</b>						
<i>logRT</i> ~ <i>Extension</i> * <i>Modifier</i> + (1   <i>subject</i> ) + (1   <i>sentence</i> )						
(Intercept)		5.806	0.049	39.16	119.16	<2e-16 ***
Extension1		-0.002	0.012	1792.02	-0.16	0.88
Modifier1		-0.019	0.012	1795.83	-1.59	0.11
Extension1:Modifier1		-0.003	0.024	1795.86	-0.12	0.91
<b>Modifier verb</b>						
<i>logRT</i> ~ <i>Extension</i> * <i>Modifier</i> + (1 + <i>Modifier</i>   <i>participant</i> ) + (1   <i>sentence</i> )						
(Intercept)		5.921	0.060	42.381	99.40	< 2e-16 ***
Extension1		0.049	0.018	823.284	2.67	0.0076 **
Modifier1		-0.044	0.024	38.650	-1.86	0.0711 .
Extension1:Modifier1		-0.112	0.037	826.403	-3.03	0.0025 **
<b>Head noun</b>						
<i>logRT</i> ~ <i>Extension</i> * <i>Modifier</i> + (1 + <i>Modifier</i>   <i>participant</i> ) + (1   <i>sentence</i> )						
(Intercept)		5.901	0.057	42.000	103.20	<2e-16 ***
Extension1		0.011	0.017	827.000	0.65	0.5127
Modifier1		-0.078	0.023	39.000	-3.36	0.0017 **
Extension1:Modifier1		0.012	0.034	830.000	0.36	0.7216
<b>Region after DP</b>						
<i>logRT</i> ~ <i>Extension</i> * <i>Modifier</i> + (1   <i>subject</i> ) + (1 + <i>Modifier</i>   <i>sentence</i> )						
(Intercept)		5.869	0.042	39.618	141.45	<2e-16 ***
Extension1		-0.016	0.011	1783.374	-1.42	0.156
Modifier1		-0.022	0.016	22.624	-1.32	0.199
Extension1:Modifier1		-0.046	0.023	1779.584	-2.01	0.045 *

Table 5.11: Linear mixed effects model with pairwise comparisons for the results at the modifier verb in Experiment 3

formula:  $\log RT \sim \text{Modifier} + \text{Modifier:Extension} + (1 + \text{Modifier} \mid \text{participant}) + (1 \mid \text{sentence})$

Fixed effects:	Estimate	Std. Error	df	t value	Pr(>  t )
(Intercept)	5.921	0.060	42.381	99.40	< 2e-16 ***
Modifier1	-0.044	0.024	38.650	-1.86	0.071 .
ModifierParticiple:Extension1	0.105	0.026	824.314	4.05	5.6e-05 ***
ModifierRC:Extension1	-0.007	0.026	825.392	-0.26	0.798

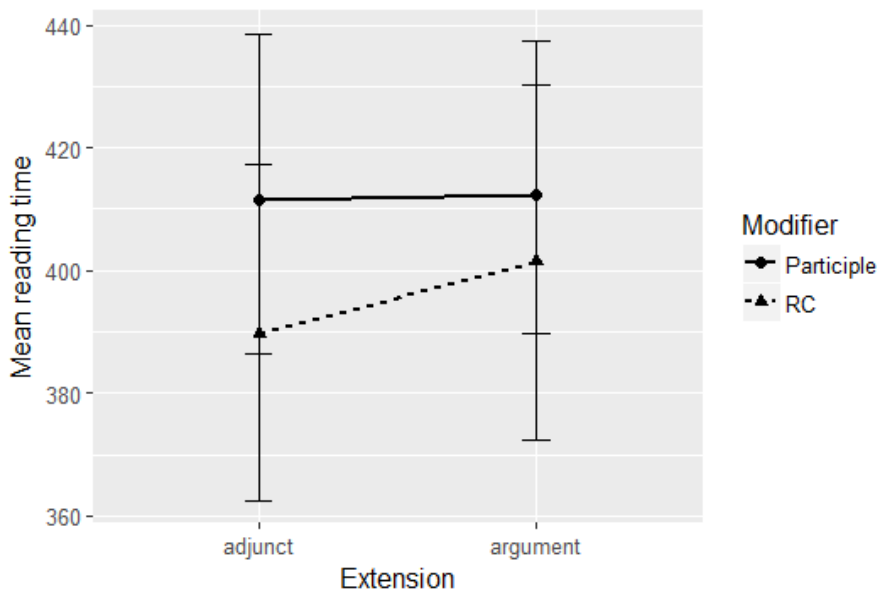


Figure 5.7: Mean reading times at the head noun (Experiment 3)

*Results at the head noun:* Figure 5.7 shows the mean RTs for the head noun (see also Table 5.9). There is a main effect of Modifier (cf. Table 5.10, indicating that the mean RTs are higher for the nouns that are modified by participles than for those modified by RCs. There is no main effect of Extension and no interaction of Extension and Modifier.

The linear mixed effects model for the region after the modified DP (*schon irgendwo* ‘already somewhere’ in (11)) reveals a significant interaction of Modifier and Extension (cf. Table 5.10). A further model with pairwise comparisons 5.12 reveals that this effect holds for the RC condition: the reading times are significantly lower for RCs with an accusative object than for those with a PP-adjunct.

Table 5.12: Linear mixed effects model with pairwise comparisons for the results at the region after the DP (Experiment 3)

formula:  $\log RT \sim \text{Modifier} + \text{Modifier:Extension} + (1 \mid \text{subject}) + (1 + \text{Modifier} \mid \text{sentence})$ 

Fixed effects:	Estimate	Std. Error	df	t value	Pr(>  t )
(Intercept)	5.87e+00	4.15e-02	3.96e+01	141.45	<2e-16 ***
Modifier1	-2.15e-02	1.63e-02	2.26e+01	-1.32	0.199
ModifierParticiple:Extension1	6.68e-03	1.60e-02	1.78e+03	0.42	0.676
ModifierRC:Extension1	-3.88e-02	1.60e-02	1.78e+03	-2.42	0.016 *

### 5.3.4 Discussion

To sum up, at the modifier verb (participle or RC verb), reading times for the participles with an accusative object are higher than for those with a PP-object. This is not the case for RCs: here the presence of a direct object does not lead to higher reading times independent of the type of construction. The fact that the mean reading times do not differ significantly for the RC condition can be seen as evidence that there is no general processing difficulty for the transitive use of the verbs in this experiment. It rather indicates difficulty with the structural or semantic integration of the direct object when it is part of a participle phrase. I assume that the adjectival properties of the participle cause this difficulty: although it is usually considered a verbal form (Bech, 1955), it behaves like an adjective, as it agrees with the head noun and is in an adjectival position. Therefore, processing the verbal and adjectival properties could slow down processing at the participle, especially when there is a richer verbal structure, i.e. an additional argument. Although, to my knowledge, this has not been previously observed for participles Manouilidou (2006) found evidence that a more complex event structure decreases the reaction times for deverbal nominals and adjectives compared to those derived from other categories in a lexical decision task, indicating that there is an interaction with the thematic and categorical features at lexical access. Contrary to her research where the words were presented in isolation, in this experiment the arguments were either present or not and preceded the participle. Furthermore, it can be argued that the verbs were always transitive, but with an optional argument (see e.g. Rice, 1988; Rappaport Hovav and Levin, 1998). Therefore, the slowdown would not be due to the thematic features of the verb itself, but rather because the relation of argument and verb and therefore the more complex sentential structure needs to be

processed in addition to the adjectival features. There could be a crucial difference to finite verbs: it is possible that in the case of the RC, participants process the complete argument structure and therefore add a prototypical object (e.g. *clean the house* in (9)), if it is omitted. For the present participle, the event might not be processed as deeply, but rather like a property of the head noun (e.g. *the aunt* in (9) is performing the activity of cleaning), and the argument would therefore not be implicitly present.

It is also possible that the semantic properties of the participle cause the difficulty. Contrary to the finite verb, present participles have an inherent imperfective aspect (Rapp 1997; Lübke and Rapp 2011, see also Chapter 2). In some cases, the presence of an accusative object could result in a change from an atelic event to a telic event, as the direct object can serve as an *incremental theme* (Dowty, 1991), i.e. a theme that undergoes a change of state during the event, changing the event from an activity to an accomplishment (cf. also Mittwoch, 1982; Olsen and Resnik, 1997; Rappaport Hovav and Levin, 1998). If this was the case, the clash of the imperfective aspect of the participle with a telic event could lead to a coercion effect, as the participants need to establish a reading in which the event lasts a certain time period, either during the event described in the matrix clause or during the utterance time and is more likely interpreted as an activity. This coercion effect could have resulted in the increase of RTs. In order to test whether there is a clash with the inherent aspect of present participles and certain properties of the verb of which it is derived, future experiments could either focus on testing verb classes in a more controlled way or manipulate the event structure by the insertion of certain adverbials (e.g. *four hours*, *in an hour*, cf. Dowty 1979).

For the RCs, there is an effect of the extension at the region following the modified DP, i.e. directly after the RC verb. Here reading times are lower for RCs with an accusative object than for those with a PP-adjunct. It is unclear, however, whether this reflects spillover or wrap-up after the comma. If so, it could reflect a facilitation due to a higher predictability of the verb if it is preceded by an argument, as it has been found in previous studies (Levy and Keller, 2013; Konieczny and Döring, 2003). Furthermore, it is possible that the participants need to infer an implicit object. These opposite findings for participle phrases and RCs suggest that the argument structure of a lexical item cannot always be used in the same way to make predictions, but this more likely depends on the construction in which it is used.

At the head noun, there is no difference for accusative objects or PP-adjuncts. However, the nouns following a participle phrase were read more slowly than those preceding a RC. Here it is crucial that the position of the noun differs for participles and RCs: at the point when the reader arrives at the head noun in the RC condition, he or she has not yet seen the modifier. Hence, higher reading times for the noun in the participle conditions could either be due to the fact that the modification is prenominal and the reader already needs to process the modifier at this point or because participle phrases in particular are difficult to process.<sup>4</sup>

The fact that there is no difference in the reading times for the beginning of the RC suggests that the difference for accusative objects or adjuncts found in the acceptability judgment experiments (Experiment 1 and 2) is not due to surprisal when the reader encounters an accusative object. However, it cannot be completely ruled out that this surprisal effect is delayed. In this case, the higher RTs for the accusative object condition at the participle could also be explained as spillover.

## 5.4 Experiment 4 – self-paced reading: modifier length

Having investigated the effect of the kind of elements inside the modifier, the current experiment tests how the length of the modifier affects processing. In the acceptability judgment data in Experiment 1, there was only an effect of the transitive or intransitive use of the verb, not of modifier length. However, previous research (Fabricius-Hansen, 2016) and the corpus data in Chapter 4 suggest that longer modifiers are more likely to be expressed as RCs than prenominally.

It is possible that there is an effect in online processing, but not for offline methods like acceptability judgments. Therefore, the online processing of short modifiers (14) and long modifiers (15) is compared in this experiment.

- (14) a. *der ein Eis essende Schüler*  
the an ice cream eating student
- b. *der Schüler, der ein Eis isst*  
the student who an ice cream eats

---

<sup>4</sup>Another possibility is that the sentence position in general has an effect. However, participants usually tend to speed up at the end of the sentence (cf. Kuperman et al., 2010; Aaronson and Ferres, 1983; Ferreira and Henderson, 1993; Chang, 1980), so the pattern found here would not be predicted.

- (15) a. *der im Park bei schönem Wetter ein Eis essende*  
the in the park during nice weather an ice cream eating  
*Schüler*  
student
- b. *der Schüler, der im Park bei schönem Wetter ein Eis*  
the student who in the park during nice weather an ice cream  
*isst*  
eats

The contradicting predictions from memory-based theories (Gibson, 1998, 2000) and experience-based theories (Hale, 2001; Levy, 2008a), as shown in chapter 4, are another reason why it is particularly interesting to investigate this factor with online measures. Although production data like in the corpus analysis in Chapter 4 indicate that long participle phrases cause higher memory load, it is also possible in the case of both participle phrases and RCs that the end of the modifier is read more quickly because it is highly expected. The predictions for different regions will be revisited after the materials have been introduced.

## 5.4.1 Method

### 5.4.1.1 Material

The experiment consists of 24 items. The DPs are again modified by present participles (all extended by arguments) or by a RC. The length of the modifier is manipulated, leading to a 2×2-design: Modifier (participle or RC) × Length (short or long). In the longer condition, adverbials are inserted. The modified DP is always the subject. As discussed in previous research (cf. Levy and Keller, 2013; Kuperman et al., 2010; Aaronson and Ferres, 1983; Ferreira and Henderson, 1993; Chang, 1980), a manipulation of length may also lead to a difference in reading times due to the different position of a critical word in the sentence. In order to avoid this confound, I constructed the sentences in a way that the modified DP is inside an embedded clause. In the conditions without adverbials inside the modifier, adverbials (the same or a plausible alternative with the same number of words) are inserted in the matrix clause. An example of the materials is shown in (16) (see Appendix D for the complete set of experimental items). There were the same 64 fillers as in the previous experiment. Half of the experimental items and half of the fillers are followed by a control question, cf. (17). The materials were divided into four lists, like in Experiment 3.

- (16) a. *present participle, long modifier*

*Peter hat gesehen, dass **der im Park bei schönem Wetter**  
 Peter has seen that the in the park during nice weather  
**ein Eis essende Schüler** gemütlich auf einer Bank gegessen  
 an ice cream eating student cozily on a bench sat  
 hat.  
 has*

- b. *present participle, short modifier*

*Peter hat im Park bei schönem Wetter gesehen, dass **der ein  
 Peter has in the park during nice weather seen that the an  
**Eis essende Schüler** gemütlich auf einer Bank gegessen hat.  
 ice cream eating student cozily on a bench sat has***

- c. *RC, long modifier*

*Peter hat gesehen, dass **der Schüler, der im Park bei  
 Peter has seen that the student who in the park during  
**schönem Wetter ein Eis aß**, gemütlich auf einer Bank  
 nice weather an ice cream ate cozily on a bench  
 gegessen hat.  
 sat has***

- d. *RC, short modifier*

*Peter hat im Park bei schönem Wetter gesehen, dass **der  
 Peter has in the park during nice weather seen that the  
**Schüler, der ein Eis aß**, gemütlich auf einer Bank gegessen  
 student who an ice cream ate cozily on a bench sat  
 hat.  
 has***

‘Peter has seen that the student (who was) eating ice cream in the park during nice weather was sitting cozily on a bench’ / ‘Peter has seen in the park during nice weather that the student (who was) eating ice cream was sitting cozily on a bench’

- (17) *Hat der Schüler ein Brötchen gegessen?*

Has the student a sandwich eaten?

‘Did the student eat a sandwich?’

#### 5.4.1.2 Participants

As in the previous experiments, the participants were recruited via the web-based platform Prolific. I used the pre-screening setting to exclude all participants who took part in previous experiments and who are not native speakers of German. As



in Experiment 3, the payment was £2.50 and the experiment took approximately 20 minutes. Overall, 49 people participated, but seven had to be excluded: two reported to not be a native speaker of German, four had an accuracy below  $< 75\%$  for the control questions and for one participant, the reason was a technical problem with the experiment. This left 42 participants for the analysis.

### 5.4.1.3 Procedure

The procedure is the same as in Experiment 3, a word-by-word self-paced reading task. Again, I created the experiment in Ixwebfarm (<http://spellout.net/ixwebfarm/>) and distributed it with a web link. The instructions and the procedure were the same as in Experiment 3. Before the experiment, participants were asked to give their consent.

### 5.4.1.4 Relevant regions and predictions

The regions that are of particular interest can be found in (18).

(18) a. *participle*

*dass der (im Park) bei schönem Wetter)*  
 that the (in the park during nice weather)  
 ein Eis essende Schüler  
 an ice cream eating student  
*gemütlich auf einer Bank gesessen hat.*  
 cozily on a bench sat has

b. *RC*

*dass der Schüler, der (im Park) bei*  
 that the student who (in the park during  
*schönem Wetter) ein Eis aß,*  
 nice weather) an ice cream ate  
*gemütlich auf einer Bank gesessen hat.*  
 cozily on a bench sat has

If present participle phrases and RCs are compared directly and independent of the length manipulation, the predictions are the same as in the previous experiment (cf. Section 5.3.1.4): the reading times on the nouns should be higher in the participle condition because here the noun follows the participle, leading to a non-local dependency of determiner and noun and therefore higher integration costs (cf. DLT,

Gibson, 2000). This is supported by the results of Experiment 3. For the beginning of the modifier, the processing costs should be higher in the participle conditions than in the RC conditions because the first DP or PP is less expected if it is not preceded by a relative pronoun and the storage costs are higher (cf. Chapter 4). However, there were no effects at this region for Experiment 3. As in the previous experiment, a direct comparison of participles and RC verbs has to be made with caution because the verb forms differ in frequency and length.

For the length manipulation and its interaction with the different kinds of modification, the predictions are different for memory- and expectation-based accounts. As described in Chapter 4, the construction can be analyzed either from an external perspective, i.e. looking at the processing of the DP as a whole, or from a modifier internal perspective.

In order to draw conclusions for the processing of the whole DP, one has to consider the reading times on the head noun. For the participle condition, the increase of the length leads to an increase of the distance between determiner and noun. Based on previous research (cf. Chapter 3 and 4), this could either lead to locality effects, i.e. higher RTs on the noun, or to anti-locality effects, i.e. lower RTs on the noun. Contrary to the participle condition, no effect of the length of the modifier is expected for the RCs.

Zooming in on the structure of the modifier itself, the modifier verb becomes interesting. The verbal properties of the participle (cf. Chapter 2) suggest that the same processing effects hold for participle phrases as for finite verb-final clauses. Hence, the effect of the length manipulation should be the same for the participle phrase and the RC. At the modifier verb, this could either lead to an anti-locality effect, i.e. lower RTs when the participle or RC verb is preceded by more material and therefore more predictable (Levy, 2008a; Konieczny, 2000), or higher RTs for a longer modifier, due to higher integration costs caused by more intervening new discourse referents (Gibson, 2000). However, the assumption that participle phrases behave like finite clauses would also suggest that an argument leads to a higher predictability of the verb or at least that there are no differences. This was not the case in Experiment 3: the presence of a direct object lead to an increase of RTs for participle phrases, but not for RCs.

Table 5.13: Proportion of correct answers for control questions for the conditions in Experiment 4

Length	Modifier	answer
short	Participle	0.89
long	Participle	0.89
short	RC	0.89
long	RC	0.90

### 5.4.2 Analysis

The data analysis was the same as in Experiment 3; see Section 5.3.2. All values higher than 1500ms and lower than 100ms were excluded from the analysis, which applied to 0.54% of the data. For the linear mixed effects models, sum contrasts (0.5,-0.5) were coded: participle vs. RC for the factor Modification and short vs. long for the factor Length.

### 5.4.3 Results

*Question accuracy:* The overall accuracy was 90%. Table 5.13 shows the percentage of correct answers for the control questions. There were no significant differences between the conditions.

In addition to the relevant regions discussed in Section 5.4.1.4, I compared the RTs at the region before the modified DP, i.e. the lexical verb of the matrix clause and the complementizer (*gesehen, dass* ‘seen that’). This serves as control, keeping in mind that the length of the matrix clause differs in order to counterbalance the difference in length for the modifier. There are no significant differences between these conditions. There are also no differences at the finite verb of the subordinate clause. Table 5.14 shows the mean RTs for the different regions that will be discussed in this section.

*Results at the first DP or PP inside the modifier:* At the beginning of the modifier (or after the relative pronoun in the case of RCs), there is a significant main effect of Modifier (see Table 5.15), with lower RTs for RCs than for participles. The interaction of Modifier and Length is marginally significant. Note that at this point, it does not really make sense to expect an effect of the length itself. The difference for this factor is rather whether an accusative object or a PP occurs.

#### 5.4. Experiment 4 – self-paced reading: modifier length

Table 5.14: Mean reading times by condition for the head noun, modifier verb and the region after the DP in Experiment 4; the standard error is given in parantheses

Modifier	Length	beginning of modifier <i>im Park / ein Eis</i> ‘in the park’ / ‘ice cream’	modifier verb <i>essende / aß</i> ‘eating’ / ‘ate’	head noun <i>Schüler</i> ‘student’	region after DP <i>gemütlich auf</i> ‘cozily on’
Participle	short	466 (10.99)	505 (12.3)	518 (11.9)	493 (9.85)
Participle	long	460 (9.69)	489 (11.7)	479 (10.6)	462 (10.01)
RC	short	439 (8.94)	457 (10.2)	459 (10.1)	459 (10.14)
RC	long	443 (9.15)	476 (10.9)	476 (11.0)	484 (10.13)

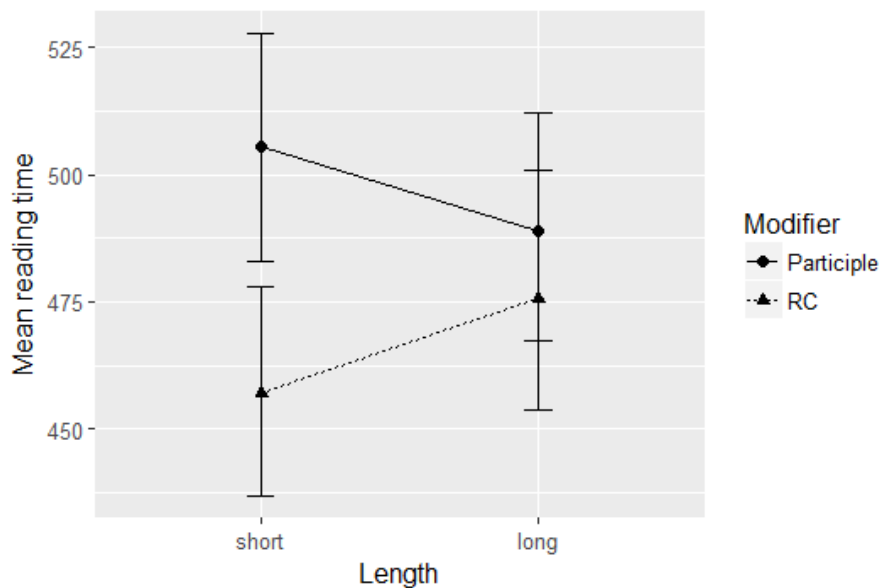


Figure 5.8: Mean reading times at the modifier verb (participle or RC verb) in Experiment 4

*Results at the modifier verb:* At the participle or RC verb, there is a main effect of Modifier, with higher RTs for participles than for RC verbs. The interaction of Modifier and the Length is only marginally significant. The tendency is that participles are read faster when the modifier is longer, whereas the RTs for the RC verb are higher with increasing RC length. The results can be found in Figure 5.8 and Table 5.15.

*Results at the head noun:* The mean RTs and the linear model for this region can be found in Figure 5.9 and Table 5.15. There is a main effect of Modifier, with higher RTs for the participle condition. A closer look at the results, however,

Table 5.15: Linear mixed effects model for the results at different regions (Experiment 4)

Region	Fixed effects:	Estimate	Std. Error	df	t value	Pr(>  t )
first PP or DP of the modifier						
$\log RT \sim Length * Modifier + (1 + Length   subject) + (1   sentence)$	(Intercept)	6.054	0.037	42.664	162.94	<2e-16 ***
	Length1	-0.007	0.020	37.193	-0.34	0.739
	Modifier1	-0.032	0.016	911.426	-2.02	0.043 *
	Length1:Modifier1	0.060	0.032	911.594	1.88	0.060 .
Modifier verb						
$\log RT \sim Length * Modifier + (1 + Modifier   participant) + (1   sentence)$	(Intercept)	6.110	0.037	44	164.03	<2e-16 ***
	Length1	0.002	0.018	905	0.12	0.908
	Modifier1	-0.056	0.021	42	-2.60	0.013 *
	Length1:Modifier1	0.070	0.037	903	1.90	0.058 .
Head noun						
$\log RT \sim Length * Modifier + (1 + Length   participant) + (1   sentence)$	(Intercept)	6.118	0.038	43	163.24	< 2e-16 ***
	Length1	-0.018	0.023	42	-0.76	0.45339
	Modifier1	-0.064	0.017	906	-3.76	0.00018 ***
	Length1:Modifier1	0.106	0.034	906	3.11	0.00196 **
Region after DP						
$\log RT \sim Length * Modifier + (1 + Modifier   participant) + (1   sentence)$	(Intercept)	6.115	0.040	41	154.89	<2e-16 ***
	Length1	-0.000	0.016	941	-0.01	0.995
	Modifier1	-0.022	0.019	40	-1.16	0.255
	Length1:Modifier1	0.093	0.031	942	2.97	0.003 **

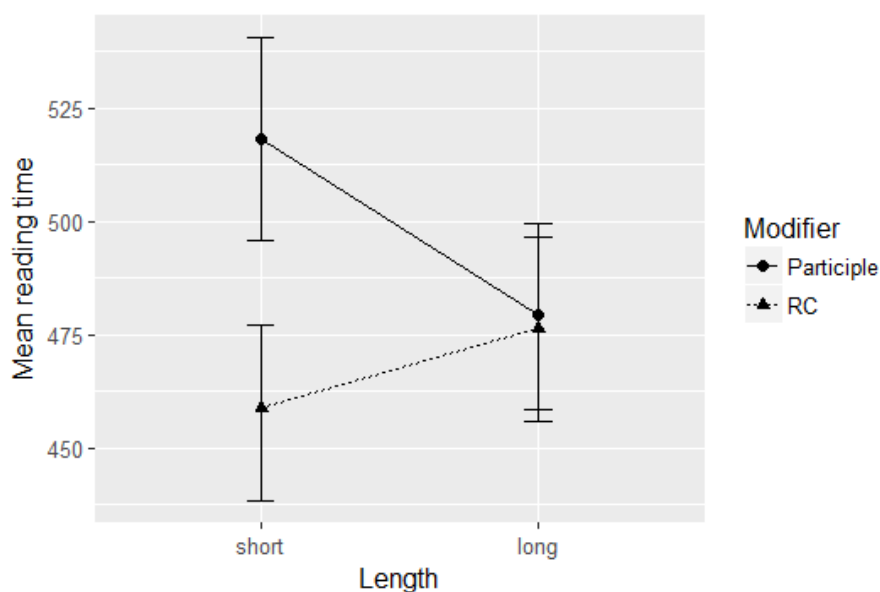


Figure 5.9: Mean reading times at the head noun in Experiment 4

shows that the head nouns following a long modifier are read almost as fast as those preceding a short relative clause. The model also reveals a significant interaction of Length and Modifier. A model with pairwise comparisons (cf. Table 5.16) shows that this interaction is caused by a difference between the long and short condition for participle phrases: the nouns that follow a longer modifier have significantly lower RTs than those following a shorter modifier. For RCs, there is no significant difference. Looking only at the mean values, the RTs seem to be a bit higher for the short modifier RC condition than for the long modifier. At this point, the reader has not seen the modifier, hence the only difference could come from the length of the matrix clause. The lower reading times for the noun following a longer matrix clause is actually not that surprising, given the fact that readers tend to speed up the further they proceed in the sentence (cf. Levy and Keller, 2013; Kuperman et al., 2010; Aaronson and Ferres, 1983; Ferreira and Henderson, 1993; Chang, 1980). An interpretation of this result should be taken with caution, however, due to the lack of significance.

*Results at the region following the modified DP:* For the two adverbs following the DP, there is a significant interaction of Modifier and Length (cf. Table 5.15). The data suggest that at this region, RTs are lower for the participle condition with a long modifier compared to a short one and the opposite holds for RCs; there are higher RTs for longer RCs than for the short ones. A linear mixed model with

Table 5.16: Linear mixed effects model with pairwise comparisons for the results at the head noun in Experiment 4

formula:  $\log RT \sim \text{Modifier} + \text{Modifier:Length} + (1 + \text{Length} \mid \text{participant}) + (1 \mid \text{sentence})$

Fixed effects:	Estimate	Std. Error	df	t value	Pr(>  t )
(Intercept)	6.118	0.037	42.50	163.241	< 2e-16 ***
Modifier1	-0.064	0.017	905.80	-3.762	0.000179 ***
ModifierParticiple:Length1	-0.071	0.029	98.90	-2.449	0.016079 *
ModifierRC:Length1	0.036	0.029	98.40	1.233	0.220491

pairwise comparisons for this region did not converge, even with the most simple random effect structure. Therefore, this finding has to be taken with caution. An explanation for the interaction could be spillover. A direct comparison of RCs and participle phrases does not make sense at this point because of the different words that precede this region. However, assuming that it is spillover, it supports two findings: for participle phrases, the fact that reading times at the head noun are lower in the long modifier condition and for RCs, it is possible that the higher RTs for longer RCs at this point are spillover from the RC verb, where the same tendency was already visible.

#### 5.4.4 Discussion

At the head noun, the reading times for participles are lower when the modifier is longer. This can be considered as an anti-locality effect: more material between determiner and noun leads to a higher expectation for the noun to be the next word (cf. Chapter 4). This result is also reflected in the spillover region. Note that the materials were constructed in a way that the adverbs do not contribute much to the predictability of the lexical identity of the noun, so it is more likely that the expectation for any kind of noun (instead of another modifier) rises. The results for the RCs at this region do not reflect the length manipulation of the modifier, because the noun appears before the modifier. As predicted, the mean RTs for the head nouns of RCs are overall lower than for those following the participle phrases, which would suggest that nouns are easier to process when they are adjacent to the determiner. However, it is also the case that the nouns in the participle, long modifier condition are read almost as quickly as those in the RC, short modifier condition, which weakens this conclusion. The results at the head noun show the

properties of the modified DP as a whole and they suggest an anti-locality effect for DPs modified by participle phrases.

For the internal processing effects of the participle phrase or RC respectively, the results are less clear. Here, the head of the modifier, the participle or RC verb, is the relevant region. As discussed in the previous experiment, the significant main effect of the kind of modification cannot really be interpreted because participles and finite verbs are different in several ways. Therefore, it is more interesting to look at the dependency resolution depending on the distance for both kinds of modification, i.e. the interaction of modifier length and kind of modifier at the participle or RC verb. The results show a tendency in opposite directions: an anti-locality effect, i.e. lower RTs for a longer modifier, for participles and a locality effect, i.e. higher RTs for a longer modifier, for RC verbs. However, the interaction did not reach significance. The locality effect for RCs seems to be reflected as spillover in the region after the DP, which is following the modifier verb in the RC condition. As the head noun follows the participle in the other two conditions, it is theoretically also possible that the anti-locality effect at this point is at least partly because of spillover from the participle.

Contrary to the previous experiment, the first element inside of the modifier was read more slowly for participle phrases than for RCs. This is in line with the *Surprisal theory* (Hale, 2001; Levy, 2008a): extended modifiers occur less frequently and therefore the reader expects an adjective or a noun after the determiner, instead of a DP or PP. In the case of an RC, the reader has already seen the relative pronoun at this point and expects an RC structure. The difference at the beginning of the modifier is also in line with the storage costs according to DLT (Gibson, 2000), assuming that both, the participle and the head noun need to be stored in memory for the participle phrase (cf. Chapter 4 and Chapter 6). However, it is unclear why these effects did not occur in the previous experiment.

## 5.5 Experiment 5 – eye-tracking: modifier length

Experiment 5 is an eye-tracking experiment using the same materials as in the previous experiment. In Experiment 4, the tendencies for an anti-locality effect at the participle and a locality effect at the RC verb are an interesting finding. However, they failed significance. Therefore, a more fine-grained method like eye-tracking might be able to give additional insights to the modifier internal processing.



Furthermore, a replication of the previous experiment would also have the advantage that the results can be tested again, with a method that is more natural than SPR. Previous studies (e.g. Price and Witzel, 2017) showed different results for SPR and eye-tracking studies on the resolution of non-local dependencies. Furthermore, Staub (2010) found that memory-based and expectation-based effects are reflected in different measures. He found evidence for locality effects in early measures such as gaze duration and evidence for experience-based effects in late measures like the total reading time or measures related to regression.

## 5.5.1 Method

### 5.5.1.1 Material

The materials were the same as in the previous SPR-experiment (Experiment 4). It consisted of 24 items with a 2×2-design, resulting in four conditions: Modifier (participle or RC) × Length (short or long). As the sentences were too long to fit onto one line, I inserted fixed line breaks. This is a difference to Experiment 4 where the line breaks were created automatically depending on the participants' screen size.

Previous research on reading patterns in multiline texts has shown that, besides the sentence position, the position in the line affects reading times (e.g. Kuperman et al., 2010): reading times are inflated at the beginning and at the end of a line, presumably due to saccade planning. In order to avoid a confound of the position for the critical regions, line breaks needed to be inserted manually. The positions of the critical areas already differ for the conditions, due to the nature of the materials. Therefore, the line breaks were inserted for each condition in a way that no critical word is at the beginning or the end of a line.

(19) shows the materials with line breaks. As in the SPR experiment, the most important regions are the participle or RC verb (e.g. *essende, aß*) and the head noun (e.g. *Schüler*).

In order to avoid a very unequal number of words per line, as would be the case if a break was inserted before the modified DP, it was inserted before the subordinate clause in the conditions with the short modifier (and therefore long matrix clause), 1,3 and between the adverbials inside the modifier for the long modifier conditions, 2, 4. For the second line break it was possible to insert it at the same position for all conditions, namely between the PP or adverbs following the modifier.

5.5. Experiment 5 – eye-tracking: modifier length

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(19)

a. *present participle, long modifier*

*Peter hat gesehen, dass **der im Park bei schönem Wetter ein Eis essende Schüler gemütlich auf** eine Bank gesessen hat.*  
Peter has seen that the in-the park during nice weather an ice cream eating student cozily on a bench sat has

b. *present participle, short modifier*

*Peter hat im Park bei schönem Wetter gesehen, dass **der ein Eis essende Schüler gemütlich auf** einer Bank gesessen hat.*  
Peter has in-the park during nice weather seen that the an ice cream eating student cozily on a bench sat has

‘Peter has seen that the student eating ice cream in the park during nice weather was sitting cozily on a bench’ / ‘Peter has seen in the park during nice weather that the student eating ice cream was sitting cozily on a bench’

c. *RC, long modifier*

*Peter hat gesehen, dass **der Schüler, der im Park bei schönem Wetter ein Eis aß, gemütlich auf** einer Bank gesessen hat.*  
Peter has seen that the student who in-the park during nice weather an ice cream ate cozily on a bench sat has

d. *RC, short modifier*

*Peter hat im Park bei schönem Wetter gesehen, dass **der Schüler, der ein Eis aß, gemütlich auf** einer Bank gesessen hat.*  
Peter has in-the park during nice weather seen that the student who an ice cream ate cozily on a bench sat has

‘Peter has seen that the student who was eating ice cream in the park during nice weather was sitting cozily on a bench’ / ‘Peter has seen in the park during nice weather that the student who was eating ice cream was sitting cozily on a bench’

In addition to the experimental materials, the experiment contained 60 fillers and 4 training sentences. These were the same as for Experiment 4. Furthermore, there were control questions for half of the items and fillers, again the same as in the corresponding SPR experiment. The experiment was created using “Experiment-Builder” from Eyelink (SR Research).

### 5.5.1.2 Participants

Overall, 29 native speakers of German participated in the experiment. They were all enrolled as students and the age range was between 20 and 39, (mean age = 25.9). They received either course credit or 8€ for their participation. 7 participants had to be excluded due to track loss or because they had a low overall question accuracy (< 75%), which left 22 for the analysis.<sup>5</sup>

### 5.5.1.3 Procedure

The eye-tracking data was recorded with an SR EyeLink 1000+ in stabilized head mode and the experiment was displayed on a 24inch monitor. Participants’ heads were stabilized using a chin rest in order to avoid track loss due to movement. The right eye was tracked. The distance between the camera and the participants’ eyes was about 55cm and the distance between the screen and the eyes was ca. 90cm.

Before the experiment, participants read an introduction which asked them to read the sentences and to answer the questions that appeared after some sentences. They should respond to the questions by pressing one of the buttons which were placed before them (green, on the left side, for ‘yes’; red, on the right side, for ‘no’). After the calibration and validation (using a nine-point grid), the participants read four training sentences, followed by the actual experiment. Each trial went the following way: it started with a drift correction, i.e. a fixation point to check whether the calibration was still correct. Then a sentence was presented and participants pressed one of the buttons after reading it. For some of the trials, this was followed by a yes/no-question and participants pressed the respective button. If they answered correctly, the text *Richtig!* (‘correct!’) appeared below the question, otherwise *Falsch!* (‘false!’). The experiment (including setup and calibration) took approximately 30 minutes.

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<sup>5</sup>Initially at least 40 participants were intended for this study. Unfortunately, the experiment was conducted during the time of the Covid-19-crisis, which made it difficult to recruit participants.

### 5.5.1.4 Relevant regions and predictions

Like the materials, the relevant regions are the same as in the previous SPR experiment, Experiment 4. Furthermore, I expect that the results of the previous experiment will be replicated. Contrary to the SPR experiment, the measures from eye-tracking are more detailed. Based on the results from Staub (2010), I hypothesize that some of the measures will reflect the effects found in the SPR experiment more than others.

Before refining the predictions, I will first provide more information about eye-tracking data (see e.g. Rayner et al. 1989; Staub and Rayner 2007 for a more detailed description). While reading, the eye fixates on a specific point (fixations) and moves quickly to the next point (saccade). If the reader re-reads part of a sentence, i.e. if the eyes move back to the left, this is called a regression. The following measures will be considered in the analysis (see also Price and Witzel, 2017; Bartek et al., 2011): *first fixation duration* is the duration of the initial landing on a region, if the region is not skipped. *Gaze duration* (or *first pass reading time*) is the sum of the time of all fixations before moving out of the region, either to the left or to the right. *Regression-path duration* includes the duration of all fixations between entering a region and moving out of the region to the right, hence also all regressions to the left. *Total reading time* captures all fixations on a region during the trial. *Regression likelihood* is the likelihood for regressive movement from a region and the *skipping rate* is the percentage of cases when there are no fixations on a region.

First fixation and gaze duration are considered early measures that indicate lexical processing, but to some extent also syntactic integration. Measures that focus on regression, regression-path duration and regression likelihood, and the total reading times are considered to reflect mainly syntactic integration and other post-lexical processes. In Staub (2010), early measures reflected memory based effects whereas he found expectation-based effects with late measures.

The first critical region is the participle or RC verb. The results in the previous SPR experiment indicated an interesting tendency at this point: RTs for participles were lower when the modifier was longer, whereas for RC verbs the RTs were higher with a longer modifier. If lower RTs on the participle are due to expectation-based effects, i.e. because the content of the modifier contributes to the predictability of the participle, this is likely to be reflected in late measures that take regressions into account. It is likely that the reading measures differ for participles and RCs, as this

was the case in Experiment 4. However, this could be due to the difference in word length or finiteness.

The second critical region is the head noun (e.g. *Schüler*): in the previous SPR experiment, reading times were lower for longer participle phrases, indicating an anti-locality effect. Again, as this is an expectation-based tendency, potentially significant effects will most likely be found in late measures. The head noun in the RC condition serves as a control: as it always appears before the modifier, I do not expect that a manipulation of modifier length affects the RTs at this point. Note, however, that the position of the noun in the whole sentence differs for the head noun in the RC condition because the additional material is inserted into the matrix clause and therefore before the noun. In the SPR experiment, this presumably led to slightly different mean RTs for short and long RCs, although the difference was not significant.

### 5.5.2 Analysis

The data was checked in Dataviewer, which is part of the EyeLink-Software. As mentioned in the participant section, only 22 of the participants were included in the analysis. Trials with a vertical drift were adjusted; this was the case for 2.65% of the trials. Furthermore, trials with poor data quality were excluded, which applied to 0.76% of all trials.<sup>6</sup> Fixations shorter than 80ms were merged to a nearby fixation within 1 degree of visual angle and all fixations shorter than 80ms and longer than 1000ms were removed.

Interest areas were created for each word. The following measures were log-transformed and analyzed with R (R Core Team, 2017) using linear mixed effects models (lme4-package; Bates et al. 2015b) for the relevant regions: first fixation duration, gaze duration, total reading time and regression-path duration. Sum contrasts (-0.5, 0.5) were coded. All models had the factors Modification (participle vs. RCs) and Length (short vs. long) as predictors and item and participant as random effects. Random slopes were simplified if the model did not converge and to create a parsimonious model, following Bates et al. (2015a) and using the RePsychLing-package (Baayen et al., 2015). In addition, the likelihood to regress out of a region was analyzed using a generalized mixed effects model with the same fixed and random effects as described above.

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<sup>6</sup>This was the case if a trial showed very few fixations or a horizontal or diagonal shift.

## 5.5. Experiment 5 – eye-tracking: modifier length

Table 5.17: Proportion of correct answers by condition in Experiment 5, including all participants

Modifier	Length	correct answer
Participle	short	0.90
Participle	long	0.91
RC	short	0.95
RC	long	0.97

Table 5.18: Results of different measures on the head noun (ms for RTs) in Experiment 5

Modifier	Length	First	Gaze	Total	RegPath	RegOut	n
Participle	short	236.6	263.9	362.2	344.8	0.118	119
Participle	long	226.3	253.4	345.5	340.4	0.113	124
RC	short	197.8	221.7	364.4	342.8	0.195	118
RC	long	192.5	237.1	361.1	310.1	0.188	117

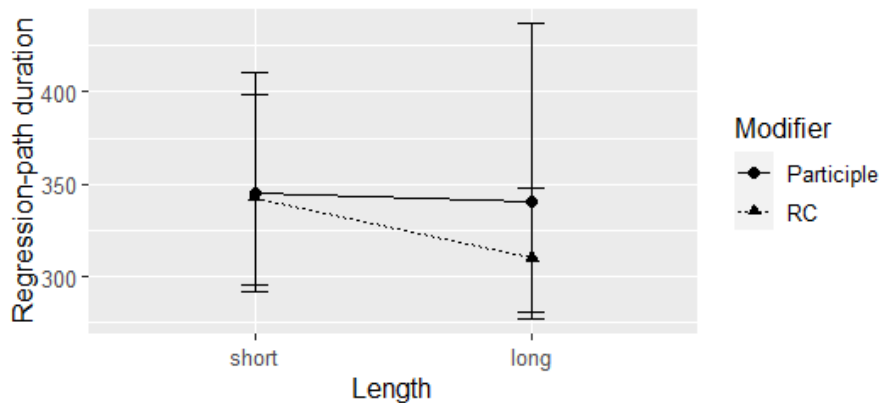


Figure 5.10: Regression-path duration at the head noun in Experiment 5

### 5.5.3 Results

*Question Accuracy:* The overall question accuracy was 93.2%. Table 5.17 shows the percentage of correct answers by condition. A *generalized mixed effects model* showed no significant differences by condition.

*Head noun:* As the head noun was the region with significantly lower RTs for longer prenominal modifiers compared to short ones in Experiment 4, I will focus on this interest area first. Table 5.18 shows the values for different measures on this region. Figures 5.10 and 5.11 show the regression-path duration and gaze duration. Interestingly, the results differ from the SPR experiment.

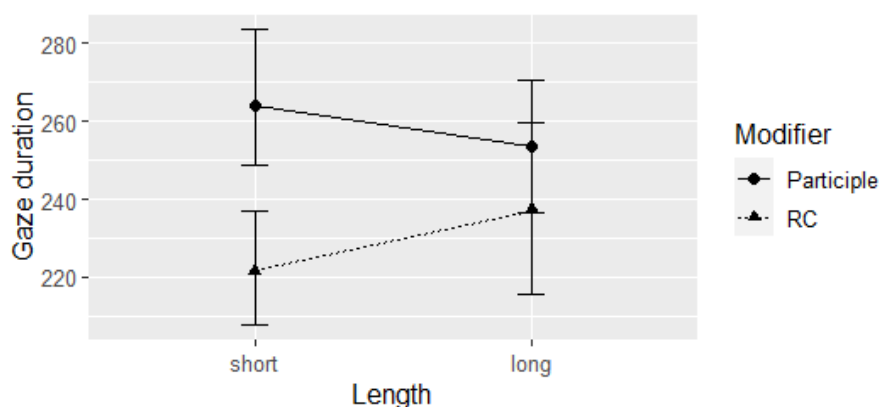


Figure 5.11: Gaze duration at the head noun in Experiment 5

The results of the linear mixed effects models are shown in Table 5.19. For gaze duration, there is a significant main effect of Modifier with higher RTs for the nouns following a participle compared to the RC condition.

There is no main effect of Length and no interaction. There are no significant effects for the total reading time and the regression-path duration. A generalized mixed effects model for the regression likelihood<sup>7</sup> showed a significant main effect for Modifier, with more regressions for head nouns of RCs than for those following a participle construction.

*Modifier verb:* Table 5.20 shows the results for the modifier verb. Graphs for regression-path duration and gaze duration are shown in Figure 5.12 and 5.13. Table 5.21 shows the linear mixed effects models at the participle or RC verb respectively.

There is a significant main effect of Modifier for all measures except the likelihood for regression, with higher RTs for participles compared to RCs. As mentioned in the prediction section, participles and RCs differ in many respects – not only in position but also in word length and finiteness. Therefore it is no surprise that there is a difference between the participle and RC condition. Besides the main effect of Modifier, the model for gaze duration shows no further significant effects. The model for total reading times reveals a significant interaction of Modifier and Length<sup>8</sup> and the model for regression-path duration also shows a significant inter-

<sup>7</sup>The model for the regression likelihood did not converge, even with the simplest random structure. I set the parameter  $nAGQ=0$ , so that the Laplace approximation was not used. Hence, the results are less accurate than for the other models.

<sup>8</sup>Like with most other measures, only a simplified model converged. I compared the maximal models with the simplified versions using ANOVA. In the case of the total RTs, there was a significant difference and the interaction between Modifier and Length was only significant in the model with a reduced random structure.

Table 5.19: Mixed effects models for different measures at the head noun (log-transformed) in Experiment 5

Fixed effects:						
Measure	Estimate	Std. Error	df	t value	Pr(>  t )	
<b>Gaze Duration</b>						
<i>log(gaze duration) ~ Modifier * Length + (1 + Modifier   participant) + (1   sentence)</i>						
(Intercept)	5.418	0.034	29.314	157.562	< 2e-16	***
Modifier1	-0.139	0.034	20.371	-4.121	0.000513	***
Length1	-0.012	0.031	417.714	-0.394	0.693992	
Modifier1:Length1	0.085	0.062	419.700	1.378	0.169052	
<b>Total RT</b>						
<i>log(total RT) ~ Modifier * Length + (1 + Modifier   participant) + (1 + Length   sentence)</i>						
(Intercept)	5.696	0.074	31.398	76.904	< 2e-16	***
Modifier1	-0.034	0.067	18.708	-0.499	0.623	
Length1	-0.050	0.047	19.951	-1.065	0.300	
Modifier1:Length1	0.021	0.079	398.591	0.270	0.788	
<b>Regression-path</b>						
<i>log(regression-path duration) ~ Modifier * Length + (1 + Modifier   participant) + (1 + Length   sentence)</i>						
(Intercept)	5.612	0.054	31.245	104.500	< 2e-16	***
Modifier1	-0.041	0.048	18.773	-0.853	0.405	
Length1	-0.062	0.067	22.022	-0.931	0.362	
Modifier1:Length1	0.018	0.090	401.741	0.201	0.841	
<b>Regression Likelihood</b>						
<i>regression likelihood ~ Modifier * Length + (1   participant) + (1   sentence)</i>						
(Intercept)	-1.897	0.221		-8.58	< 2e-16	***
Modifier1	0.696	0.275		2.54	0.011	*
Length1	-0.072	0.274		-0.26	0.792	
Modifier1:Length1	-0.003	0.548		-0.01	0.996	



Table 5.20: Results of different measures on the participle/RC verb in Experiment 5

Modifier	Length	First	Gaze	Total	RegPath	RegOut	n
Participle	short	241.6	293.6	512.1	550.6	0.287	129
Participle	long	247.1	289.0	438.4	344.6	0.077	130
RC	short	232.1	271.1	387.0	328.6	0.141	128
RC	long	228.7	261.1	397.5	394.4	0.155	116

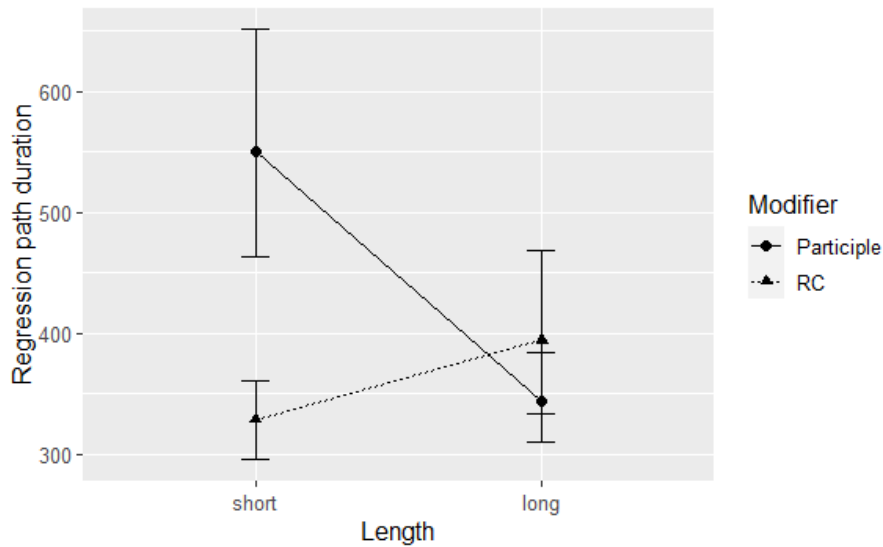


Figure 5.12: Regression-path duration at the participle/RC verb in Experiment 5

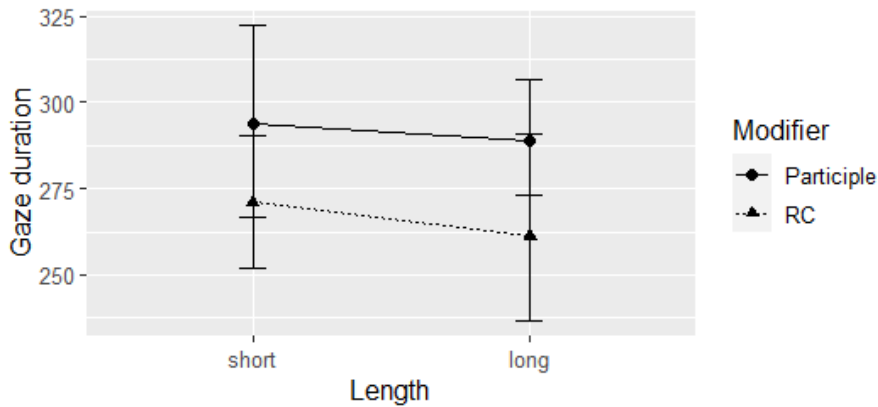


Figure 5.13: Gaze duration at the participle/RC verb in Experiment 5

action of both factors and a significant main effect of Length, with faster RTs for longer modifiers than for short ones. The same holds for the regression likelihood: a generalized mixed effects model shows a main effect of Length, with higher RTs

Table 5.21: Mixed effects models for different measures at the participle or RC verb (log-transformed) in Experiment 5

Fixed effects:					
Measure	Estimate	Std. Error	df	t value	Pr(>  t )
<b>Gaze</b>					
<i>log(gaze duration) ~ Modifier * Length + (1   participant) + (1   sentence)</i>					
(Intercept)	5.539	0.039	29.703	140.937	< 2e-16 ***
Modifier1	-0.106	0.034	459.474	-3.126	0.00189 **
Length1	-0.006	0.034	457.612	-0.191	0.84864
Modifier1:Length1	-0.096	0.068	457.964	-1.427	0.15437
<b>Total</b>					
<i>log(total RT) ~ Modifier * Length + (1 + Length   participant) + (1 + Modifier   sentence)</i>					
(Intercept)	5.905	0.063	28.079	93.992	< 2e-16 ***
Modifier1	-0.257	0.053	21.507	-4.876	7.55e-05 ***
Length1	-0.064	0.043	19.356	-1.490	0.1524
Modifier1:Length1	0.165	0.082	421.922	2.014	0.0447 *
<b>Regression-path</b>					
<i>log(regression-path duration) ~ Modifier * Length + (1   participant) + (1   sentence)</i>					
(Intercept)	5.785	0.051	29.931	113.990	< 2e-16 ***
Modifier1	-0.182	0.047	459.507	-3.841	0.000140 ***
Length1	-0.116	0.047	457.799	-2.448	0.014750 *
Modifier1:Length1	0.362	0.095	458.205	3.831	0.000145 ***
<b>Regression Likelihood</b>					
<i>regression likelihood ~ Modifier * Length + (1   participant) + (1   sentence)</i>					
(Intercept)	-1.897	0.221		-8.58	< 2e-16 ***
Modifier1	-0.065	0.267		-0.25	0.80626
Length1	-0.771	0.268		-2.88	0.00403 **
Modifier1:Length1	1.801	0.536		3.36	0.00078 ***

Table 5.22: Linear mixed effects model (pairwise comparisons) for regression-path duration at modifier verb (log-transformed) in Experiment 5 (formula:  $\log(\text{regression-path duration}) \sim \text{Modifier} + \text{Modifier:Length} + (1 \mid \text{participant}) + (1 \mid \text{sentence})$ )

Fixed effects:	Estimate	Std. Error	df	t value	Pr(>  t )
(Intercept)	5.785	0.051	29.931	113.990	< 2e-16 ***
Modifier1	-0.182	0.047	459.507	-3.841	0.00014 ***
ModifierParticiple:Length1	-0.297	0.066	456.469	-4.517	8e-06 ***
ModifierRC:Length1	0.065	0.068	459.417	0.963	0.33607

Table 5.23: Generalized mixed effects model (pairwise comparisons) for regression likelihood at modifier verb in Experiment 5 (formula:  $\text{regression likelihood} \sim \text{Modifier} + \text{Modifier:Length} + (1 \mid \text{participant}) + (1 \mid \text{sentence})$ )

Fixed effects:	Estimate	Std. Error	df	t value	Pr(>  t )
(Intercept)	-1.897	0.221	-8.58	< 2e-16 ***	
Modifier1	-0.065	0.267	-0.25	0.81	
ModifierParticiple:Length1	-1.672	0.390	-4.29	1.8e-05 ***	
ModifierRC:Length1	0.130	0.370	0.35	0.72	

for short modifiers as compared to long ones, and an interaction of Modifier and Length.

An additional model with regression-path duration as the dependent variable and focusing on the interaction reveals that the difference between short and long modifiers is significant for participles, but not RCs, with shorter participles being read significantly slower than longer ones. The model is shown in Table 5.22.

The likelihood to regress to the left from the verbal element in the modifier is also significantly higher for short participles than for longer ones. Table 5.23 shows the results for a generalized mixed effects model with pairwise comparisons.

*Further analyses:* At the beginning of the participle phrase and the region after the relative pronoun for RCs, regression-path duration and total RTs were significantly lower in the long modifier condition compared to short modifiers. However, this main effect is not very informative, as the lexical items in this region differ between the short and long condition. There is also a main effect of Modifier: participles had significantly higher RTs than RCs. No other measures were significant. Tables 5.24 and 5.25 show the reading times at the first two words inside the mod-

Table 5.24: Results of different measures on the two words at the beginning of the modifier or following the relative pronoun (Experiment 5)

Modifier	Length	First	Gaze	Total	RegPath	RegOut	n
Participle	short	218	247	423	419	0.260	227
Participle	long	208	239	346	327	0.175	217
RC	short	213	246	347	350	0.244	209
RC	long	212	237	329	299	0.159	201

ifier and the results for the mixed models for regression-path duration and total reading times.

There were no significant effects for the reading times at the verb of the subordinate clause and for the region following the modified DP.

#### 5.5.4 Discussion

The results show that at the head noun, first fixation and gaze duration were higher if the noun followed a participle compared to nouns preceding an RC. There was no effect of modifier length and no interaction at those points. However, at the modifier verb, participle or RC verb, there is a significant interaction of the kind of modification and modifier length, with long participles showing significantly lower regression-path duration and total RTs and a lower likelihood for regressions than shorter ones and no such effect for RC verbs.

The main effect for early measures at the head noun could be explained by higher memory load if the noun follows a modifier compared to an (at this point) unmodified noun. This could be due to higher memory load while processing the modified noun phrase. However, as there is no difference between short and long participle phrases, memory load does not increase with more intervening material between determiner and noun. It rather seems to be due to processing a prenominal participle phrase in general. Also note that all participle phrases contained a transitive verb and an accusative object. As the acceptability judgment experiments (Experiment 1 and 2) have shown, this seems to be more problematic than participles without an (overt) object. The SPR experiment investigation online processing effects of the presence or absence of a direct object (Experiment 3) also revealed higher RTs at the participle if there was an accusative object in the modifier. Hence it is possible that the prenominal modifier in both the long and the short modifier

Table 5.25: Mixed effects models for different measures at the two words at the beginning of the modifier or following the relative pronoun (log-transformed) in Experiment 5

Measure	Estimate	Std. Error	df	t value	Pr(>  t )
Fixed effects:					
Total					
$\log(\text{total RT}) \sim \text{Modifier} * \text{Length} + (1 + \text{Modifier}   \text{participant}) + (1   \text{sentence})$					
(Intercept)	5.706	0.051	23.632	111.10	<2e-16 ***
Modifier1	-0.127	0.043	21.714	-2.92	0.0081 **
Length1	-0.078	0.036	800.981	0.0310 *	
Modifier1:Length1	0.129	0.072	805.614	1.78	0.0747 .
Regression-path					
$\log(\text{regression-path duration}) \sim \text{Modifier} * \text{Length} + (1   \text{participant}) + (1   \text{sentence})$					
(Intercept)	5.653	0.049	21.058	114.95	< 2e-16 ***
Modifier1	-0.095	0.037	821.627	-2.58	0.01 *
Length1	-0.154	0.037	817.329	-4.16	3.6e-05 ***
Modifier1:Length1	0.058	0.074	817.733	0.78	0.44

condition leads to particularly high processing load, which would not be the case for simple adjectives or even (extended) intransitive participle phrases. Although there is also a significant main effect for participles vs. RCs at the modifier verb, which goes in the same direction as the effect for nouns, this effect is difficult to interpret due to further differences between participles and RC verbs.

The results indicate an anti-locality effect at the participle, which means that additional material leads to a higher expectation or more precise prediction for the participle at the end of the modifier. Interestingly, this effect is reflected in late measures, like surprisal effects that are also connected to expectation in processing in Staub (2010). Furthermore, the anti-locality effect at the participle is in line with previous findings for verb-final sentences (Konieczny, 2000; Konieczny and Döring, 2003; Vasishth and Lewis, 2006; Nakatani and Gibson, 2008). There is, however, one puzzling aspect: being a verb-final clause as well, the same effect should have occurred at the RC. On the contrary, the results do not show a tendency for an anti-locality effect but rather the opposite, although only numerically. One possible explanation could be that there is additional memory load for RC verbs, due to the connection to the head noun or that the advantage of predictability in the longer condition is overridden by a wrap-up effect at the comma (see Hirotani et al., 2006).

A comparison with the SPR data in Experiment 4 shows that in principle the same effects are replicated. In both experiments, there was a main effect of modifier at the noun and the results indicated an anti-locality effect for the participle phrases but not for the head noun. However, this anti-locality effect for the participle phrase occurs at different regions: whereas longer participle phrases lead to faster RTs at the modifier noun in the SPR experiment, already the participle is read more quickly in the eye-tracking experiment and there is no difference at the noun. This raises the question at which point the actual effect occurs. On the one hand, the results of SPR experiment could be due to spillover if the actual effect is at the participle. On the other hand, it is also possible that parafoveal preview in the eye-tracking experiment enabled the participants to anticipate the noun already one word earlier at the participle. Note, that nouns begin with an upper case letter in German which makes it even easier to recognize. At this point, it is not possible to determine which of these possibilities is true. Theoretically, more material inside the modifier leads to a higher predictability of both, participle and noun. As the corpus data and previous literature on participle phrases (Chapter 4) have shown, extended prenominal attributes tend to be short. Hence, more material increases

the likelihood for the next word to be the right edge of the modifier, i.e. the participle. However, after the participle the noun also becomes highly predictable and it is also likely that the reader is expecting the right edge of the DP even more when the modifier is longer. Without further experiments, it will not be possible to conclusively determine the location of the effect.

As in Experiment 4, the first two words of the modifier are read more slowly when they are inside a participle phrase compared to their occurrence inside the RC, i.e. after the relative pronoun. This is reflected in regression-path duration and total reading times and it can be explained by higher surprisal costs. After a determiner, a DP or PP is more unexpected than after an relative pronoun.

## 5.6 Summary

The experiments in this chapter investigated two different factors on the processing of participle phrases and RCs: the length of the modifier and its internal structure. The first two experiments tested both factors simultaneously in an acceptability judgment questionnaire. Experiment 3 tested the effect of an accusative object compared to an adjunct in online processing using SPR. Experiment 4 tested the modifier length with SPR, followed by Experiment 5, an eye-tracking experiment.

The length of the modifier did not have the effect on the comprehension of participle phrases that was expected based on previous literature (e.g. Fabricius-Hansen, 2016), production data and memory-based processing theories (Gibson, 1998, 2000): longer modifiers did not cause more processing difficulties. For the acceptability judgment experiments, longer participle phrases had a tendency to be rated worse than shorter ones, which was not the case for RCs, but there was no significant effect that could be attributed to modifier length, only to the presence or absence of an accusative object. The online experiments (Experiment 4 and 5) show results that are the opposite of the predictions of memory based accounts: RTs were lower at the end of a prenominal modifier, when it contained additional PPs. This indicates an anti-locality effect due to anticipation of the end of the DP, as explained by prediction-based theories (Hale, 2001; Levy, 2008a). Interestingly, the effect occurred at the participle in Experiment 4 and at the head noun in Experiment 5, which is both in line with a prediction-based effect. For RCs, however, there was no anti-locality effect – or it had been overridden by an additional memory or wrap-up effect. The anti-locality effect in Experiment 5 is reflected in late eye-tracking

measures, which is in line with findings from previous research (Staub, 2010) that found expectation-based effects in late measures.

There was a significant effect of the presence of an accusative object as opposed to an adjunct in both acceptability judgment experiments and the corresponding SPR-experiment (Experiment 3). In the acceptability judgment experiments, participle phrases received lower ratings when they contained an accusative object. In the SPR experiment, the RTs at the participle were higher when it followed an accusative object compared to an adjunct. The effect occurred only for prenominal attributes with present participles and not for corresponding RCs. Hence, it can be concluded that it is caused by a property of the prenominal attribute. This finding has not been discussed in the previous literature. I assume that the reason is the mixed properties of the participle, which serves as an adjective and a verb. A more complex modifier internal structure could cause higher processing load at the participle, as its adjectival properties with respect to the whole DP need to be processed additionally. More precisely, I assume that verbal features are only processed if necessary, contrary to RC verbs, where the argument structure is always present. Therefore, the participle is processed faster the more it resembles a prototypical adjective, which does not have a direct object. Another explanation would be that there is a change from an atelic to a telic event caused by the presence of the accusative objects for some of the verbs. This has been suggested for verbs with optional arguments (Dowty, 1991; Mittwoch, 1982; Olsen and Resnik, 1997; Rappaport Hovav and Levin, 1998). If so, the telic interpretation needs to be matched with the imperfective aspect of the present participle, which could cause a coercion effect and therefore increase the RTs and decrease the acceptability.

The comparison of prenominal present participles and RCs also yielded further results that are in line with current processing theories (see Chapter 3): in the online experiments, the reading times at the nouns were higher when they followed an extended prenominal modifier as compared to the RC condition, where the noun appeared directly after the determiner. This is in line with an assumption of higher memory costs due to the processing of the modifier, which disrupts the DP. However, the decrease of RTs with an increase of the modifier length is not in line with these accounts. Surprisal theory (e.g. Levy, 2008a) predicts higher RTs at the beginning of an extended prenominal modifier and not for an RC because PPs or DPs are less expected to occur after a determiner. This was observed only for Experiments 4 and 5.



## Chapter 6

# Double center embedding

The fact that multiple layers of center embedding lead to an increase of sentence complexity was already stated and discussed decades ago (Chomsky, 1957, 1965; Yngve, 1960; Chomsky and Miller, 1963; Miller and Chomsky, 1963; Miller and Isard, 1964). As shown in Chapter 3, a sentence like (1-a) leads to processing difficulties, whereas (1-b) is relatively easy to understand.

- (1) a. This is the malt that the rat that the cat that the dog worried killed ate.  
b. This is the malt that was eaten by the rat that was killed by the cat that was worried by the dog.

(Miller and Chomsky, 1963)

The reason for this difference is that the object RCs in (1-a) are center embedded. This is illustrated in Figure 6.1: another RC ( $CP_3$ ) intervenes between the subject of  $CP_2$ , *rat*, and its verb, *ate*. The same holds for  $CP_3$ , which is in turn interrupted by  $CP_4$ , intervening between the subject (*cat*) and the verb (*killed*). The result is that partially parsed CPs need to be kept in memory, while parsing the other center embedded CP, which leads to high memory load and makes the sentence almost impossible to comprehend.

In contrast, the previous RCs in (1-b) are always completed before the next one begins, as shown in Figure 6.2, resulting in a right-branching structure. Therefore, it is much easier to comprehend than the multiple center embedded RC, even

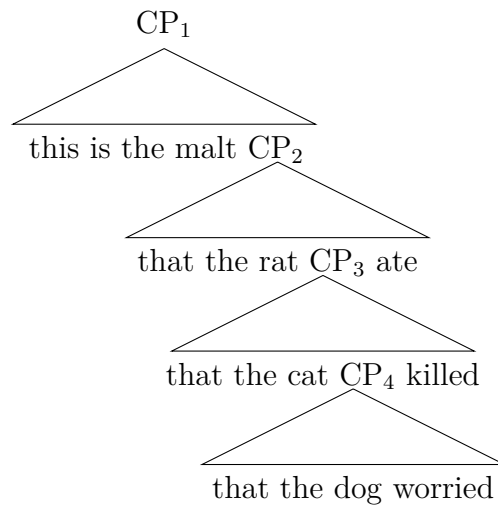


Figure 6.1: Example of a center embedded-structure

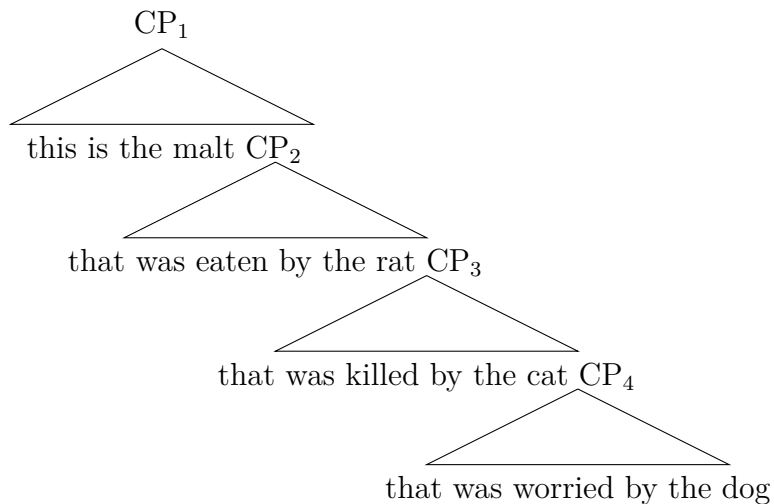


Figure 6.2: Example of a right-branching structure

though it expresses the same content.

Further evidence for difficulties with multiple center embedding comes from the so-called *VP-illusion* (Frazier, 1985; Gibson and Thomas, 1999; Christiansen and MacDonald, 2009; Vasishth et al., 2010; Bader, 2016). Several studies have shown that an ungrammatical sentence like (2-a) is often perceived as being as good as the actually grammatical sentence in (2-b). This effect suggests that multiple layers of center embedding lead to high memory load and that readers forget a part of the structure that they built incrementally when they arrive at the corresponding

VP. For SOV languages like German, however, the effect seems to occur only under certain conditions (Vasishth et al. 2010; Häussler and Bader 2015; Bader 2016, see Chapter 3 for a more detailed review of the illusion).

- (2) a. \*The patient who the nurse who the clinic had hired met Jack.  
 b. The patient who the nurse who the clinic had hired admitted met Jack.

(cf. Gibson and Thomas, 1999, p. 226–227)

Several accounts aim to capture the difficulties found in (multiple) center embedding, like higher depth (Yngve 1960, cf. Chapter 3) or higher processing load due to incomplete dependencies. The latter, in the form of DLT assumptions (e.g. Gibson, 2000) will be discussed further in this chapter.

Table 6.1 shows processing costs for a DP that is modified by a double embedded RC according to the DLT metric.<sup>1</sup> As described in more detail in Chapter 3, there are two kinds of costs: *storage costs* and *integration costs*. Note that in the course of this chapter, I am comparing complexity by using the maximal storage and integration costs, following previous literature (e.g. Gibson, 2000; Bader, 2018). Hence, only the highest peak is considered, instead of e.g. the mean.

*Storage costs* rise with the number of predicted heads. In Table 6.1, the number of predicted heads is highest after the relative pronoun of the most deeply embedded RC (*im* ‘in-the’), because at this point two VPs and a noun are predicted. A single embedded RC with the same number of words as in Table 6.2 has only maximally two predicted heads, a VP and a noun, because at each point in the DP, only one VP is needed to complete it in a grammatical way. Hence, the *storage costs* would suggest that a double (center) embedded RC is more costly than a single embedded RC of the same length.

The *integration costs* depend on the number of new discourse referents that intervene between two dependent elements. In Table 6.1 and 6.2, the most relevant dependency for the comparison holds between the RC verb and its subject, as these two dependents are the most distant ones. In the double embedded DP, the *integration costs* are higher at this point, because three new discourse referents are crossed: the individuals *Enkelin* ‘granddaughter’ and *Garten* ‘garden’ and the event *spielen* ‘play’. In the single embedded condition, there is no second RC verb,

<sup>1</sup> In this table and the following ones, only the DP is considered. Ending the sentence in a grammatical way, e.g. with an intransitive verb, leads to additional costs, which are not part of the comparison discussed here.

Table 6.1: Storage and Integration Costs for double embedded RCs according to DLT

	der the	Opa, grandpa	der who	die the	Enkelin granddaughter	die who	im in-the	Garten garden	spielt plays	umarmt hugs
Storage costs	N	-	V	VN	V	VV	VVN	VV	V	-
MU	1	0	1	2	1	2	3	2	1	0
New DR	0	1	0	0	1	0	0	1	1	1
SIC	0	0	0	0	0	0	0	0	1	1
Total costs	0	1	0	0	1	0	0	1	2	4

Table 6.2: Storage and Integration Costs for single embedded RCs according to DLT

	der the	Opa, grandpa	der who	die the	Enkelin granddaughter	draußen outside	im in-the	Garten garden	umarmt hugs
Storage costs	N	-	V	VN	V	V	VN	V	-
MU	1	0	1	2	1	1	2	1	0
New DR	0	1	0	0	1	0	0	1	1
SIC	0	0	0	0	0	0	0	0	2
Total costs	0	1	0	0	1	0	0	1	3

hence only two nouns are intervening. However, the integration costs are not tied to the level of embedding in general, they only depend on the number of intervening discourse referents. Hence, it would be possible to create a sentence pair in which the maximal integration costs are equal, e.g. by adding more adjuncts in the single embedded sentence.

Table 6.3 shows one way to apply the DLT to double embedded participle phrases and Table 6.4 shows a corresponding DP with only one participle phrase. In this case, the adjective is treated like a verb in terms of its argument structure. This also means that it is an additional predicted head. Note that this is only one way of looking at the construction: the fact that it actually behaves like an adjectival phrase raises the question whether it can be treated the same way as a finite RC.

For double embedded participle phrases (Table 6.3), the maximum of predicted upcoming heads occurs at the beginning of the most deeply embedded participle phrase, when the parser realizes that the embedded DP is also a complex noun phrase. At this point, two adjectives are predicted, in order to complete the adjectival or participle phrases. Additionally, the corresponding nouns need to be stored in memory as well. If there is only one participle phrase, as in Table 6.4, there is only one adjective-noun pair predicted throughout the phrase, leading to lower *storage costs*. The difference to RCs lies in the additional embedding of the participle phrase inside the DP: to complete the construction, only a verb is necessary for the RC, whereas for a participle phrase, a participle and a noun are predicted. This has two consequences: first, the overall *storage costs* are higher for participle phrases than for RCs and second, the difference between single and double embedded modifiers should be greater for participle phrases than for RCs.

The difference in the maximal *integration costs* for single and double embedded participle phrases occurs because in the double embedded DP, two nouns and the participle, hence three new discourse referents, intervene between the modified noun and the determiner, whereas only two nouns intervene for the single embedded DP. Again, participle phrases have higher maximal costs than RCs, due to the fact that the modifier itself is center-embedded in the DP. The underlying assumption for the *integration costs* of participle phrases is again that participles and finite verbs show the same processing effects. More precisely, the hybrid nature of participles, with properties of adjectives and verbs (see Chapter 2, Rapp 1997; Lübke and Rapp 2011), leaves open whether they should be treated as discourse referents or whether

Table 6.3: Storage and Integration Costs for double embedded present participle phrases according to DLT

		der	die	im	Garten	Enkelin	umarmende	Opa
		the	the	in-the	garden	granddaughter	hugging	grandpa
Storage costs	MU	1	3	5	4	3	2	1
Integration costs	New DR	0	0	0	1	1	1	1
	SIC	0	0	0	0	0	2	0
	Total costs	0	0	0	1	1	3	1

Table 6.4: Storage and Integration Costs for single embedded present participle phrases according to DLT

		der	die	Enkelin	draußen	im	Garten	umarmende	Opa
		the	the	granddaughter	outside	in-the	garden	hugging	grandpa
Storage costs	MU	1	3	2	2	3	2	1	0
Integration costs	New DR	0	0	1	0	0	1	1	1
	SIC	0	0	0	0	0	0	1	3
	Total costs	0	0	1	0	0	1	2	4

Table 6.5: Highest storage and integration costs

	<i>storage costs</i>		<i>integration costs</i>	
	participle	RC	participle	RC
double	5	3	5	4
single	3	2	4	3

they are only modifying the head noun, introducing only one new discourse referent with the whole DP. For now, I will consider them as denoting discourse events that contribute to (structural) integration costs, like RC verbs.

A comparison of the DLT processing costs for double and single embedded participles and RCs (Table 6.5) suggests the following pattern: participles should in general be more problematic than the corresponding RCs due to the center embedding of the modifier inside the DP. Double embedding leads to higher *storage costs* for RCs and participles, because an additional embedded modifier comes with another predicted head, which is not the case for single embedded modifiers. However, the difference in *storage costs* caused by double embedding should be greater for participles, assuming that participle and head noun are both predicted heads. Hence, additional levels of embedding should have a larger effect on the complexity of participle phrases, compared to RCs.

As for *integration costs*, participles and RCs should both deteriorate in the same way with an additional level of embedding. It is unclear, however, how both kinds of costs interact. Bader (2018) investigates how storage and integration costs interact if they are in conflict. He found that the effect of *storage costs* can outweigh an effect of *integration costs*, although the latter have an independent effect as well. For the examples and material in this chapter, both costs predict an effect in the same direction. The difference is that *integration costs* predict an additive effect, i.e. that the ratings for RCs and participle deteriorate to the same extent with double embedding, whereas *storage costs* predict an interaction, i.e. that double embedding leads to even lower ratings for participles. Hence, I would assume that both costs add up and that *integration costs* could completely mask a potential effect.

In the course of this chapter, an effect of double embedding on participle phrases and RCs and the DLT predictions will be tested experimentally. As the hypotheses are based on the assumption that the internal structure of participle phrases resembles that of a RC, with the verbal element as a predicted head, the results can shed light on the question whether both constructions are structurally similar or not.

## 6.1 Experiment 6 – acceptability judgment experiment: double center embedding

Experiment 6 compares how a second level of embedding affects participles and corresponding RCs. The underlying idea is that complexity or processing difficulty is reflected in the acceptability of the sentence, hence acceptability judgments as the chosen method. The experiment compares single and double embedded prenominal modifiers and the corresponding RCs.

Based on the DLT metric (cf. Table 6.5) and assuming that processing costs are reflected in the acceptability of sentences, the following predictions can be formulated: RCs should receive higher acceptability ratings overall than participle phrases and double embedding should be rated worse than single embedding. If the storage costs affect the ratings strongly enough, the difference in the acceptability between single and double embedding should be higher for participles than for RCs. Furthermore, the costs suggest that single embedded participles and double embedded RCs should receive similar ratings.

### 6.1.1 Method

#### 6.1.1.1 Material

For the experiment, 20 experimental items were created that include DPs such as in Tables 6.1, 6.2, 6.3 and 6.4. The experiment has a  $2 \times 2$  design, with the factors Embedding (double or single) and Modification (participle or RC). (3) shows an example of the material (see Appendix E for the complete set of experimental items).

- (3) a. participle, single embedded

*Martin hat den die vierjährige Enkelin draußen im  
Martin has the the four-year-old granddaughter outside in.the  
Garten umarmenden Opa heute Morgen kennengelernt.  
garden hugging grandpa this morning met*

- b. participle, double embedded

*Martin hat den die im Garten spielende Enkelin  
Martin has the the in.the garden playing granddaughter  
umarmenden Opa heute Morgen kennengelernt.  
hugging grandpa this morning met*

- c. RC, single embedded



*Martin hat den Opa, der die vierjährige Enkelin  
 drauen im Garten umarmt, heute Morgen kennengelernt.*  
 Martin has the grandpa who the four-year-old granddaughter  
 outside in.the garden hugs this morning met

- d. RC, double embedded

*Martin hat den Opa, der die Enkelin, die im Garten  
 spielt, umarmt, heute Morgen kennengelernt.*  
 Martin has the grandpa who the granddaughter who in.the garden  
 plays hugs this morning met

‘Martin has met the grandpa (who is) hugging the (four-year-old) grand-  
 daughter (who is) playing in the garden / outside in the garden.’

The accusative object of the matrix clause is modified by either a participle or RC. As in the examples in the introduction, all modifiers contain an accusative object (*die Enkelin* ‘the granddaughter’), which is in turn modified in the double embedded condition. The deepest level of embedding only contains an intransitive verb or participle. An accusative object is avoided at this point for the following reason: as the experiments in Chapter 5 have shown, the insertion of an accusative object in a participle phrase leads to a deterioration of acceptability judgments, which is not the case for RCs. Hence, if there is a second participle phrase that also contains an accusative object, the ratings might be lower than for the corresponding RCs, simply because the construction is not as acceptable in this combination, not because of the higher level of embedding. In order to still have an extended participle phrase, the second modifier contains an adjunct (*im Garten* ‘in the garden’).

The single and double embedded conditions match with respect to the number of words. In order to ensure this, an additional adverb (*drauen* ‘outside’) was inserted and the accusative object inside the participle or RC is modified by an adjective, which is not extended (*vierjhrige* ‘four-year-old’). As in the double embedded condition, an additional PP adjunct (*im Garten* ‘in the garden’) is added. If possible, this was kept identical in both conditions. However, in some cases a different PP with approximately the same length needed to be inserted in order ensure plausibility.

## 6.1. Experiment 6 – acceptability judgment experiment: double center embedding

The modified DP was masculine in 13 of the sentences and feminine in seven.<sup>2</sup> The accusative DP inside the modifier always had a different gender than the head noun.

The material was mixed with 80 filler sentences, part of which belonged to other experiments. The material was divided into four lists using the Latin Square method, so that each participant only saw one condition for each item.

### 6.1.1.2 Participants

48 native speakers of German participated in the experiment. As in most of the previous experiments described in Chapter 5, they were recruited with the web-based platform Prolific. They received £2 for their participation. I used the pre-screening options of Prolific to ensure that the participants did not take part in any of the previous experiments of this dissertation.

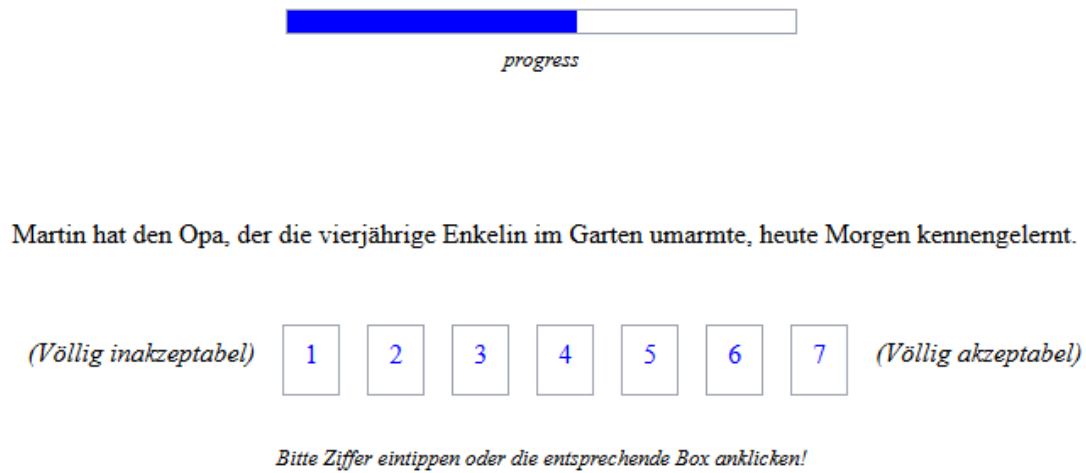
### 6.1.1.3 Procedure


The experiment was created in Ibex Farm (<http://spellout.net/ibexfarm/>). The participants were presented with the sentences as whole and were asked to rate them on a scale from 1–7 by clicking on a number or by pressing the respective key. Figure 6.3 shows an example of the stimuli as they were presented in the experiment.

1 was described as totally unacceptable and 7 as totally acceptable. They were instructed to judge the sentences based on their own intuitions and not on prescriptive rules. They could give their rating either by clicking on a respective field with a mouse or on a touch screen or inserting the number with the respective bar on their keyboard. After rating the item, the following sentence was displayed for a few seconds: *Bitte warten Sie auf den nächsten Satz.* ‘Please wait for the next sentence’. The experiment started after two practice items and took approximately 15–20 minutes. The progress was shown with a bar above the displayed sentences. As it was a web-based experiment, participants used their own devices, which could be a desktop computer, notebook, tablet or smartphone.

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<sup>2</sup>In the previous experiments in Chapter 5, the gender of the head noun did not affect the ratings. Similarly, in this experiment, the results for sentences with masculine and feminine head nouns did not differ much (overall: 4.45 for masculine, 4.39 for feminine head noun, no interactions with other factors).



  
*progress*

Martin hat den Opa, der die vierjährige Enkelin im Garten umarmte, heute Morgen kennengelernt.

*(Völlig inakzeptabel)*







*(Völlig akzeptabel)*

*Bitte Ziffer eintippen oder die entsprechende Box anklicken!*

Figure 6.3: Experimental item as it was presented during Experiment 6

### 6.1.2 Analysis

The data was analyzed in R (R Core Team, 2017) and using a *cumulative link mixed model* (from the *ordinal* package; Christensen 2019). Sum contrasts (-0.5,0.5) were coded, with double vs. single for the factor Embedding and with participle vs. RC for Modification. If interactions occurred, they were further investigated with pairwise comparisons using tukey tests (part of the “lsmeans” package, Lenth 2016).

### 6.1.3 Results

Figure 6.4 shows the mean acceptability ratings in Experiment 6; the mean ratings can also be found in Table 6.6. The cumulative link mixed model (Table 6.7) reveals a significant main effect of Modification, with overall lower ratings for participles than for RCs (3.49 vs. 5.37). There is also a significant main effect of Embedding, with lower ratings for sentences containing double embedding than for single embedding (3.96 vs. 4.89). The interaction of these two factors is also significant. A closer look at this interaction, using pairwise comparisons (Table 6.8), reveals that there is a significant difference for all comparisons, except for the difference between double and single embedded participles.

## 6.1. Experiment 6 – acceptability judgment experiment: double center embedding

Table 6.7: Cumulative Link Mixed Model (fitted with the Laplace approximation) for Experiment 6

formula:  $\text{response} \sim \text{Modification} * \text{Embedding} + (1 + \text{Modification} * \text{Embedding} | \text{subject}) + (1 + \text{Modification} * \text{Embedding} | \text{sentence})$

Coefficients				
	Estimate	Std. Error	z value	Pr(>  z )
Modification	1.662	0.179	9.28	< 2e-16 ***
Embedding	0.911	0.113	8.10	5.6e-16 ***
Modification:Embedding	0.783	0.102	7.71	1.3e-14 ***

Table 6.8: Pairwise comparisons (Tukey method) for Exp.6

contrast	estimate	SE	z.ratio	p.value
Participle,double - RC,double	-1.76	0.345	-5.090	<.0001
Participle,double - Participle,single	-0.26	0.222	-1.150	0.6570
Participle,double - RC,single	-5.15	0.477	-10.780	<.0001
RC,double - Participle,single	1.50	0.361	4.160	<.0001
RC,double - RC,single	-3.39	0.367	-9.240	<.0001
Participle,single - RC,single	-4.89	0.469	-10.430	<.0001

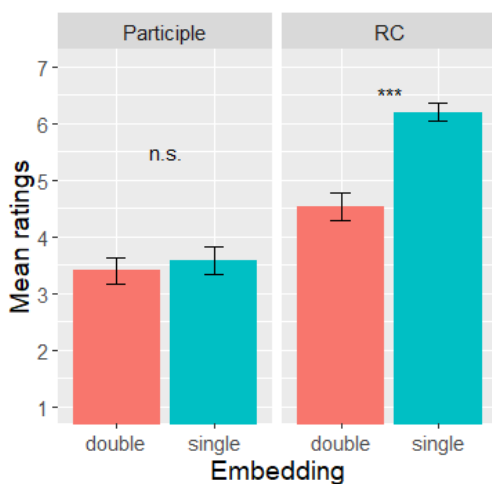


Figure 6.4: Mean acceptability ratings in Experiment 6

Table 6.6: Mean ratings in Experiment 6 (standard deviation in parentheses)

embedding	participle	RC
double	3.40 (1.89)	4.53 (1.94)
single	3.59 (1.90)	6.20 (1.25)

### 6.1.4 Discussion

According to the DLT, participle phrases should receive lower ratings overall than RCs and an additional level of embedding should have an effect on both, but a

larger one on participles (as shown in Tables 6.1–6.4 and 6.5). Only part of these hypotheses are borne out: there is a significant difference between single and double embedding for RCs. Furthermore, the ratings for RCs are overall higher than for participles, which is also in line with the maximal storage and integration costs. However, both kind of processing costs would predict a difference for participles as well, which should be even higher than for RCs if the storage costs are considered. The results do not support this prediction: I failed to find evidence for a difference between single and double embedded participles. Furthermore, the single embedded participles also received significantly lower ratings than the double embedded RCs, which should be similar in terms of processing difficulty. Hence, the results for participle phrases are unexpected. One possible conclusion is that the difference between single and multiple embedding does not occur for participle phrases, possibly because their structure is fundamentally different than that of RCs, e.g. due to the lack of finiteness. Hence, it could be concluded that only length matters for participle phrases and that long participle phrases are not very acceptable in general.

However, there is a problem with this conclusion: in Experiment 1 (Chapter 5), the acceptability of participle phrases and RCs depending on different elements inside the modifier was compared, which also included a manipulation of modifier length. In one condition, the modifier contained a direct object and an adjunct, like in the single embedded condition of the present experiment. (4) shows an example from the conditions with long participle phrases from both experiments.

- (4) a. ‘long modifier’-condition in Experiment 1 (mean score: 5.23)

*Lisa hatte **die bei der Hochzeit einen Walzer tanzende***  
 Lisa had the at the wedding a waltz dancing  
***Cousine** irgendwie kaum beachtet.*  
 cousin somehow little noticed

- b. single embedded condition in Experiment 6 (mean score: 3.59)

*Martin hat **den die vierjährige Enkelin** **draußen im***  
 Martin has the the four-year-old granddaughter outside in.the  
***Garten umarmenden Opa** heute Morgen kennengelernt.*  
 garden hugging grandpa this morning met.

A general strong effect of modifier length as suggested by the results of the present experiment would also suggest relatively low ratings for the respective condition in

Experiment 1. However, sentences like (4-a) had a mean rating of 5.23, whereas sentences like (4-b) only received a score of 3.59. As those ratings are from different experiments, it must be taken into consideration that aspects other than differences in the materials might have affected the ratings, such as filler sentences or differences between subjects. However, if the corresponding RCs are compared, the ratings in both experiments are quite similar (6.20 in Experiment 6 and 6.28 in Experiment 1).

This difference suggests that other, unknown factors might have led to low ratings in the single embedded condition of Experiment 6. (4-b) differs from (4-a) in four crucial ways: the accusative object is animate, modified by an adjective, definite and in a different position, namely at the left edge of the participle phrase. I chose animate DPs for practical reasons, because in order to add another level of embedding, the accusative object of the first participle phrase needs to be the subject of the embedded sentence. As the prototypical subject is animate, it is easier to find plausible verbs for the embedded sentence. The adjective was inserted in order to have approximately the same length as in the embedded condition.

Any of these factors might have contributed to the relatively low ratings of the single embedded participle phrases. One possibility is that the head noun and the modifier-internal noun are very similar in definiteness and animacy. Assuming similarity-based interference, this could have led to lower ratings. If so, there is still the question as to why double and single embedding did not affect the ratings. One explanation might be that there is some kind of “floor effect”. Although the ratings are still considerably above the bottom line and therefore it cannot be a real floor effect, it could be that there is a lowest boundary for sentences that are clearly grammatical but still complex. Part of the filler sentences are ungrammatical, therefore it is unlikely that grammatical sentences receive the lowest ratings.

## 6.2 Experiment 7

Experiment 7 again investigates the effect of double embedding, but with the single embedded condition (5-b) resembling the material of Experiment 1: the accusative object is inanimate, indefinite and its position is directly before the participle. The only difference to Experiment 1 is that the PP is modified by an adjective in order to have the same number of words. If the low ratings in the single embedded condition are due to any of these properties of the sentences in Experiment 6, the ratings for the single embedded participle phrases should be higher in Experiment 7. The

question is then, whether there is a difference between single and double embedded participles and if so, whether it is greater than for the RC conditions.

Under the assumption that the results in Experiment 6 were influenced by a confound, the predictions that were formulated based on the DLT (cf. Table 6.5) still hold: RCs should receive higher ratings than participles and double embedded modifiers should be rated worse than single embedding. This is predicted for RCs as well as for participles. Furthermore, the gap between single and double embedding should be higher for participles than for RCs, since two predicted categories, noun and participle, need to be stored in memory for each level of embedding, compared to only a verb for the RC. The processing costs also suggest that single embedded participles and double embedded RCs should be on the same level of complexity, hence receive similar acceptability ratings.

It is also possible that the results of Experiment 6 are replicated in this experiment and that there is no difference between single and double embedding for participles. In this case, either the structure of both modifiers must be more different than previously assumed or other processing theories could be more suitable to explain the results.

## 6.2.1 Method

### 6.2.1.1 Material

The factors are the same as in Experiment 6: Modification (participle or RC) and Embedding (single or double), leading to a 2×2 design with four conditions. (5) shows an example of the material (all experimental items are listed in Appendix F).

- (5) a. participle, double embedded

*Ingrid will die einen nach Zimt duftenden Apfelkuchen*  
 Ingrid wants the a like cinnamon smelling apple pie  
*backende Nachbarin später noch besuchen.*  
 baking neighbor later still visit

- b. participle, single embedded

*Ingrid will die am frühen Morgen einen Apfelkuchen*  
 Ingrid wants the in.the early morning an apple pie  
*backende Nachbarin später noch besuchen.*  
 baking neighbor later still visit

- c. RC, double embedded

*Ingrid will die Nachbarin, die einen Apfelkuchen, der nach  
Ingrid wants the neighbor who an apple pie that like  
Zimt duftet, backt, später noch besuchen.  
cinnamon smells bakes later still visit*

- d. RC, single embedded

*Ingrid will die Nachbarin, die am frühen Morgen einen  
Ingrid wants the neighbor who in.the early morning an  
Apfelkuchen backt, später noch besuchen.  
apple pie bakes later still visit*

‘Ingrid later still wants to visit the neighbor (who is) baking an apple pie that smells/smelling like cinnamon/early in the morning.’

As mentioned above, the accusative object inside the modifier is always inanimate and indefinite (e.g. *ein Apfelkuchen* ‘an apple pie’). In order to arrive at the same number of words for single and double embedded modifiers, an adjective was added to the adjunct PP. As in Experiment 6, this PP was not always identical for the single and double embedded condition.

20 lexically different experimental items were created. They were combined with 80 filler sentences.<sup>3</sup> The material was again divided into four lists using the Latin Square method.

### 6.2.1.2 Participants

48 participants were recruited with Prolific. None of them took part in any of the previous experiments. One of them reported to be not a native speaker of German. Hence, 47 participants were considered for the analysis. Like in experiment 6, the participants were paid £2 for completing the questionnaire.

### 6.2.1.3 Procedure

The procedure was the same as for Experiment 6.

## 6.2.2 Analysis

The data analysis was the same as in Experiment 6.

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<sup>3</sup>The filler sentences were mostly the same ones as in Experiment 6. 20 of them differed slightly because there was a follow-up to one of the other experiments in the questionnaire of Experiment 6.



### 6.2.3 Results

Figure 6.5 and Table 6.9 show the mean ratings by condition in Experiment 7. In contrast to Experiment 6, there is a difference between single and double embedding for participles and for RCs. The cumulative link mixed model (Table 6.10) and pairwise comparisons (Table 6.11) support this: there is a main effect of Modification, with higher ratings for RCs than for participles (4.11 vs. 5.45) and a main effect of Embedding with higher ratings for single than for double embedded modifiers (4.19 vs. 5.37). There is also a significant interaction for Modification and Embedding. In contrast to Experiment 6, the difference in ratings between single vs. double embedded participles is significant. However, the significant interaction of Modification and Embedding shows that the difference for double vs. single embedding is stronger for RCs than for participle phrases. All other pairwise comparisons are significant, except the difference between single embedded participles and double embedded RCs.

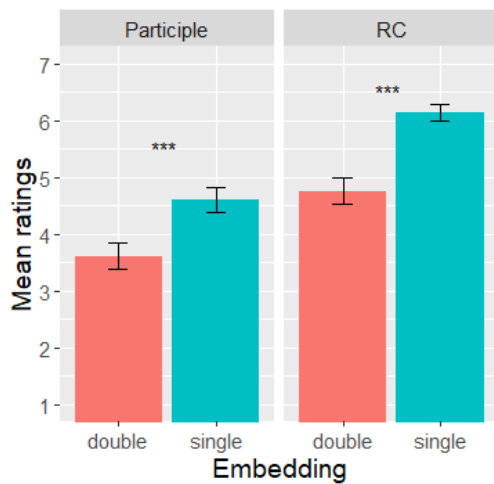


Table 6.9: Mean ratings in Experiment 7 (standard deviation in parentheses)

embedding	participle	RC
double	3.61 (1.80)	4.76 (1.82)
single	4.61 (1.73)	6.14 (1.15)

Figure 6.5: Mean acceptability ratings in Experiment 7

### 6.2.4 Discussion

Although the results in Experiment 7 are closer to the predictions of the DLT than those in the previous experiment, the pattern for participle phrases is still not as predicted.

As in Experiment 6 and in line with the DLT processing costs, the ratings for RCs were lower with a second level of embedding. Furthermore, RCs received overall

## 6.2. Experiment 7

Table 6.10: Cumulative Link Mixed Model (fitted with the Laplace approximation) for Experiment 7

formula: response  $\sim$  Modification \* Embedding + (1 + Modification + Embedding | subject) + (1 + Modification | sentence)

Coefficients				
	Estimate	Std. Error	z value	Pr(>  z )
modification	1.224	0.172	7.10	1.2e-12 ***
embedding	0.997	0.119	8.37	< 2e-16 ***
modification:embedding	0.305	0.102	3.01	0.0026 **

Table 6.11: Pairwise comparisons (Tukey method) for Experiment 7

contrast	estimate	SE	z.ratio	p.value
Participle,double - RC,double	-1.84	0.377	-4.880	<.0001
Participle,double - Participle,single	-1.38	0.245	-5.640	<.0001
Participle,double - RC,single	-4.44	0.462	-9.610	<.0001
RC,double - Participle,single	0.46	0.371	1.230	0.6080
RC,double - RC,single	-2.60	0.368	-7.070	<.0001
Participle,single - RC,single	-3.06	0.422	-7.240	<.0001

higher ratings than participle phrases, which is also predicted due to the prenominal position of the participle and the additional level of center embedding.

The change in the materials had an effect on the ratings for the single embedded participle condition: they were rated higher in this experiment (mean: 4.61) compared to Experiment 6 (mean: 3.59). Interestingly, double embedded RCs and single embedded participles received similar ratings, which is in line with their complexity according to maximal storage and integration costs. Although single embedded participle phrases obtained higher ratings in this experiment, this was not the case for double embedding. Therefore, an effect of embedding was found for participle phrases as well.

The major difference to the DLT predictions is reflected in the interaction of Modification and Embedding: in the experiment, adding a second level of embedding had a stronger effect on RCs than on participles. The storage costs, however, would seem to predict the opposite: assuming that a head noun and the participle need to be predicted and therefore stored in memory at the second level of embedding, the difference in complexity should be higher for participles. For RCs, the parser

is only waiting for one more element, namely the verb of the second RC. There are several possibilities why this prediction is not borne out:

(i) The DLT might not be enough to explain the data for present participles. It is possible that expectation-based effects override memory-based effects: for participles, it is obvious at the beginning of the modifier that a noun needs to appear at some point. Therefore, the noun is highly expected, leading to an anti-locality effect at the end of the participle phrase in online processing (Levy, 2008a; Hale, 2001; Konieczny, 2000). However, it is unclear whether this is reflected in offline acceptability judgments. Furthermore, the participle agrees with the head noun in gender and number. According to theories like ACT-R (Lewis and Vasishth, 2005) that assume cue-based retrieval, these features could function as retrieval cues and facilitate retrieval of the head noun. Therefore, the additional embedding in the DP would be less problematic for processing, at least as far as integration costs are concerned.

(ii) A further explanation for the obtained results is that participle phrases might be processed in a more shallow way (see e.g. Ferreira et al., 2002; Karimi and Ferreira, 2016). If the participants did not end up with the complete and correct representation of the prenominal modifier, they might not have noticed the double embedding and the higher complexity. There are reasons to assume that the participants end up with a less accurate representation for prenominal attributes than for RCs: contrary to RCs, prenominal modifiers can also contain information that is already part of the reader’s knowledge, whereas information in a non-restrictive RC should not be trivial (Fabricius-Hansen, 2016) and referents introduced inside a prenominal modifier are not accessible for the further discourse. As this would also be in line with part of the results in Chapter 5, I will come back to this issue in the general discussion of the thesis (Chapter 7).

(iii) Lastly, it cannot be excluded that other differences between the single and double embedded participles beside the additional level of embedding contributed to the difference between these two conditions. The sequence of two articles (*den die* ‘the the’ or *den eine* ‘the a’) could have played a role. If this combination is in general dispreferred, this could have affected the ratings. In Experiment 6, two articles were adjacent in the single and double embedded participle conditions and both received equally low acceptability ratings. However, as a consequence

of changing the materials to be more like the sentences in Experiment 1, only the double embedded participles have two adjacent articles in Experiment 7. Therefore, it is possible that the difference between double and single embedded participles is of a different nature than for RCs. To exclude this possibility, future experiments that replicate the effect without two adjacent articles in both conditions are needed. As potential problems with two adjacent articles partly affect other experiments as well, the likelihood of this confound and potential reasons for it will be discussed further in Chapter 7.

## 6.3 Summary

In this Chapter, an effect of multiple embedding on participle phrases was explored and compared to corresponding RCs. Precise predictions were formulated using a memory-based processing account, the DLT (Gibson, 1998, 2000).

Two experiments were conducted. While both confirmed the predicted effect of additional embedding for RCs, the results for participle phrases are mixed: Experiment 6 suggests that there is no difference at all. Assuming that other factors might have contributed to low ratings for single embedded participles, I conducted a follow-up experiment. In Experiment 7, there was a difference for participle phrases. However, the effect of embedding on the ratings was weaker for participles than for RCs, contrary to the predictions by the DLT.

Experiment 7 suggests that higher complexity caused by an additional level of center embedding can also be assumed for participle phrases and therefore, complex nominal phrases are affected in the same way by embedding that other clauses are. The discrepancy between the predictions and the results could be due to anticipatory effects.

However, at this point the conclusions drawn for Experiment 7 should be taken with some caution, especially because it is not clear why the results were different in Experiment 6. Although I am assuming that lack of a difference between single and double embedded participle phrases in Experiment 6 occurred, because both conditions were perceived as grammatical but complex, it is also possible that the difference between single and double embedded participle conditions in Experiment 7 is of a different nature than the effect for RCs. One such explanation could be the adjacency of two articles. In order to rule out such other confounds, the effect of embedding needs to be replicated in future experiments. Furthermore, the

factors that deteriorated the results of single embedded participle phrases need to be investigated further.

# Chapter 7

## General discussion

In the previous chapters, experimental data were obtained in order to shed light on the processing of prenominal attributive present participles and to compare the processing of prenominal modification to that of RCs. While the results suggest that extended prenominal participles are in general more difficult to process than RCs, although they are perceived as highly acceptable, the experiments testing modifier length, internal structure and embedding showed mixed results with respect to the hypotheses I formulated in Chapter 4.

In this chapter, I provide a summary of the results and discuss the explanations for the experimental findings. The findings in this thesis also allow predictions about other adjectival elements. Therefore, I discuss which of the findings can be expected for past participles and regular adjectives as well and at what point I assume differences. I then turn to the question concerning the occurrence and production of extended present participles in German, followed by a discussion of participles and pre- versus postnominal RCs in other languages.

### 7.1 Summary of the results

In the experimental part of this thesis, I investigated three potential factors that could affect the processing of prenominal participle phrases differently than RCs: the modifier length, the internal structure of the modifier and an additional layer of embedding. The aim of the studies was to find out whether similar processing effects occur for sentential prenominal modifiers and RCs and to provide further evidence for the role of memory- or expectation-based mechanisms in processing (see Chapter 3 and 4). Overall, the results show that present participle phrases differ

from RCs and that for some of the investigated factors, memory- or expectation-based processing theories alone do not suffice to account for the results.

The length of the modifier was investigated with acceptability judgment questionnaires in Experiment 1 and 2, with SPR in Experiment 4 and with eye-tracking during reading in Experiment 5 (see Chapter 5). The experiments manipulated the length of the modifier by inserting adjuncts (and arguments in the acceptability judgment experiments) and compared prenominal modifiers with present participles to RCs. The previous literature (Weber, 1971; Doherty, 2010; Fabricius-Hansen, 2016) and the corpus analysis in Chapter 4 suggest that with increasing length, e.g. a higher number of words, modifiers are more likely realized as an RC than prenominal in language production. Although comprehension difficulties for longer prenominal modifiers caused by higher memory load would be in line with processing theories like the DLT (Gibson, 1998, 2000), there was no clear evidence for a decrease of the ratings with increasing modifier length in the acceptability experiments. For online comprehension, Experiment 4 and 5, the opposite effect occurred, namely that long prenominal modifiers yielded faster reading times (RTs) than short ones at their right edge (the participle or head noun). For RCs, there was no significant difference between the long and short condition.

The second influence on the processing of participles and RCs that was investigated in this thesis was the internal structure of the modifier (see Chapter 5). In addition to modifier length, Experiment 1 and 2 tested whether the presence of an accusative object inside the modifier affects the acceptability of prenominal present participles and corresponding RCs. This was further investigated with a SPR-experiment in which prenominal participles were either extended with an accusative object or an adjunct, again compared to corresponding RCs. Although the presence of accusative objects or arguments in general has not been directly hypothesized to affect the realization as a pre- or postnominal modifier or the comprehension of the modifier, corpus data (see Chapter 4) showed that attributive present participles do not take accusative objects as frequently as RC verbs. The experiments showed lower acceptability ratings for present participles with accusative objects and higher RTs on the participle if the object was present. There was no significant difference between the presence of the accusative object or an adjunct for the RCs.

Two acceptability judgment experiments tested whether an additional level of embedding affects prenominal modifiers in a different way than RCs. Participle phrases and RCs that contained a DP that was in turn modified by a participle

phrase or RC were compared to single embedded modifiers of the same length. The initial assumption, based on the storage cost metric of the *dependency locality theory* (DLT, Gibson 1998, 2000), was that the position between determiner and noun, i.e. center embedding in the DP itself, might lead to greater difficulties for double embedded participles than for RCs. However, this assumption was not borne out. Experiment 6 did not show a significant difference between single and double embedded participle phrases. Both were rated rather low. There was a difference between single and double embedded RCs. Assuming that confounding factors in the material lead to very low ratings for the single embedded condition, a follow-up experiment was conducted. Experiment 7 showed that a second embedded participle phrase leads to a decrease in acceptability ratings, as for RCs. However, the effect of embedding on participles was smaller than for RCs, contrary to the prediction.

Overall, prenominal participles seem to be more difficult to process than RCs. The acceptability judgment experiments (Experiment 1 and 2) show lower ratings for participles than for RCs, with equally high ratings only if the participles are not extended. In the online experiments investigating modifier length, there were overall higher RTs for nouns following a participle, compared to those preceding a RC. Furthermore, the experiments that tested effects of additional embedding consistently showed lower ratings for participles than for RCs. Another finding was that RTs were higher at the beginning of the prenominal modifier, i.e. in the region after the determiner, compared to the region following a relative pronoun in Experiment 4 and 5. This is expected because the comma and the relative pronoun already introduce the RC, whereas nouns or adjectives are more likely to occur after a determiner than arguments or adjuncts of an extended modifier, resulting in higher surprisal costs and therefore higher RTs.

## 7.2 Accounting for the observed findings

In Chapter 4, I developed hypotheses about the effects of modifier length, internal structure and embedding on the processing of prenominal present participle constructions and corresponding RCs. The predictions were based on general processing theories about language comprehension and on previous findings and theoretical assumptions about attributive present participles and other prenominal modifiers. Not all of the predictions were borne out in the experimental part.



A crucial finding is that participles and RCs did not behave the same way. More precisely, if processing theories were applied taking the position of both constructions into account, no theory accounts for both the processing of RCs and participles. This suggests that there are more differences between extended participles and RCs than their position with respect to the head noun.

In the following part, I discuss why only some processing mechanisms were reflected in the results and why the observed pattern differs from RCs in certain ways.

### **7.2.1 Reasons for an anti-locality effect with present participles**

With both SPR (Experiment 4) and eye-tracking (Experiment 5), a longer prenominal modifier phrase resulted in faster RTs at the end of the DP. In the SPR experiment, the effect occurred at the head noun, but it was observed at the participle in the eye-tracking experiment.

These results suggest that the processing of either the participle or noun – or both – was facilitated due to an increased predictability, in line with expectation-based processing theories (Hale, 2001; Levy, 2008a) and previous findings for head-final constructions in German (e.g. Konieczny, 2000). The idea is that the reader already knows at the beginning of the modifier that it will end with an adjective or participle, which is eventually followed by a noun. The corpus data in Chapter 4 showed that present participles occur most often without extensions and if they are extended, they contain a low number of words. Hence, with every additional word or phrase, the likelihood that the modifier is going to end with the next word increases. This higher expectation leads to faster processing and therefore lower RTs. Furthermore, additional phrases inside the modifier can also help to make more specific predictions about the participle and noun, i.e. which lexical item will be used. I used neutral adjuncts in the experimental sentences to avoid a difference due to additional information, but this cannot be completely excluded.

The findings are mixed with respect to the region where a higher expectation facilitates processing: either the noun (as in Experiment 4) or the participle (as in Experiment 5), or both. On the one hand, it is likely that an effect on the participle could have spilled over to the noun in the SPR-experiment. On the other hand, the

noun could have been anticipated at the participle due to parafoveal preview in the eye-tracking experiment, resulting in an effect already at the participle.

As described above, more material inside the modifier theoretically leads to a higher predictability of both participle and noun. More material increases the likelihood for the next word to be the right edge of the modifier and therefore the participle. However, the noun is very likely to appear directly after the participle. Although it is possible that the participle is followed by another adjectival element, stacked adjectives are relatively infrequent (see e.g. Münzberg and Bildhauer, 2020). Therefore, I assume that another adjective is less expected than a noun and that it is also likely that the reader is expecting the right edge of the DP even more when the modifier is longer, resulting in an anti-locality effect at the noun. Further research is needed to conclusively determine the location of the effect.

Especially under the assumption that the anti-locality effect happens at the participle, it is interesting that there is no advantage due to increased predictability with the presence of an accusative object in Experiment 3. Contrary to adjuncts, the object definitely narrows down the possibilities for the head of the modifier phrase: they can only be combined with present participles and no other adjectival elements and those participles need to be transitive verbs. The longer RTs at the participle with accusative objects contradict a purely prediction-based explanation of the obtained results in the online experiments.

There was no anti-locality effect for RCs, although the verb also occurs at the end of the clause and additional material should therefore contribute in the same way to predictability. I assume that there could have been a facilitation as well, but it is masked by a counteracting effect. It is possible that a wrap-up effect occurred due to the punctuation and prosodic pause after the RC verb (see e.g. Hirotsu et al., 2006). Assuming that this wrap-up effect is stronger with more material inside the phrase, this could have masked an anti-locality effect. However, Vasisht and Drenhaus (2011) found evidence for a locality effect in RC clause verbs and in their material, the verb consisted of an analytic form, i.e. a past participle followed by an auxiliary. By measuring at the participle, they avoided the confound of wrap-up, but they still found evidence for a locality effect.

There are certain differences between extended present participles and RCs that might play a role: for present participles, the subject of the modifier has not yet

been read at the participle. (1) and (2) show an example of the material with the dependency relations.<sup>1</sup>

- (1)  $\overbrace{\text{der (im Park ...) ein Eis essende Schüler}}$   
 the (in-the park ...) an ice cream eating student  
 ‘the student eating ice cream (in the park...)’

- (2)  $\overbrace{\text{der Schüler, der (im Park ...) ein Eis isst}}$   
 the student who (in-the park...) an ice cream eats  
 ‘the student who is eating ice cream (in the park...)’

In order to establish a subject-verb dependency at the participle, only grammatical information about the subject could be retrieved from the determiner, whereas the lexical information follows it, as indicated by the dashed lines in (1).<sup>2</sup> Furthermore, I initially predicted a locality effect for participles at the head noun due to the separation of determiner and noun, following the DLT (Gibson, 1998, 2000). There might be a difference for the dependency resolution of both constructions based on the lexical content that is involved. For RCs, the grammatical and conceptual properties of the noun need to be retrieved at the RC verb. In addition, a relation between the relative pronoun and the head noun needs to be established (as indicated by the dashed line in (2)). It is possible that the retrieval of this additional information leads to higher processing load for the dependency resolution. Furthermore, more lexical content could increase the likelihood of interference caused by DPs that share similar features inside the RC (see e.g. Gordon et al., 2001; Lewis and Vasishth, 2005).

Note that it is unlikely that the fact that RC verbs are finite, contrary to participles, prevents an anti-locality effect because a decrease of RTs with more material before the verb has been observed in other verb-final constructions in German (Konieczny, 2000) and other head-final languages (Vasishth and Lewis, 2006; Nakatani and Gibson, 2008).

Another difference to participles is that there is the possibility for RCs to be extraposed, as in (3) (see also Chapter 2).

<sup>1</sup>Note that I left out the dependency between the direct object *Eis* ‘ice cream’ and the participle or RC verb because there is no difference between the two constructions.

<sup>2</sup>This only applies if a determiner is present, which was the case for the materials.

- (3) a. *Peter ist von der Katze, die gerade schon wieder das Sofa zerstört,*  
Peter is by the cat that now yet again the sofa destroys  
*genervt.*  
annoyed
- b. *Peter ist von der Katze genervt, die gerade schon wieder das Sofa*  
Peter is by the cat annoyed that now yet again the sofa  
*zerstört.*  
destroys  
'Peter is annoyed by the cat that destroys the sofa yet again'

The extraposition of material to the right edge of the clause is considered a way to reduce memory load for language production (Hawkins 2004, but cf. Konieczny 2000), if there is not too much material between the DP and the relative pronoun and especially if the RC is longer. On the one hand, this shows that RC length affects memory load when the whole clause is considered, at least in production. On the other hand, the additional possibility to extrapose could also affect the ratings and RTs in the experiments, as a very long modifier might more likely be expected to be extraposed. However, this aspect needs to be taken with caution for two reasons: firstly, Konieczny (2000) found a general preference for adjacent RCs and lower RTs at the main clause verb when it appeared after a long RC. Secondly, extraposition would not have been a very natural option for the sentences in the SPR and eye-tracking experiments because in this case the subject of a subordinate clause was modified. If the RC appeared at the right edge of the clause, it would have been far away from its head noun.

To sum up, the anti-locality effect for participles can be explained by expectation-based processing mechanisms and it is in line with previous findings. It is still possible that there is an additional effect of higher memory load with an increased number of words and DPs inside the modifier, but it must be weaker and therefore overridden by the facilitation due to higher predictability at the end of the modifier. The difference to RCs, which did not show a decrease of RTs in the longer condition, could be due to additional processing load, either because of the prosodic boundary (marked by the comma) or because of differences in the dependency resolution.

### 7.2.2 Internal structure of the modifier

The next finding that needs further explanation is that the acceptability ratings in Experiment 1 and 2 and the RTs in Experiment 3 were affected by the presence

of an accusative object. The ratings were significantly lower when the object was present and it lead to an increase of RTs at the participle, indicating slower processing. Interestingly, the results are at variance with previous findings for finite clauses in which arguments actually facilitated the processing of a sentence-final verb because they contribute to its predictability (Levy and Keller, 2013; Konieczny and Döring, 2003). This indicates that the penalty is caused by specific properties of the participle.

The finding is in line with the corpus data, where accusative objects were found less frequently with present participles than inside RCs (see Chapter 4). Furthermore, one restriction for the use of present participles in German dialects like Bavarian is that participles from transitive verbs are prohibited (Weiß, 2017). Although this restriction can also be explained with a general ungrammaticality of present participles that are extended, there is a further restriction that present participles have to describe a property, not an action (e.g. Zehetner, 1985; Weiß, 2017). In standard German, this does not apply, which is reflected in the grammaticality judgments in Experiment 1 and 2, which are all high for present participles in general. However, I assume that the difference between participles extended by an object and those occurring with an adjunct can be explained by a difference in their resemblance to regular adjectives. In other words, the penalty is caused by the mixed properties of the present participle, i.e. its verbal and adjectival features. When the reader arrives at the participle, he or she first has to process the verbal properties, e.g. the arguments and the temporal relation to the matrix clause, followed by its adjectival properties like its relation to the head noun. I suggest that the participle is processed faster when its verbal properties differ less from the adjectival properties. Full verbs, in contrast, do not have the additional adjectival function, therefore no such effect is expected.

As the verbs used in the experiments could not denote properties, especially in combination with adjuncts as well as accusative objects, the deviation from regular adjectives, which was stronger with the presence of an object, must have been due to the argument structure. Although it would be desirable to determine one specific property in which participles differ from adjectives and which causes a slowdown in processing, I assume that there is a gradual difference between “verbal” and “adjectival” present participles (cf. Merkle, 1990, p. 50). The presence of an accusative object could have enhanced the verbal properties of the participle in several ways, which might all have contributed to slower processing. Figure 7.1 shows a suggestion

## 7.2. Accounting for the observed findings

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Figure 7.1: Simplified scale showing which participles would be considered more verbal or adjectival based on their properties



for a simplified scale showing these gradual differences based on properties like the argument structure. There might also be further, more fine-grained properties that play a role.

One reason could be that the syntactic structure is more complex when an accusative object is present (see Chapter 2 and Struckmeier 2007, 2010 for a syntactic analysis of present participles and adjectives). The more sentential the modifier is, the less it resembles a regular adjective. Furthermore, it is possible that the processing of the modifier takes longer when it is more sentential, i.e. when the relation between the verb and its argument needs to be established. When these processes happen simultaneously to the processing of the adjectival features of the participle, it could lead to difficulties. However, an effect caused by a more complex syntactic structure is speculative at this point because to the best of my knowledge, no processing difficulties due to the presence of arguments have been observed in finite clauses or RCs. The RC verbs in Experiment 3 also did not show higher RTs when they followed an object, hence if this causes the difficulty for participles it must have been because of its hybrid status.

Further evidence for a processing slowdown due to verbal features in mixed categories comes from studies on other deverbal elements. Manouilidou (2006) investigates how thematic structure affects the processing of deverbal nominals and deverbal adjectives (e.g. *readable*) in Greek. She conducted several experiments using a lexical decision task, in which the participants are presented with deverbal adjectives/nouns, denominal adjectives/nouns, non-derived adjectives/nouns and pseudo-words. After seeing the stimuli, they need to decide whether the word exists or not and the reaction times are measured. The results show slower reaction times for deverbal adjectives and nouns compared to those that are derived from nouns or not derived. The findings suggest an interaction of thematic features and the grammatical class, at least for some deverbal nouns and adjectives. The reason lies in the way lexical information is accessed. The general idea is that information about lexical items is stored in the mental lexicon. This comprises e.g. conceptual

information and grammatical information such as e.g. gender (in German) and the grammatical class. For verbs, this also includes the thematic features, i.e. who participates in the event in which way. According to Manouilidou (2006), p. 163, this is “an integral part of their representation” and the information is always accessed. In contrast, nouns do not have this component and if adjectives take arguments, they have a simpler thematic structure. Whether the thematic component is accessed at all depends on the prominence of these features. Furthermore, she assumes that lexical access occurs in several stages, with thematic features being accessed later than categorical features (Manouilidou, 2006, p. 175).<sup>3</sup>

There is a difference between the present study and the findings by Manouilidou (2006): the deverbal elements that she tested were presented without objects. Hence, the slowdown in lexical access was due to the thematic feature inherent to the lexeme, but the arguments were not present. The verbs used in Experiment 1, 2 and 3 could be used either with or without an accusative object. This comprises verbs like *eat*, *clean*, *sing*, etc. For both, used either with or without an object, the thematic role of the head noun stays the same (mainly agent, in some cases stimulus or experiencer). These verbs are usually considered transitive, but the object can be omitted because it can be induced from context or from typical scenarios described by the verb, so-called semantic frames (Rice, 1988). For example in (4), a listener or reader would simply assume a prototypical object, in this case e.g. *a song* (cf. Rice, 1988; Rappaport Hovav and Levin, 1998).

(4) John sings.

If the object is implicitly present, the verb would still be transitive and the thematic features would be the same independent of the presence of the object. Hence the results and conclusions from Manouilidou (2006) cannot be directly applied. Nevertheless, her results show an interaction between verbal and adjectival or nominal features. For the present participle, where an object leads to a slowdown in processing, the interaction might be rather on a clausal level, i.e. when the whole modifier (or reduced RC, see Chapter 2) is processed together with the adjectival features.

Note that assuming effects caused by an interaction of thematic features and the grammatical class questions the categorical status of the present participle, which

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<sup>3</sup>Radman (2015) investigates the processing of deverbal nominals in Serbian, using a lexical decision task. She finds a tendency that process nominals cause slower reaction times than result nominals, which is also evidence for slower lexical access due to more prominent thematic features.

is usually analyzed as a verbal form (Bech 1955, see Chapter 2). The results in this thesis can therefore be interpreted as evidence for an adjectival status of the participle, although it is also in line with a hybrid status.

Interestingly, arguments that follow deverbal nominals are actually processed faster than adjuncts (e.g. Kennison, 2002), presumably due to the strong expectation for an argument after a verb denoting a transitive event. This indicates that difficulties due to the presence of an object occur at the deverbal element itself, and strengthens the described assumption of an interaction of argument structure and the grammatical class.

If the richer argument structure itself causes the penalty, any additional argument should lead to a slowdown of RTs or lower acceptability. However, it is also possible that it depends on the thematic roles that are involved. The external arguments of adjectives, i.e. the head noun in the case of nominal modification, are typically themes (e.g. Baker and Bobaljik, 2002; Manouilidou, 2006, p. 60). The participles used in the experimental materials mostly modified the agent of the event, which therefore diverges from the prototypical argument structure of adjectival elements. Although this did not depend on the presence or absence of an accusative object, the actual presence of a theme inside the modifier could mean an even stronger deviation from the typical properties of adjectives. This would result in additional processing time at the participle to establish the thematic relations in the event and to process its adjectival function with respect to the whole DP.

There is one problem with this suggestion: if adjectival elements modifying the theme are easier to process, present participles formed from unaccusative verbs like *der fallende Mann* ‘the falling man’ should be ideal. However, in German dialects where the use of present participles is restricted, like Bavarian, these verbs are not grammatical when they are used as present participles (Weiß, 2017). This restriction in the dialect might also be reflected in the processing of standard German participles, although present participles of unaccusative verbs are grammatical there.

A way to test whether the processing of present participles interacts with the kind of thematic roles that are part of the event would be to systematically compare sentences in which either an agent or a theme is modified. Furthermore, investigating other thematic roles, e.g. by comparing Experiencer-subject (e.g. *bewundern* ‘admire’) and Experiencer-object verbs (e.g. *beeindrucken* ‘impress’) could also be interesting.



Alternatively, it is possible that the aspectual properties of the participle cause the penalty for the presence of an accusative object. As described in Chapter 2, the present participle is inherently imperfective (Rapp, 1997; Lübke and Rapp, 2011). For the temporal interpretation this means that the event described by the participle takes place over the whole time span of the event described in the main clause or during the utterance time. Hence, the event expressed by the participle ideally lasts for a longer time period. In Vendler's (1967) classification of Aktionsart, this applies best to activity or state verbs. Some of the verbs used in the experiments describe an activity when they are used without an object, but with the presence of a direct object, an *incremental theme* (Dowty, 1991), they describe an achievement. (5) shows an example: if only the verb is used, as in (5-a), the event of cleaning could be considered an activity that does not have a certain endpoint and is therefore atelic. If the theme is present, as in (5-b), the event is telic and there is an endpoint, namely when the shelf is completely cleaned (cf. also Mittwoch, 1982; Olsen and Resnik, 1997).

- (5) a. *die Tante putzt*  
the aunt cleans
- b. *die Tante putzt ein Regal*  
the aunt cleans a shelf

Furthermore, some of the inserted adjuncts, like *seit Stunden* 'for hours' could have emphasized that the event takes place over a longer time period, even facilitating the processing of the participle. It is likely that an atelic event matches with the imperfective aspect of the participle. In contrast, for an event that has a specific endpoint, participants might need more time to construct the temporal relation with the matrix clause. Here, the interaction with properties specific to present participles would be problematic and the effect would be not due to a difference to adjectival properties. In a way, however, a connection to prototypical adjectival properties is still possible, because both a property and an ongoing activity last for the time span of the event described in the matrix clause.<sup>4</sup> If, however, the event

<sup>4</sup>Note that the same holds for past participles, which have inherent perfective aspect (Rapp, 1997; Lübke and Rapp, 2011). In a DP such as (i), the event of cleaning is already completed, therefore there is no further change of state.

- (i) *das geputzte Regal*  
the cleaned shelf

Figure 7.2: Simplified scale showing which participles would be considered more verbal or adjectival based on the denoted event



changes or is completed during this time span, the description of the agent of the event, which is also the head noun, changes. In addition to the properties shown in 7.1, the kind of event described by the participle could also characterize it as more verbal or adjectival, as shown in Figure 7.2.

To sum up, my suggestion is that there is a penalty for participles that take an accusative object as compared to those extended by an adjunct because they diverge more from typical adjectives. In general, this is in line with the restrictions for dialects, where present participles are only grammatical if they have an adjectival character (e.g. Zehetner, 1985; Weiß, 2017). Furthermore, it relates to the findings for deverbal nominals and adjectives, where verbal properties slow down lexical access. The suggestions about the exact difference to regular adjectives that causes more difficulties for processing with the presence of an accusative object should be teased apart in future research, as well as potential effects caused by other kinds of arguments.

### 7.2.3 Differences in the effect of embedding for participles and RCs

For the two acceptability judgment questionnaires investigating multiple embedding, it must be explained why there was no effect of embedding for participles in Experiment 6 and why there was an effect of embedding – but smaller than expected – in Experiment 7.

The lack of any effect of embedding for participles in Experiment 6 was surprising because center embedding clearly deteriorated the ratings for RCs and should affect prenominal modifies as well, according to memory-based theories like the DLT (Gibson, 1998, 2000). Furthermore, there were no instances of prenominal participle phrases with internal DPs modified by an adjectival element in the corpus data (see Chapter 4) and in the previous literature, these cases are claimed to be very rare (e.g. Weber, 1971). Instead of concluding that an additional level of embedding

does not affect prenominal modifiers, I reasoned that the single embedded (control) condition (repeated in (6)) must have been problematic.

- (6) *Martin hat den die vierjährige Enkelin draußen im Garten umarmenden Opa heute Morgen kennengelernt.*  
 Martin has the the four-year-old granddaughter outside in.the garden  
 hugging grandpa this morning met.  
 ‘Martin has met the grandpa hugging the four-year-old granddaughter outside in the garden’

I suggested several potential reasons: the accusative object of the participle is very similar to the head noun, as both are animate and definite. This could have led to similarity-based interference (see e.g. Gordon et al., 2001; Lewis and Vasishth, 2005), resulting in processing difficulties at the head noun. Furthermore, it is possible that the animacy and definiteness configuration is infrequent for prenominal modifiers, which would also affect processing. Due to the definite article of the modifier internal DP, there were two adjacent definite articles in both the single and double embedded participle condition and this repetition could have also negatively affected the acceptability of the sentences. All these problems could have led to low ratings for the single embedded condition. It is possible that the long modifier condition was already so problematic that the participants considered both single and double embedded participles as grammatical but difficult to process. Another issue could have been that the modifier-internal DP is modified by an adjective, which might have a similar effect as an extended modifier. It would be interesting to tease apart the effect of factors like animacy and definiteness for pre- versus postnominal modification. However, a further experimental investigation of these factors is beyond the scope of this thesis.

In Experiment 7, additional modification led to lower ratings for both kinds of modification. Applying the storage cost metric of the DLT to participles and RCs, I hypothesized that the difference should be greater for participles. However, the deterioration was smaller for participles than for RCs. Note that Experiment 6 already showed that there are confounds that might not be known, as certain properties of the materials affect the processing of extended participles differently than RCs. Therefore, speculations about a general effect of multiple embedding need to be made with some caution.

That being said, there are potential reasons why the storage and integration costs of the DLT are not sufficient in explaining the results or why it might be better to apply them differently. One might be related to the findings for the length of the modifier, discussed in Section 7.2.1, namely that prenominal modifiers seem to be more prone to expectation-based processing effects than RCs. The strong anticipation of the participle and noun could have overridden the predicted memory-based effects for embedding, in contrast to RCs. However, it is unclear whether such an expectation-based effect would be reflected in acceptability ratings. Furthermore, both the anti-locality effect for longer modifiers and a weaker effect of embedding could be explained by a more shallow way of processing for prenominal modifiers, as will be discussed in more detail in the course of this chapter.

There might also be a difference between participle phrases and RCs due to their position. In the case of the participle phrase, the noun follows the participle and therefore both are predicted heads at the beginning of the modifier. However, whether they should be treated as distinct predicted heads or not is complicated because the participle also has adjectival properties and is therefore modifying the noun. The reason why I predicted that the ratings would decrease more for participles than for RCs with an additional embedded modifier was because prenominal modifiers are embedded in the DP. If, however, the effect of separating determiner and noun does not contribute to processing costs in the same way that the disruption of the modifier itself does, there should not be a greater difference.

Furthermore, in the case of RCs the final verbs are stacked, i.e. the final verbs of the two RCs follow each other directly (see (7-b)), whereas in the case of the participle phrase the modified DP is always completed with the participle and the noun (see (7-a)).

- (7) a. [*die* [*einen nach Zimt      duftenden Apfelkuchen*] *backende*  
the a      like cinnamon smelling apple pie      baking  
*Nachbarin*]  
neighbor
- b. *die Nachbarin*, [*die einen Apfelkuchen*, [*der nach Zimt      duftet*],  
the neighbor    who an      apple pie      that like cinnamon smells  
*backt*]  
bakes  
'the neighbor (who is) baking an apple pie (that is) smelling like cinnamon'

It is possible that with two words to complete the modified DP, the reader has more time to process the dependencies and is therefore able to read more fluently, compared to RCs.

There is also the additional difference that RCs can be extraposed. A more natural way to express (7-b) would be to move the second RC to the right edge of the first one, like in (8).

- (8) *die Nachbarin, die einen Apfelkuchen backt, der nach Zimt duftet*  
the neighbor who an apple pie bakes that like cinnamon smells

A double embedded RC like this was also found in the corpus data in Chapter 4. In addition, there is the possibility to use passive voice to avoid double center embedding. These strategies show that there is higher memory load with center embedding compared to right branching. Furthermore, the low ratings for RCs might also be due to a possible alternative. When judging the sentence, the participants might have compared it to the extraposed version and therefore given it a low rating.

### 7.3 Alternative accounts

Based on assumptions by Weber (1971); Doherty (2010); Fabricius-Hansen (2016), one of the main hypotheses investigated in this thesis was the effect of complexity as defined by memory-based processing theories, in particular the DLT (Gibson, 2000), on pre- vs. postnominal sentence-like attributes. This theory predicted difficulties for present participles with increasing modifier length and more levels of embedding. Most of the experimental results, however, do not provide evidence for a purely memory-based processing mechanism.

While an experience-based account for sentence processing was already introduced as an explanation for the observed anti-locality effect, I will further investigate a potential role of shallow parsing and of frequency for the results of all experiments. Furthermore, recent processing theories combine effects caused by memory and expectation. Therefore, I will discuss whether a combination of theories or additional ones can explain more of the obtained data and what predictions they make.

### 7.3.1 Shallow processing

There is an alternative explanation for the results for double embedding, which showed that embedding had a stronger effect on RCs than on participles and – to some extent – for the anti-locality effect, which I only found for participles and not for RCs: it is possible that the content in the prenominal modifier is not processed as carefully as it is inside an RC, especially when there are additional adjuncts. Shallow processing in this case applies to the lexical content of the modifier, i.e. that the modifier internal words and their relations were not fully processed. This could also mean that the participants did not detect an additional level of embedding in Experiment 6 and 7. For the online-experiments testing modifier length (Experiment 4 and 5), shallow processing might have contributed to the anti-locality effect under the assumption that both memory and expectation played a role, but the latter had a stronger effect. If the additional material, including new discourse referents, was not processed deeply, more material would lead only to a weak locality effect, making it easier for the expectation-based effect to override it. Note that the modifier length suffices to anticipate the participle because long extended prenominal modifiers are rare and the likelihood for the next word to be the right edge increases with each additional word. Hence, for an anti-locality effect, the lexical content does not necessarily need to be processed completely.

I suggest that shallow parsing is more likely for extended present participles than for RCs because non-restrictive prenominal modifiers are not-at-issue (Fabricius-Hansen, 2009; Schwarz, 2020) and – contrary to RCs – they can be used to mention trivial information that might not be relevant for the further discourse (Fabricius-Hansen, 2016). This is also supported by a difference in accessibility of referents that occur inside a prenominal attribute compared to an RC, as pointed out by Fabricius-Hansen (2016), p. 24f, with the example in (9). The same applies to the modifier as a whole, as in (10).

- (9) a. *Die zeitweise sogar bis ins Alpenvorland<sub>i</sub> vorgestoßenen*  
The sometimes even into the foothills of the Alps advanced  
*Gletscher haben #es<sub>i</sub> mit der Zeit umgeformt.*  
glaciers have it with the time reshaped
- b. *Die Gletscher, die zeitweise sogar bis ins Alpenvorland<sub>i</sub>*  
The glaciers, which sometimes even into the foothills of the Alps  
*vorgestoßen sind, haben ?es<sub>i</sub> mit der Zeit umgeformt.*  
advanced are have it with the time reshaped

‘The glaciers, which sometimes advanced into the *foothills of the Alps*<sub>i</sub>, have reshaped it<sub>i</sub> over time.’

- (10) a. *Die zeitweise sogar bis ins Alpenvorland vorgestoßenen*  
 The sometimes even into the foothills of the Alps pushed  
*Gletscher haben #dadurch die Landschaft geändert.*  
 glaciers have this way the landscape changed
- b. *Die Gletscher, die zeitweise sogar bis ins Alpenvorland*  
 The glaciers, which sometimes even into the foothills of the Alps  
*vorgestoßen sind, haben dadurch die Landschaft geändert.*  
 pushed are have this way the landscape changed  
 ‘The glaciers, which are sometimes pushed into the *foothills of the Alps*<sub>i</sub>,  
 have this way the landscape changed.’ ‘The glaciers, which at times even  
 advanced into the foothills of the Alps, have changed the landscape this  
 way.’

Therefore it is possible that readers are used to perceiving extended prenominal modifiers as side information that may or may not be interesting and new for them, but that will not be relevant for rest of the discourse. The participants in the experiments might have used this as a strategy, especially when it comes to the adjuncts inside the modifier. Without the need for paying attention very closely to the elements inside the modifier, there might not have been additional memory load with the insertion of further PPs in Experiment 4 and 5. For the additional embedding inside a prenominal modifier (Experiment 6 and 7), this could mean that participants did not pay as much attention to the content of the participle phrase as to the RC, which might have contributed to the lack of an effect for double embedding with participles in Experiment 6 and to a smaller effect than predicted in Experiment 7. In this case, participants realize that there is a long participle phrase and perceive it as complex, but do not process the content deeply enough to realize the complexity caused by the additional level of embedding.

Further evidence for an interaction of prominence and shallow parsing comes from the literature on good-enough parsing: Ferreira et al. (2002); Karimi and Ferreira (2016) suggested that listeners or readers do not always end up with a correct representation of a sentence, but a parse that is “good enough” (or not) for a specific task (see also Sanford and Graesser, 2006). Since then, evidence for good enough parsing has been found e.g. with semantic illusions (e.g. Erickson and Mattson, 1981; Park and Reder, 2004; Sanford et al., 2011) and with rare structures

like implausible passive sentences (e.g. Ferreira 2003, but cf. Bader and Meng 2018). However, if there is focus on one constituent, e.g. in a cleft construction, participants always end up with the correct interpretation of the sentence (Bredart and Modolo, 1988). There seems to be a difference between main clauses and subordinate clauses as well (Baker and Wagner, 1987), suggesting that shallow parsing is more likely to occur in less prominent or accessible discourse elements (Sanford and Graesser, 2006).

Note that the control questions in the online experiments did not ask for the adjuncts inside the modifier, as this was not constant in different conditions. Hence, there was no need for the participants to pay more attention to them as a strategy to fulfill the requested task. Unfortunately, this also makes it impossible to verify whether shallow parsing occurred for the prenominal long modifiers (and not for RCs) in Experiments 4 and 5.

As prenominal modifiers and RCs constitute an interesting test case for a potential interaction of discourse structure and (not-)at-issueness with shallow parsing, this would be an interesting line of future research. Possible ways to investigate this aspect could be a combination of RTs and control questions targeting the content of the modifier, but also a manipulation of plausibility. The prediction would be that participants are less likely to obtain a correct representation for prenominal attributes compared to RCs or main clauses.

#### **7.3.2 The role of frequency**

As mentioned above, prediction-based processing mechanisms explain an anticipation of the participle and noun in the prenominal construction, resulting in anti-locality effects. In addition, a low frequency of certain properties tested in the experiment might have led to a surprisal effect. This could have in particular been the case for the occurrence of an accusative object inside the participle phrase, providing an alternative explanation for lower acceptability ratings and higher RTs with the presence of an accusative DP.

The corpus data from Weber (1971) and in Chapter 4 showed that accusative objects do not occur very frequently with present participles. Furthermore, they do not occur with adjectives or past participles, with only few exceptions e.g. for degree adjectives that can be combined with accusative DPs. Dative objects were even less frequent. When participants encounter a DP that starts with an article, it



might therefore lead to higher surprisal costs than for a PP or an adverb, as these elements are more frequent with participles and also occur with other adjectival elements. This might have led to the observed effect of the presence of an accusative object compared to an adjunct in Experiments 1, 2 and 3. In addition, the experiments testing embedding (Experiment 6 and 7) also had particularly low ratings for present participle phrases starting with an accusative DP, which was the case in both participle conditions in Experiment 6, but coincided with the manipulation of embedding in Experiment 7. The same holds true for the manipulation of length in Experiments 4 and 5, where the short participle phrase which leads to higher RTs at the participle or noun also started with two adjacent articles. Hence, it cannot be completely excluded that starting a participle phrase with the infrequent accusative object especially leads to difficulties. However, if frequency was the only explanation for the difference between adjuncts and accusative objects and a confound in other experiments, surprisal costs should have already occurred at the accusative DP instead of the participle in the online data (Experiment 3), which was not the case.

In the corpus data, there was no evidence for an extended participle phrase containing another extended modifier, although Weber (1971) mentions a few examples. Under the assumption that this construction is very rare, this could also contribute to lower ratings for double embedded modifiers in Experiment 7. In this case the same would presumably apply for RCs as well. However, it is difficult to distinguish a frequency effect from the effects predicted by the DLT.

Overall, the frequency of the two investigated constructions and the properties that were manipulated is very likely to affect processing, together with memory effects or specific properties of the participle. Therefore, future research focusing on further production data than provided in the small corpus search in Chapter 4 could shed light on the connection between production and comprehension of alternate constructions and contribute to approaches that aim to link both modalities (e.g. MacDonald, 2013).

### **7.3.3 Interactions of memory and expectation**

The investigation in this thesis started with memory-based assumptions for a length effect. However, part of the results can be explained better with a prediction-based theory and for the effect of the accusative, I assume that the combination of verbal

and adjectival properties of the participle can account for the observed findings. In the following part, I will reflect on how a combination of expectation and memory, as suggested in recent theories, or other accounts provide an explanation for the observed findings in the different experiments of this thesis.

One alternative view on the obtained results could be with the *Lossy Context Model* (Futrell et al. 2020, see Chapter 3). As with surprisal, it is assumed that upcoming material is predicted and that a higher predictability facilitates processing. The base for these predictions, however, is not always the correct representation because part of the previous material might not have been processed correctly or might have gotten lost in memory.

Taking this into consideration, the higher RTs at the participle in the accusative condition of Experiment 3 and in the short condition in Experiments 4 and 5 could be explained in the following way: the first of the two adjacent determiners is not represented in the parse of the sentence which is used to make predictions about upcoming material. Hence, instead of (11-a), readers arrive at (11-b). In cases where the modifier internal object is neuter or feminine, it is syncretic with nominative case. Therefore, a clause like (11-b) could be continued in a way like (11-c) (also depending on the matrix clause content).

- (11) a. *dass der ein Eis...*      (*essende Schüler*)  
          that the an ice cream eating student
- b. *dass ein Eis...*  
          that an ice cream
- c. *dass ein Eis gut schmeckt*  
          that an ice cream good tastes

If the reader assumes the DP *ein Eis* 'an ice cream' is the subject of the clause, the participle (*essende* 'eating') would be highly unexpected, therefore leading to surprisal costs reflected in higher RTs when the modifier begins with an accusative object. For the experiments testing the modifier length (Experiments 4 and 5), this would mean that the lower RTs for a longer modifier are not due to an anti-locality effect, but that shorter modifiers starting with an article cause higher surprisal costs.

Note that the pronominal modifier would also be grammatical without the first determiner (*ein Eis essende Schüler* 'students eating ice cream'), but Bader (2010) showed that in these ambiguous cases an analysis as the subject or object of a VP is preferred to an adjectival or participle phrase.

Furthermore, a *noisy-channel model* (e.g. Levy, 2008b; Levy et al., 2009; Gibson et al., 2013; Shannon, 1948), which is part of the assumptions of the *Lossy Context Model* acknowledges that conversations do not happen under ideal conditions and are affected by e.g. background noise or speech errors. Hence, the comprehender assumes that the perceived speech signal could be erroneous and he or she might reconstruct it in a plausible way. For written language, two adjacent articles could be a typical error, e.g. when the writer first wanted to write the wrong DP. When the reader encounters this point, it is possible that the first article is ignored, again resulting in (11-b) and surprisal costs at the participle.

There is, however, evidence that speaks against such a hypothesis. A masculine DP is unambiguously marked as accusative, therefore it would have to be the object of a (subordinate) clause with OS word order, given the material in the online experiments. However, this order is less frequent and due to information structural restrictions marked with inanimate and indefinite objects (see e.g. Bader and Häusler, 2010). There are further constructions that would be possible continuations, as in (12). In this case, it can be assumed that a main clause analysis is not pursued as strongly as for an ambiguous form, resulting in lower surprisal costs at the participle.

- (12) *dass einen Papierstapel aufräumen keinen Spaß macht.*  
 that a stack of papers clean up no fun makes  
 ‘that it makes no fun to clean up a stack of papers’

If this was the case, however, sentences with a masculine modifier internal DP should not show the same difference between arguments and adjuncts as those containing feminine or neuter DPs. However, a closer look at the material in Experiment 3 reveals that this is not the case: prenominal modifiers with masculine nouns all have higher RTs at the participle in the accusative object condition.

The question whether participants arrive at a main clause interpretation, possibly also in cases where the modifier begins with a prepositional phrase, could nevertheless be investigated in future research. One way to achieve this could be to make the determiner more salient, e.g. by using a demonstrative pronoun, as in (13).

- (13) *dass dieser ein Eis essende Schüler*  
 that this an ice cream eating student

A different approach to the obtained data could be provided by the ACT-R framework (Lewis and Vasishth, 2005): here, locality effects can be explained by retrieval difficulties if dependents are further apart, but elements can also be activated by retrieval cues. This has been used to explain anti-locality effects in previous studies (e.g. Konieczny, 2000; Konieczny and Döring, 2003; Demberg and Keller, 2008). In the case of attributive participle constructions, one such retrieval cue could be provided by the agreement of the participle with the noun in gender, number and case. Therefore the dependency of determiner and noun could be different than argument-verb dependencies. In the ACT-R model, this cue might have facilitated the retrieval of the head noun for the participle and reduced locality effects.

## 7.4 Further implications

After the explanations for the observed findings and the discussion about potential underlying processing mechanisms, I will now turn to implications beyond the investigated construction. I will discuss how the detected effects relate to other adjectival elements, what they mean for the use of the construction and what can be expected for similar constructions in other languages.

### 7.4.1 Potential differences to other adjectival elements

The experiments in this thesis investigated only prenominal attributes with participles as their heads. The same construction is also possible with adjectives, past participles and gerunds. In the following part, I will discuss how much of the results could be expected for these modifier heads as well, and where I would assume differences.

Firstly, I will focus on the length of the modifier. Weber (1971, 1994), Doherty (2010) and Fabricius-Hansen (2016) focus on all prenominal attributes with the assumption that the length of the modifier affects processing or the production of the construction. There was no evidence for the investigated present participles. In an acceptability experiment similar to Experiment 1, but testing past participles instead of present participles, I found that ratings decreased with the insertion of either a PP-ad adjunct or a by-phrase and even more with the presence of both. This was not the case for corresponding RCs. Hence, modifier length did have an effect, contrary to present participles (Gößwein, to appear). It is possible that modifier

length does affect all prenominal attributes, but that it is overridden in the case of present participles by the effect of the accusative object. For online data, however, I do not see any reason to assume that more material affects the predictions about other modifier heads differently than for present participles, therefore I would predict an anti-locality effect for adjectives, past participles and gerunds as well.

One difference between present participles compared to other modifier heads lies in the word ratio of pre- versus postnominal modifiers: in the case of present participles, a corresponding RC contains only one additional element, namely the relative pronoun (see (14)). For past participles, the RC contains a passive auxiliary (see (15)) and a copula is necessary for adjectives (see (16)).

- (14) a. *die eine Maus jagende Katze*  
 the a mouse hunting cat  
 ‘the cat hunting a mouse’
- b. *die Katze, die eine Maus jagt*  
 the cat that a mouse hunts  
 ‘the cat that hunts a mouse’
- (15) a. *die von dem Kind gejagte Katze*  
 the by the child hunted cat
- b. *die Katze, die von dem Kind gejagt wird*  
 the cat that by the child hunted is  
 ‘the cat (that is) hunted by the child’
- (16) a. *der dem Herrchen treue Hund*  
 the the owner loyal dog
- b. *der Hund, der dem Herrchen treu ist*  
 the dog that the owner loyal is  
 ‘the dog (that is) loyal to his owner’

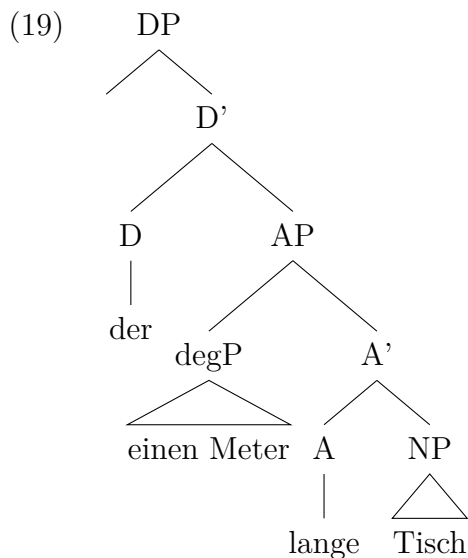
According to Fabricius-Hansen (2016), the word ratio could be a reason for short modifiers to be expressed as prenominal attributes because in this way a speaker can express the same content using less words. When the modifier becomes longer, however, economy seems to become less important – although she states that it is unclear why exactly. The additional word needed to form a RC might lead to a stronger preference for a prenominal attribute if the modifier is short or not extended at all, compared to present participles. If this is the case, it might also be reflected in acceptability data.

Another question is whether the penalty for an object compared to an adjunct also applies for modifier heads other than present participles. As mentioned above, I found no such effect for by-phrases with past participles (Gößwein, to appear), but the by-phrase could also be considered as an adjunct (e.g. Baker et al., 1989). It is up to future research to test whether a penalty occurs for all arguments or only for accusative objects. As the latter only occur with present participles, the findings cannot be applied to other elements. In general, dative objects occur even more rarely with prenominal modifiers (Weber 1971, see Chapter 2 and 4), hence I would expect them to lead to difficulties as well. If a sentential structure, including objects in general, causes the penalty, a DP like in (17) could be problematic as well, depending on whether the presence of the argument requires a VP structure or not.

- (17) *der auf den Sohn stolze Vater*  
 the of the son proud father  
 ‘the father proud of the son’

Presumably a different case, however, are degree phrases that superficially resemble accusative objects. Those are assumed to be part of an extended adjectival projection (Abney 1987, cf. also Bresnan 1973; Heim 2000; Kennedy 1999; Bhatt and Pancheva 2004). An example is given in (18) and (19).

- (18) *der einen Meter lange Tisch*  
 the one meter long table



In this case I would expect different results because the degree phrase is part of the adjectival structure and not of a VP. If the obtained results are due to surprisal at the beginning of the modifier internal DP, however, the same results should be obtained.

#### **7.4.2 Further implications for the role of (extended) attributive participles in grammar and production**

After the questions concerning the observed processing effects, their implications for theories on language comprehension and predictions for similar modifiers, I will now turn to the role of prenominal participles in German grammar. More precisely: why do extended prenominal participles and RCs both occur and why are present participles with accusative objects grammatical, if they are more difficult to process?

First of all, the results of Experiment 1 and 2 show that prenominal modifiers are acceptable in written language, even if they are extended. The online data also suggests that there are differences in processing, but none of them indicated that participants had difficulties understanding the prenominal modifier and there is no difference in the question accuracy for pre- and postnominal modification. Hence, it can be assumed that both constructions are well established in written language. It is likely that the processibility and even the grammaticality of the construction depends on the modality, as stated by e.g. Weber (1994).

An investigation of the construction in spoken language goes beyond the scope of this thesis, but I assume that modifier length matters more in this case as participants to not have the possibility to pause or reread. Furthermore, I would expect the processing difficulties with transitive participles or participles with an overt object to be more pronounced, which would also be in line with the restrictions of present participles in German dialects (Weiß 2017, see Chapter 2).

Since extended prenominal attributes are also used for stylistic reasons and are typical for specific registers, e.g. legal or academic texts or newspaper texts (Weber, 1994; Thurmair, 2007; Mertzluft, 2010; Lötscher, 2016), this might affect processing as well. The sentences used in the experiments are mostly describing daily scenarios as they would be found e.g. in conversations or in stories. Although fictional texts also make use of the construction, the expectations of participants might be different for typical events found in newspaper texts or official documents. It might even be the case that for some registers, participants are more used to

prenominal modification. If, however, prenominal modifiers would be more difficult to comprehend under certain circumstances or more prone to shallow parsing as discussed in Section 7.3.1, this might also suggest that an extensive use in certain texts is problematic for readers.

Besides stylistic reasons, functional or information structural reasons could affect not only the production but also the comprehension of the construction. As discussed in Section 7.3.1, the online data from Experiments 5 and 6 can be interpreted as showing that the prenominal modifier might be processed more superficially than the RC. This would be in line with the idea that background information in written texts might be expressed as a prenominal modifier, leaving it open whether this information is new or relevant to the reader or not (Fabricius-Hansen 2016, see also Potts 2005).

A further use of the construction could be corrective focus or repetition. The processing of the construction is easier if the part of the content is already known and in this case it might be more economical to use a prenominal participle rather than a RC, as the latter contains an additional word with the relative pronoun. However, at this point, this is only speculation.

There might be additional factors that influence the processing of extended prenominal participles and attributes in general. This is suggested in particular by Experiment 6, in which even single embedded participle phrases lead to very low acceptability ratings compared to the other experiments. While it is beyond the scope of this theses to tease apart the potential cause for these results, it suggests that properties like definiteness and animacy play a role for present participles. Animacy configurations have been found to play a role in the processing of RCs: object RCs are usually considered more difficult to process than subject RCs (see e.g. Ford, 1983; King and Just, 1991; Mecklinger et al., 1995; Schriefers et al., 1995; Gordon et al., 2001; Grodner and Gibson, 2005). However, this difference is eliminated under certain circumstances, e.g. when the object is inanimate (Mak et al., 2002, 2006). Therefore, it is likely that some configurations of extended prenominal attributes are more natural and easier to process. The experimental data suggests that the similarity of the modified DP and an internal noun plays a greater role for participles than for RCs, as two animate and definite DPs lead to lower ratings in Experiment 7, compared to the other experiments where the modifier internal noun differed more from the modified noun. This is in line with a similarity-based interference account (Gordon et al., 2001) and it would be interesting to verify this



assumption in an experiment that manipulates the animacy of the modifier internal DP. Furthermore, under the assumption that the penalty for accusative objects is due to more verbal properties of the participle, it is likely that agentivity plays a role as well and that verbs that do not have a volitional agent are more typical participles. If this is the case, participle phrases that modify inanimate DPs should be easier to process.

### 7.4.3 Cross-linguistic implications

Finally, the question arises how the obtained results relate to similar constructions in other languages. There are different implications for extended prenominal modifiers, depending on their properties. One question is what this means for other languages which have the same alternation as German, either to the same extent or more restricted. In the following part, I will formulate hypotheses based on the data for German. It is also interesting to take a closer look at other languages with prenominal RCs, as processing findings based on the position of the modifier and modifier verb in particular enable to make predictions for these languages.

#### 7.4.3.1 Prenominal versus postnominal modification in other languages

There are other Germanic languages that allow extended participle constructions in prenominal position. However, the construction is more restricted in some of them. For Dutch, I would expect the same results as in German, as the construction and the general word order do not differ.

Fabricius-Hansen (2010) provides a comparison of extended prenominal attributes in German, English and Norwegian. All three languages allow prenominal participles and adverbs and degree phrases with a prenominal modifier. Prenominal adjectives and participles with arguments, by-phrases and adjuncts are common in (written) German, whereas they are mainly restricted to *officialesse* in Norwegian and ungrammatical in English (see (20)).

- (20) a. dieser die Zuhörer stark beunruhigende Gedanke  
b. !! denne tilhørerne sterkt foruroligende tanken  
c. \*this the listeners strongly worrying thought

German differs from English and Norwegian with respect to the word order, as the latter are SVO-languages. According to Fabricius-Hansen (2010), the word order

could be a reason for the acceptability of extended prenominal modifiers: although she states that AN does not necessarily correlate with OV, German speakers might be able to make use of strategies that facilitate the processing of head-final structures. If such processing strategies play a role it could be expected that online processing of the construction in Norwegian is more likely to show locality effects than anti-locality effects.

In English, contrary to German<sup>5</sup>, extended participles and adjectives are allowed in a postnominal position (21).

(21) The cat *destroying the couch* is hungry.

In this construction, there is no separation of determiner and noun, which was one of the main reasons for the investigation of the German participle construction in this thesis. Adnominal participle constructions in English occur mainly in written language, in particular academic texts (Beaman, 1984; Chafe and Danielewicz, 1987) and present participles are less frequent than past participles (Granger, 1997). A comparison of this construction and RCs would be particularly interesting with respect to the difference between adjunct and accusative object found in the experiments on German, because in English there is only a difference in finiteness.

##### 7.4.3.2 Languages with prenominal RCs

The discussions and findings in this thesis are also interesting for languages which in general have prenominal RCs. Especially Chinese has been in the focus of research on RCs, as the prenominal position is unusual for an SVO language. Several studies on processing focused on subject versus object RCs (e.g. Gibson and Wu, 2013; Wu et al., 2018; Vasishth et al., 2013). The difference between Chinese RCs and German prenominal participles, however, is the word order, as the verb occurs before the object in subject RCs.

Therefore, I will focus on languages that are head-final. This applies e.g. to Japanese and Turkish. The difference between these languages and German is that postnominal RCs are the only strategy for relativization in German.

Firstly, I will focus on Turkish RCs. Turkish is a head-final language, so the fact that RCs appear to the left of the noun is not surprising (Kornfilt, 2000). There is no overt relative pronoun and the verb is nominalized. There are two different

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<sup>5</sup>The exception are prosodically marked appositions in German.

suffixes:  $-(y)An$  appears, when the modified noun is the subject of the RC, otherwise  $-DIK$  is used ((22), (23); Kornfilt 2000; Aydin 2007). Whereas  $-DIK$  agrees with the subject of the RC (i.e. bears the agreement suffix of nominalized elements), no agreement morphology occurs with  $-(y)An$ .

- (22)  $[e_i \text{ kadın-}i \quad \text{sev-en}] \quad \text{adam}_i$  (Turkish)  
 woman-ACC love-SPart man  
 ‘the man who loves the woman’
- (23)  $[\text{kadın-}in \quad e_i \text{ sev-diğg-i}] \quad \text{adam}_i$   
 woman-GEN love-OPart-3s man  
 ‘the man who the woman loves’ (Aydin, 2007, p. 298)

Here, I will focus on subject RCs as they correspond to present participle constructions and subject RCs in German.

The structure of RCs in Turkish resembles that of finite clauses, as they can have several arguments and adjuncts. Sentential adverbs like *obviously* or *probably* can occur in the RC. Negation, modality morphology and passivization is also possible (Kornfilt, 2000). As modal auxiliaries and passive structure are not possible in German, the nominalized verb in Turkish RCs behaves more like a verb than a participle. This is also supported by the fact that nominalization is a strategy that occurs also in other contexts (see Kornfilt, 2001). Furthermore, German present participles have inherent aspect. Turkish deverbal elements in RCs, however, do not distinguish aspectual features. One question is whether RCs with an object might be more problematic than those without it, as it was the case in German (see Experiment 1, 2 and 3). The RC head is also a deverbal element, therefore the explanation that the mixed category causes the penalty could also apply here. However, nominalization is a frequent strategy in Turkish and I would assume that speakers are so used to it that verbal properties do not cause any problems. This would also be in line the wider range of verbal morphology like modals and passives.

Besides the modifier head, both languages also differ with respect to determiners in the nominal domain: in Turkish, definite determiners are not overtly expressed. Therefore determiner and noun are not separated. It is, however, possible to express the demonstrative and in this case the position varies: the demonstrative article *bu* can be either before or after the RC, as shown in (24) (but cf. Kornfilt, 2000, 2001).

#### 7.4. Further implications

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- (24) a. *uyuyan bu kedi...*  
sleep-NOUN this cat  
b. *bu uyuyan kedi...*  
this sleep-NOUN cat  
'this sleeping cat'

This possibility raises the question whether the length of the modifier influences the position of the demonstrative. (25) shows that the length of the modifier could be one factor here: for longer RCs, it is not possible to place the demonstrative before the RC ((25-a), (25-c) vs. (25-b), (25-d)).

- (25) a. *bir fare kovalayan bu kedi...*  
a mouse chase-NOUN this cat  
b. *\*bu bir fare kovalayan kedi...*  
this a mouse chase-NOUN cat  
'this cat chasing a mouse'  
c. *bir kanapede uyuyan bu kedi...*  
a couch-LOC sleep-NOUN this cat  
d. *\*bu bir kanapede uyuyan kedi...*  
this a couch-LOC sleepNOUN cat  
'this cat sleeping on a couch'

A length effect would be in favor of a memory-based effect for modified DPs, which was one hypothesis for participles but not borne out in this thesis. Note, however, that judgments differ for this construction and that there may be subtle differences in meaning, e.g. a preference for restrictive or non-restrictive interpretation depending on the position of the demonstrative. Furthermore, DPs that begin with a demonstrative may cause a garden-path effect because they can already serve as a complete sentence (e.g. in (25-b): *This is the cat that chases the mouse.*).

In Japanese RCs, the form of the verb is the same as in a main clause and there is no RC marker except for the prenominal position. Furthermore, all constructions that can be expressed in a main clause can occur in an RC, including embedded clauses (see Kuno, 1975). The lack of differences between the verb form in RCs and main clauses, as well as the fact there is only one way to express a sentential modifier, suggest that there should not be a difference between verbs with or without an object. As in Turkish, Japanese has a demonstrative which can occur before or after the RC. According to Ishizuka (2008), the placement correlates with restrictiveness,

hence it is unclear whether modifier length could play a role, as hypothesized for Turkish.

# Chapter 8

## Conclusion

In this thesis, sentential prenominal participle constructions were investigated from a processing perspective. The aim was to test experimentally how different kinds of complexity affect the acceptability and online comprehension of the construction. RCs were used as a comparison, as they express the same content. A different effect of complexity for participle constructions than for RCs was expected for two different reasons:

(i) Present participles are embedded in the DP, as they occur between a determiner and a noun. In contrast, RCs are postnominal. The difference in the position leads to a non-local dependency and an additional level of embedding. The data from the experimental studies in this thesis show that nouns modified by extended participle phrases are less acceptable and have longer RTs than those modified by corresponding RCs. However, the results did not provide evidence that processing load increases with increasing length of the modifier or an additional level of embedding, as would have been predicted by memory-based theories like the DLT (Gibson, 2000).

(ii) The second difference is finiteness: present participles are considered infinite verb forms whereas RCs contain a finite verb. Furthermore, participles are considered ‘hybrids’ between verb and adjective (Fuhrhop and Teuber, 2000; Lübke and Rapp, 2011). The assumption in this thesis is that sentential properties such as a direct object are more problematic for participle constructions than for RCs due to this double role.

The following experiments were conducted to test how complexity affects the processing of the constructions. Two acceptability judgment questionnaires tested length and the presence or absence of a direct object for prenominal participles

and RCs. In Experiment 1, the object was modified and in Experiment 2, the subject. While there was a tendency for shorter prenominal modifiers to obtain higher ratings than longer ones, contrary to RCs where there was no difference or rather the opposite, the only significant difference was the presence versus the absence of a direct object. For prenominal modifiers, an accusative DP inside the modifier phrase lead to significantly lower ratings, which was not the case for RCs. Overall, modifiers that consisted only of a present participle were rated as good as RCs, but extended modifier phrases received lower ratings.

Both the presence or absence of an accusative object and the modifier length were further investigated in online reading experiments. Experiment 3 focused on the effect of a direct object in SPR. Verbs that allow transitive and intransitive use were combined with either an argument or an adjunct. The experiment yielded higher RTs for participle phrases containing an object than for those with an adjunct. This effect was not observed for corresponding RC verbs, suggesting that the presence of an accusative object affects only the processing of participles. I assume that the effect occurs because the participle has verbal and adjectival properties; verbal with respect to its internal structure and adjectival with respect to the head noun (Fuhrhop and Teuber, 2000; Lübbe and Rapp, 2011; Lowe, 2020). A verbal structure that diverges more from typical adjectives is more difficult to combine with the adjectival properties. This could either be the presence of arguments itself or a change in the event structure. An alternative explanation could be the lower frequency of accusative DPs occurring with adjectival elements (Weber 1971; Fanselow 1986, see also the corpus data in Chapter 4).

Experiment 4 manipulated the modifier length, again using SPR. Instead of processing difficulties with increasing length, the longer prenominal modifier resulted in faster RTs at the head noun, indicating an anti-locality effect. For RCs, there were no effects, but the head noun, which in this case preceded the modifier, was processed faster. A follow-up eye-tracking during reading experiment, Experiment 5, replicated the results with the difference that the anti-locality effect could be observed at the participle instead of the noun. Again, no such effect occurred for the RCs, also not at the RC verb. The anti-locality effect is in line with previous findings, in particular for head-final constructions (e.g. Konieczny, 2000; Konieczny and Döring, 2003; Demberg and Keller, 2008).

The last two experiments were acceptability judgment questionnaires that investigated how an additional level of embedding affects participles and RCs. I

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assumed that the storage cost component of the DLT would predict that multiple embedding is more difficult for participle phrases than for corresponding RCs. However, this prediction was not borne out. In Experiment 6, there was no difference between double embedded participle phrases and single embedded modifiers of the same length, while for RCs the additional embedding lead to a decrease of the ratings. In Experiment 7, the additional embedding also had an effect on participle phrases, but the effect was smaller than for RCs. In both experiments, the extended participle phrases received overall lower ratings than RCs. The experiments showed that embedding can also affect prenominal modifiers, but only under certain circumstances, and that the results do not completely reflect the predicted storage costs. The reason for this could either be that additional processing mechanisms, like the role of predictions or shallow parsing, need to be considered more or that the storage costs need to be calculated in a different way due to the double role of the participle as verb and adjective.

The results do not completely support the predictions by the DLT, but they are in line with other processing accounts like experience-based theories. The finding that transitivity affects present participles in a different way than (finite) RC verbs is particularly interesting and needs to be investigated further in future research. In this thesis, I assume that the reason is the combination of verbal and adjectival properties of the participle. If this is the case, it should be possible to observe similar effects for the processing of other mixed categories, e.g. deverbal nouns (see Manouilidou, 2006) and for participles in other languages.

Although this thesis investigated several aspects of the processing of prenominal present participles and corresponding RCs, there are still several open questions.

(i) The experiments testing the internal structure of the modifier focused only on accusative objects. Future research concentrating on dative and prepositional objects as well could provide further evidence for the explanation that the hybrid nature of the participle leads to difficulties when it is combined with an argument.

(ii) Information structure and restrictiveness could not be investigated in the scope of this dissertation. It has been suggested that contextual factors influence the choice of prenominal attributes or RCs and are likely to contribute to the predictability and therefore the comprehension of either of these constructions. Future experiments that take context into account would complete the findings observed in this thesis.



(iii) Memory-based effects due to the different positions of the construction could be investigated further: in this thesis, I focused on modifier length as defined by the DLT. However, other aspects like the similarity of intervening material could play a role as well (see e.g. Gordon et al., 2001; Lewis and Vasishth, 2005). Experiment 6 suggests that animacy and definiteness could affect the processing of the construction.

(iv) One explanation for part of the data is that the information inside the prenominal participle phrase is processed in a more shallow way, as described in the general discussion (Chapter 7). A further investigation of this aspect would be interesting on the one hand for processing theories, as there could be a connection between the accessibility of certain constructions and the attention of participants. On the other hand, if readers are less likely to process the information inside sentential prenominal attributes correctly, this also has practical implications, e.g. that it recommends expressing important information in an RC instead.

(v) This thesis focused only on German. A comparison of the data either with findings for languages that only have prenominal modifiers or languages that have both variants would help complete the picture, in particular concerning the presence of arguments as mentioned above.

(vi) Extended prenominal attributes are a written language phenomenon (Weber, 1971, 1994). This suggests that they lead to more processing difficulties in spoken language. Hence, it would be insightful to investigate effects of modifier length, transitivity and embedding using auditory stimuli. In addition, research on the choice of pre- versus postnominal modification was, to my knowledge, mainly based on corpus data and translation studies. Therefore, it would be interesting to see how production data from experiments relate to the findings about the comprehension of the two constructions.

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# Appendix A

## Appendix – Experiment 1

### Experimental items (Experiment 1)

- (1) a. *Frank will die bastelnde Tochter jetzt langsam abholen.*  
Frank wants the handcrafting daughter now slowly pick up
- b. *Frank will die in der Kita bastelnde Tochter jetzt langsam abholen.*  
Frank wants the in the kindergarden handcrafting daughter now slowly pick up
- c. *Frank will die einen Kalender bastelnde Tochter jetzt langsam abholen.*  
Frank wants the a calendar handcrafting daughter now slowly pick up
- d. *Frank will die in der Kita einen Kalender bastelnde Tochter jetzt langsam abholen.*  
Frank wants the in the kindergarden a calendar handcrafting daughter now slowly pick up
- e. *Frank will die Tochter, die bastelt, jetzt langsam abholen.*  
Frank wants the daughter who handcrafts now slowly pick up
- f. *Frank will die Tochter, die in der Kita bastelt, jetzt langsam abholen.*  
Frank wants the daughter who in the kindergarden handcrafts now slowly pick up
- g. *Frank will die Tochter, die einen Kalender bastelt, jetzt langsam abholen.*  
Frank wants the daughter who a calendar handcrafts now slowly pick up
- h. *Frank will die Tochter, die in der Kita einen Kalender bastelt, jetzt langsam abholen.*  
Frank wants the daughter who in the kindergarden a calendar handcrafts now slowly pick up  
'Frank wants to pick up his daughter soon who is handcrafting (a calendar) (in the kindergarden)'
- (2) a. *Erik will die putzende Tante jetzt gleich anrufen.*  
Erik wants the cleaning aunt now soon call
- b. *Erik will die seit einer Weile putzende Tante jetzt gleich anrufen.*  
Erik wants the for a while cleaning aunt now soon call
- c. *Erik will die ein Regal putzende Tante jetzt gleich anrufen.*  
Erik wants the a shelf cleaning aunt now soon call

- d. *Erik will die seit einer Weile ein Regal putzende Tante jetzt gleich anrufen.*  
Erik wants the for a while a shelf cleaning aunt now soon call
- e. *Erik will die Tante, die putzt, jetzt gleich anrufen.*  
Erik wants the aunt who cleans now soon call
- f. *Erik will die Tante, die seit einer Weile putzt, jetzt gleich anrufen.*  
Erik wants the aunt who for a while cleans now soon call
- g. *Erik will die Tante, die ein Regal putzt, jetzt gleich anrufen.*  
Erik wants the aunt who a shelf cleans now soon call
- h. *Erik will die Tante, die seit einer Weile ein Regal putzt, jetzt gleich anrufen.*  
Erik wants the aunt who for a while a shelf cleans now soon call  
'Erik wants to call his aunt who has been cleaning (a shelf) (for a while) right now'
- (3) a. *Lisa soll die malende Nichte demnächst wieder betreuen.*  
Lisa should the drawing niece soon again look after
- b. *Lisa soll die im Wohnzimmer malende Nichte demnächst wieder betreuen.*  
Lisa should the in-the living room drawing niece soon again look after
- c. *Lisa soll die ein Bild malende Nichte demnächst wieder betreuen.*  
Lisa should the a picture drawing niece soon again look after
- d. *Lisa soll die im Wohnzimmer ein Bild malende Nichte demnächst wieder betreuen.*  
Lisa should the in-the living room a picture drawing niece soon again look after
- e. *Lisa soll die Nichte, die malt, demnächst wieder betreuen.*  
Lisa should the niece who draws soon again look after
- f. *Lisa soll die Nichte, die im Wohnzimmer malt, demnächst wieder betreuen.*  
Lisa should the niece who in-the living room draws soon again look after
- g. *Lisa soll die Nichte, die ein Bild malt, demnächst wieder betreuen.*  
Lisa should the niece who a picture draws soon again look after
- h. *Lisa soll die Nichte, die im Wohnzimmer ein Bild malt, demnächst wieder betreuen.*  
Lisa should the niece who in-the living room a picture draws soon again look after  
'Lisa should soon again look after the niece who is painting (a picture) (in the living room).'
- (4) a. *Harald muss den aufräumenden Angestellten wahrscheinlich bald entlassen.*  
Harald must the tidying up clerk probably soon fire
- b. *Harald muss den seit zwei Stunden aufräumenden Angestellten wahrscheinlich bald entlassen.*  
Harald must the for two hours tidying up clerk probably soon fire
- c. *Harald muss den einen Papierstapel aufräumenden Angestellten wahrscheinlich bald entlassen.*  
Harald must the a pile of papers tidying up clerk probably soon fire

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- d. *Harald muss den seit zwei Stunden einen Papierstapel aufräumenden Angestellten*  
 Harald must the for two hours a pile of papers tidying up clerk  
*wahrscheinlich bald entlassen.*  
 probably soon fire
- e. *Harald muss den Angestellten, der aufräumt, wahrscheinlich bald entlassen.*  
 Harald must the clerk who tidies up probably soon fire
- f. *Harald muss den Angestellten, der seit zwei Stunden aufräumt, wahrscheinlich bald*  
 Harald must the clerk who for two hours tidies up probably soon  
*entlassen.*  
 fire
- g. *Harald muss den Angestellten, der einen Papierstapel aufräumt, wahrscheinlich*  
 Harald must the clerk who a pile of papers tidies up probably  
*bald entlassen.*  
 soon fire
- h. *Harald muss den Angestellten, der seit zwei Stunden einen Papierstapel aufräumt,*  
 Harald must the clerk who for two hours a pile of papers tidies up  
*wahrscheinlich bald entlassen.*  
 probably soon fire  
 ‘Harald will probably soon have to fire the clerk who has been tidying up (a pile of  
 papers) (for two hours).’
- (5) a. *Christine hat den essenden Jungen schon irgendwo gesehen.*  
 Christine has the eating boy already somewhere seen
- b. *Christine hat den im Park essenden Jungen schon irgendwo gesehen.*  
 Christine has the in-the park eating boy already somewhere seen
- c. *Christine hat den ein Eis essenden Jungen schon irgendwo gesehen.*  
 Christine has the an ice cream eating boy already somewhere seen
- d. *Christine hat den im Park ein Eis essenden Jungen schon irgendwo*  
 Christine has the in-the park an ice cream eating boy already somewhere  
*gesehen.*  
 seen
- e. *Christine hat den Jungen, der isst, schon irgendwo gesehen.*  
 Christine has the boy who eats already somewhere seen
- f. *Christine hat den Jungen, der im Park isst, schon irgendwo gesehen.*  
 Christine has the boy who in-the park eats already somewhere seen
- g. *Christine hat den Jungen, der ein Eis isst, schon irgendwo gesehen.*  
 Christine has the boy who an ice cream eats already somewhere seen
- h. *Christine hat den Jungen, der im Park ein Eis isst, schon irgendwo*  
 Christine has the boy who in-the park an ice cream eats already somewhere  
*gesehen.*  
 seen  
 ‘Christine has already seen the boy who is eating (ice cream) (in the park) somewhere’
- (6) a. *Paul hat den lesenden Rentner ganz schön beneidet.*  
 Paul has the reading retiree quite pretty envied
- b. *Paul hat den auf der Liege lesenden Rentner ganz schön beneidet.*  
 Paul has the on the recliner reading retiree quite pretty envied



- c. *Paul hat den ein Buch lesenden Rentner ganz schön beneidet.*  
Paul has the a book reading retiree quite pretty envied
- d. *Paul hat den auf der Liege ein Buch lesenden Rentner ganz schön beneidet.*  
Paul has the on the recliner a book reading retiree quite pretty envied
- e. *Paul hat den Rentner, der liest, ganz schön beneidet.*  
Paul has the retiree who reads quite pretty envied
- f. *Paul hat den Rentner, der auf der Liege liest, ganz schön beneidet.*  
Paul has the retiree who on the recliner reads quite pretty envied
- g. *Paul hat den Rentner, der ein Buch liest, ganz schön beneidet.*  
Paul has the retiree who a book reads quite pretty envied
- h. *Paul hat den Rentner, der auf der Liege ein Buch liest, ganz schön beneidet.*  
Paul has the retiree who on the recliner a book reads quite pretty envied  
'Paul quite envied the retiree who is reading (a book) (on the recliner).'
- (7) a. *Julia will den rauchenden Dozenten später noch treffen.*  
Julia wants the smoking lecturer later still meet
- b. *Julia will den vor der Uni rauchenden Dozenten später noch treffen.*  
Julia wants the in front of the university smoking lecturer later still meet
- c. *Julia will den eine Zigarette rauchenden Dozenten später noch treffen.*  
Julia wants the a cigarette smoking lecturer later still meet
- d. *Julia will den vor der Uni eine Zigarette rauchenden Dozenten später noch treffen.*  
Julia wants the in front of the university a cigarette smoking lecturer later still meet
- e. *Julia will den Dozenten, der raucht, später noch treffen.*  
Julia wants the lecturer who smokes later still meet
- f. *Julia will den Dozenten, der vor der Uni raucht, später noch treffen.*  
Julia wants the lecturer who in front of the university smokes later still meet
- g. *Julia will den Dozenten, der eine Zigarette raucht, später noch treffen.*  
Julia wants the lecturer who a cigarette smokes later still meet
- h. *Julia will den Dozenten, der vor der Uni eine Zigarette raucht, später noch treffen.*  
Julia wants the lecturer who in front of the university a cigarette smokes later still meet  
'Julia wants to meet the lecturer who is smoking (a cigarette) (in front of the university) later.'
- (8) a. *Martin muss den renovierenden Nachbarn doch wirklich hassen.*  
Martin must the renovating neighbor after all really hate
- b. *Martin muss den am Sonntag renovierenden Nachbarn doch wirklich hassen.*  
Martin must the on Sunday renovating neighbor after all really hate
- c. *Martin muss den ein Zimmer renovierenden Nachbarn doch wirklich hassen.*  
Martin must the a room renovating neighbor after all really hate
- d. *Martin muss den am Sonntag ein Zimmer renovierenden Nachbarn doch wirklich hassen.*  
Martin must the on Sunday a room renovating neighbor after all really hate

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- e. *Martin muss den Nachbarn, der renoviert, doch wirklich hassen.*  
 Martin must the neighbor who renovates after all really hate
- f. *Martin muss den Nachbarn, der am Sonntag renoviert, doch wirklich hassen.*  
 Martin must the neighbor who on Sunday renovates after all really hate
- g. *Martin muss den Nachbarn, der ein Zimmer renoviert, doch wirklich hassen.*  
 Martin must the neighbor who a room renovates after all really hate
- h. *Martin muss den Nachbarn, der am Sonntag ein Zimmer renoviert, doch wirklich hassen.*  
 Martin must the neighbor who on Sunday a room renovates after all really  
 hate  
 ‘Martin must really hate the neighbor who is renovating (a room) (on Sunday) after  
 all’
- (9) a. *Michaela hat die einkaufende Nachbarin sofort richtig erkannt.*  
 Michaela has the shopping neighbor immediatly correctly identified
- b. *Michaela hat die beim Bäcker einkaufende Nachbarin sofort richtig erkannt.*  
 Michaela has the at-the bakery shopping neighbor immediatly correctly  
 identified
- c. *Michaela hat die ein Brot einkaufende Nachbarin sofort richtig erkannt.*  
 Michaela has the a loaf of bread shopping neighbor immediatly correctly  
 identified
- d. *Michaela hat die beim Bäcker ein Brot einkaufende Nachbarin sofort richtig erkannt.*  
 Michaela has the at-the bakery a loaf of bread shopping neighbor  
 immediatly correctly identified
- e. *Michaela hat die Nachbarin, die einkauft, sofort richtig erkannt.*  
 Michaela has the neighbor who shopped immediatly correctly identified
- f. *Michaela hat die Nachbarin, die beim Bäcker einkauft, sofort richtig erkannt.*  
 Michaela has the neighbor who at-the bakery shopped immediatly correctly  
 identified
- g. *Michaela hat die Nachbarin, die ein Brot einkauft, sofort richtig erkannt.*  
 Michaela has the neighbor who a loaf of bread shopped immediatly correctly  
 identified
- h. *Michaela hat die Nachbarin, die beim Bäcker ein Brot einkauft, sofort richtig erkannt.*  
 Michaela has the neighbor who at-the bakery a loaf of bread shopped  
 immediatly correctly identified  
 ‘Michaela immediatly correctly identified the neighbor who is shopping (a loaf of bread)  
 (at the bakery).’
- (10) a. *Laura will den kündigenden Architekten noch etwas beruhigen.*  
 Laura wants the quitting architect still a little calm down

- b. *Laura will den aus Frust kündigenden Architekten noch etwas beruhigen.*  
 Laura wants the out of frustration quitting architect still a little calm down
- c. *Laura will den einen Bürojob kündigenden Architekten noch etwas beruhigen.*  
 Laura wants the out of frustration an office job quitting architect  
 still a little calm down
- d. *Laura will den aus Frust einen Bürojob kündigenden Architekten noch etwas beruhigen.*  
 Laura wants the out of frustration an office job quitting architect still  
 a little calm down
- e. *Laura will den Architekten, der kündigt, noch etwas beruhigen.*  
 Laura wants the architect who quits still a little calm down
- f. *Laura will den Architekten, der aus Frust kündigt, noch etwas beruhigen.*  
 Laura wants the architect who out of frustration quits still a little  
 calm down
- g. *Laura will den Architekten, der einen Bürojob kündigt, noch etwas beruhigen.*  
 Laura wants the architect who an office job quits still a little calm down
- h. *Laura will den Architekten, der aus Frust einen Bürojob kündigt, noch etwas beruhigen.*  
 Laura wants the architect who out of frustration an office job quits still  
 a little calm down  
 ‘Laura still wants to calm down a little the architect who is quitting (an office job)  
 (out of frustration).’
- (11) a. *Diana hat die studierende Bekannte länger nicht gesehen.*  
 Diana has the studying acquaintance for some time not seen
- b. *Diana hat die in der Hauptstadt studierende Bekannte länger nicht gesehen.*  
 Diana has the in the capital studying acquaintance for some time not  
 seen
- c. *Diana hat die eine Naturwissenschaft studierende Bekannte länger nicht gesehen.*  
 Diana has the a natural science studying acquaintance for some time not  
 seen
- d. *Diana hat die in der Hauptstadt eine Naturwissenschaft studierende Bekannte länger nicht gesehen.*  
 Diana has the in the capital a natural science studying acquaintance  
 for some time not seen
- e. *Diana hat die Bekannte, die studiert, länger nicht gesehen.*  
 Diana has the acquaintance who studies for some time not seen
- f. *Diana hat die Bekannte, die in der Hauptstadt studiert, länger nicht gesehen.*  
 Diana has the acquaintance who in the capital studies for some time not  
 seen

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- g. *Diana hat die Bekannte, die eine Naturwissenschaft studiert, länger nicht gesehen.*  
 Diana has the acquaintance who a natural science studies for some time  
 not seen
- h. *Diana hat die Bekannte, die in der Hauptstadt eine Naturwissenschaft studiert, länger nicht gesehen.*  
 Diana has the acquaintance who in the capital a natural science studies  
 for some time not seen  
 ‘Diana has not seen the acquaintance for some time who is studying (a natural science) (in the capital).’
- (12) a. *Heinz muss den spielenden Enkel leider früh heimbringen.*  
 Heinz must the playing grandson unfortunately early bring home
- b. *Heinz muss den mit der Schwester spielenden Enkel leider früh heimbringen.*  
 Heinz must the with the sister playing grandson unfortunately early  
 bring home
- c. *Heinz muss den ein Videospiel spielenden Enkel leider früh heimbringen.*  
 Heinz must the a video game playing grandson unfortunately early  
 bring home
- d. *Heinz muss den mit der Schwester ein Videospiel spielenden Enkel leider früh heimbringen.*  
 Heinz must the with the sister a video game playing grandson  
 unfortunately early bring home
- e. *Heinz muss den Enkel, der spielt, leider früh heimbringen.*  
 Heinz must the grandson who plays unfortunately early bring home
- f. *Heinz muss den Enkel, der mit der Schwester spielt, leider früh heimbringen.*  
 Heinz must the grandson who with the sister plays unfortunately early  
 bring home
- g. *Heinz muss den Enkel, der ein Videospiel spielt, leider früh heimbringen.*  
 Heinz must the grandson who a video game plays unfortunately early  
 bring home
- h. *Heinz muss den Enkel, der mit der Schwester ein Videospiel spielt, leider früh heimbringen.*  
 Heinz must the grandson who with the sister a video game plays  
 unfortunately early bring home  
 ‘Unfortunately, Heinz has to bring the grandson home early who is playing (a video game) (with the sister).’
- (13) a. *Andreas will den betenden Mönch besser nicht stören.*  
 Andreas wants the praying monk better not disturb
- b. *Andreas will den vor dem Gottesdienst betenden Mönch besser nicht stören.*  
 Andreas wants the before the service praying monk better not disturb
- c. *Andreas will den einen Rosenkranz betenden Mönch besser nicht stören.*  
 Andreas wants the a rosary praying monk better not disturb

- d. *Andreas will den vor dem Gottesdienst einen Rosenkranz betenden Mönch*  
 Andreas wants the before the service a rosary praying monk  
*besser nicht stören.*  
 better not disturb
- e. *Andreas will den Mönch, der betet, besser nicht stören.*  
 Andreas wants the monk who prays better not disturb
- f. *Andreas will den Mönch, der vor dem Gottesdienst betet, besser nicht stören.*  
 Andreas wants the monk who before the service prays better not disturb
- g. *Andreas will den Mönch, der einen Rosenkranz betet, besser nicht stören.*  
 Andreas wants the monk who a rosary prays better not disturb
- h. *Andreas will den Mönch, der vor dem Gottesdienst einen Rosenkranz betet,*  
 Andreas wants the monk who before the service a rosary prays  
*besser nicht stören.*  
 better not disturb  
 ‘Andreas does not want to disturb the monk who is praying (a rosary) (before the service).’
- (14) a. *Jasmin hätte die tippende Jugendliche doch fast überfahren.*  
 Jasmin had the typing teenager yet almost ran over
- b. *Jasmin hätte die auf dem Smartphone tippende Jugendliche doch fast überfahren.*  
 Jasmin had the on the smartphone typing teenager yet almost ran over
- c. *Jasmin hätte die eine Nachricht tippende Jugendliche doch fast überfahren.*  
 Jasmin had the a message typing teenager yet almost ran over
- d. *Jasmin hätte die auf dem Smartphone eine Nachricht tippende Jugendliche doch fast überfahren.*  
 Jasmin had the on the smartphone a message typing teenager yet almost ran over
- e. *Jasmin hätte die Jugendliche, die tippt, doch fast überfahren.*  
 Jasmin had the teenager who types yet almost ran over
- f. *Jasmin hätte die Jugendliche, die auf dem Smartphone tippt, doch fast überfahren.*  
 Jasmin had the teenager who on the smartphone types yet almost ran over
- g. *Jasmin hätte die Jugendliche, die eine Nachricht tippt, doch fast überfahren.*  
 Jasmin had the teenager who a message types yet almost ran over
- h. *Jasmin hätte die Jugendliche, die auf dem Smartphone eine Nachricht tippt, doch fast überfahren.*  
 Jasmin had the teenager who on the smartphone a message types yet almost ran over  
 ‘Jasmin almost ran over the teenager who is typing (a message) (on her smartphone).’
- (15) a. *Anna hat die unterrichtende Referendarin gleich gerne gemocht.*  
 Anna has the teaching trainee teacher immediately much liked
- b. *Anna hat die seit einer Woche unterrichtende Referendarin gleich gerne gemocht.*  
 Anna has the since a week teaching trainee teacher immediately much liked

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- c. *Anna hat die ein Wahlfach unterrichtende Referendarin gleich gerne gemocht.*  
 Anna has the an elective subject teaching trainee teacher immediately much liked
- d. *Anna hat die seit einer Woche ein Wahlfach unterrichtende Referendarin gleich gerne gemocht.*  
 Anna has the since a week an elective subject teaching trainee teacher immediately much liked
- e. *Anna hat die Referendarin, die unterrichtet, gleich gerne gemocht.*  
 Anna has the trainee teacher who teaches immediately much liked
- f. *Anna hat die Referendarin, die seit einer Woche unterrichtet, gleich gerne gemocht.*  
 Anna has the trainee teacher who since a week teaches immediately much liked
- g. *Anna hat die Referendarin, die ein Wahlfach unterrichtet, gleich gerne gemocht.*  
 Anna has the trainee teacher who an elective subject teaches immediately much liked
- h. *Anna hat die Referendarin, die seit einer Woche ein Wahlfach unterrichtet, gleich gerne gemocht.*  
 Anna has the trainee teacher who since a week an elective subject teaches immediately much liked  
 ‘Anna immediately liked the trainee teacher who has been teaching (an elective subject) (for a week).’
- (16) a. *Ingrid will die backende Nachbarin später noch besuchen.*  
 Ingrid wants the baking neighbor later still visit
- b. *Ingrid will die am Vormittag backende Nachbarin später noch besuchen.*  
 Ingrid wants the in-the morning baking neighbor later still visit
- c. *Ingrid will die einen Apfelkuchen backende Nachbarin später noch besuchen.*  
 Ingrid wants the an apple pie baking neighbor later still visit
- d. *Ingrid will die am Vormittag einen Apfelkuchen backende Nachbarin später noch besuchen.*  
 Ingrid wants the in-the morning an apple pie baking neighbor later still visit
- e. *Ingrid will die Nachbarin, die backt, später noch besuchen.*  
 Ingrid wants the neighbor who bakes later still visit
- f. *Ingrid will die Nachbarin, die am Vormittag backt, später noch besuchen.*  
 Ingrid wants the neighbor who in-the morning bakes later still visit
- g. *Ingrid will die Nachbarin, die einen Apfelkuchen backt, später noch besuchen.*  
 Ingrid wants the neighbor who an apple pie bakes later still visit
- h. *Ingrid will die Nachbarin, die am Vormittag einen Apfelkuchen backt, später noch besuchen.*  
 Ingrid wants the neighbor who in-the morning an apple pie bakes later still visit  
 ‘Later, Ingrid wants to visit the neighbor who is baking (an apple pie) (in the morning).’

- (17) a. *Clara kann die abhörende Agentin überhaupt nicht leiden.*  
Clara can the listening to agent at all not stand
- b. *Clara kann die im Nebenraum abhörende Agentin überhaupt nicht leiden.*  
Clara can the in-the next room listening to agent at all not stand
- c. *Clara kann die ein Telefonat abhörende Agentin überhaupt nicht leiden.*  
Clara can the a phone call listening to agent at all not stand
- d. *Clara kann die im Nebenraum ein Telefonat abhörende Agentin überhaupt nicht leiden.*  
Clara can the in-the next room a phone call listening to agent at all  
nicht leiden.  
not stand
- e. *Clara kann die Agentin, die abhört, überhaupt nicht leiden.*  
Clara can the agent who listens to at all not stand
- f. *Clara kann die Agentin, die im Nebenraum abhört, überhaupt nicht leiden.*  
Clara can the agent who in-the next room listens to at all not stand
- g. *Clara kann die Agentin, die ein Telefonat abhört, überhaupt nicht leiden.*  
Clara can the agent who a phone call listens to at all not stand
- h. *Clara kann die Agentin, die im Nebenraum ein Telefonat abhört, überhaupt nicht leiden.*  
Clara can the agent who in-the next room a phone call listens to at all  
nicht leiden.  
not stand  
'Clara doesn't like the agent at all who is listening (to a phone call) (in the next room).'
- (18) a. *Sandra will den spülenden Onkel gerade nicht stören.*  
Sandra wants the (dish-)washing uncle right now not disturb
- b. *Sandra will den nach der Party spülenden Onkel gerade nicht stören.*  
Sandra wants the after the party (dish-)washing uncle right now not disturb
- c. *Sandra will den eine Schüssel spülenden Onkel gerade nicht stören.*  
Sandra wants the a bowl washing uncle right now not disturb
- d. *Sandra will den nach der Party eine Schüssel spülenden Onkel gerade nicht stören.*  
Sandra wants the after the party a bowl washing uncle right now not  
stören.  
disturb
- e. *Sandra will den Onkel, der spült, gerade nicht stören.*  
Sandra wants the uncle who (dish-)washes right now not disturb
- f. *Sandra will den Onkel, der nach der Party spült, gerade nicht stören.*  
Sandra wants the uncle who after the party (dish-)washes right now not disturb
- g. *Sandra will den Onkel, der eine Schüssel spült, gerade nicht stören.*  
Sandra wants the uncle who a bowl washes right now not disturb
- h. *Sandra will den Onkel, der nach der Party eine Schüssel spült, gerade nicht stören.*  
Sandra wants the uncle who after the party a bowl washes right now not  
stören.  
disturb  
'Sandra does not want to disturb the uncle who is washing (a bowl) (after the party) right now.'

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- (19) a. *Fabian will den korrigierenden Dozenten noch einmal sprechen.*  
 Fabian wants the correcting lecturer again speak
- b. *Fabian will den zum ersten Mal korrigierenden Dozenten noch einmal sprechen.*  
 Fabian wants the for-the first time correcting lecturer again speak
- c. *Fabian will den eine Klausur korrigierenden Dozenten noch einmal sprechen.*  
 Fabian wants the an exam correcting lecturer again speak
- d. *Fabian will den zum ersten Mal eine Klausur korrigierenden Dozenten noch einmal sprechen.*  
 Fabian wants the for-the first time an exam correcting lecturer again speak
- e. *Fabian will den Dozenten, der korrigiert, noch einmal sprechen.*  
 Fabian wants the lecturer who corrects again speak
- f. *Fabian will den Dozenten, der zum ersten Mal korrigiert, noch einmal sprechen.*  
 Fabian wants the lecturer who for-the first time corrects again speak
- g. *Fabian will den Dozenten, der eine Klausur korrigiert, noch einmal sprechen.*  
 Fabian wants the lecturer who an exam corrects again speak
- h. *Fabian will den Dozenten, der zum ersten Mal eine Klausur korrigiert, noch einmal sprechen.*  
 Fabian wants the lecturer who for-the first time an exam corrects again speak  
 ‘Fabian wants to speak again to the lecturer who is correcting (an exam) (for the first time).’
- (20) a. *Helena hatte den zeichnenden Künstler ein bisschen beobachtet.*  
 Helena had the drawing artist a bit watched
- b. *Helena hatte den im Museum zeichnenden Künstler ein bisschen beobachtet.*  
 Helena had the in-the museum drawing artist a bit watched
- c. *Helena hatte den eine Statue zeichnenden Künstler ein bisschen beobachtet.*  
 Helena had the a statue drawing artist a bit watched
- d. *Helena hatte den im Museum eine Statue zeichnenden Künstler ein bisschen beobachtet.*  
 Helena had the in-the museum a statue drawing artist a bit watched
- e. *Helena hatte den Künstler, der zeichnet, ein bisschen beobachtet.*  
 Helena had the artist who draws a bit watched
- f. *Helena hatte den Künstler, der im Museum zeichnet, ein bisschen beobachtet.*  
 Helena had the artist who in-the museum draws a bit watched
- g. *Helena hatte den Künstler, der eine Statue zeichnet, ein bisschen beobachtet.*  
 Helena had the artist who a statue draws a bit watched
- h. *Helena hatte den Künstler, der im Museum eine Statue zeichnet, ein bisschen beobachtet.*  
 Helena had the artist who in-the museum a statue draws a bit watched



‘Helena had been watching the artist who is drawing (a statue) (in the museum) for a bit.’

- (21) a. *Christian hatte die fotografierende Reporterin gleich wieder heimgeschickt.*  
Christian had the photographing reporter right back home sent
- b. *Christian hatte die während der Untersuchungen fotografierende Reporterin gleich wieder heimgeschickt.*  
Christian had the during the investigation photographing reporter right back home sent
- c. *Christian hatte die ein Beweismittel fotografierende Reporterin gleich wieder heimgeschickt.*  
Christian had the during the investigation a piece of evidence photographing reporter right back home sent
- d. *Christian hatte die während der Untersuchungen ein Beweismittel fotografierende Reporterin gleich wieder heimgeschickt.*  
Christian had the during the investigation a piece of evidence photographing reporter right backhome sent
- e. *Christian hatte die Reporterin, die fotografierte, gleich wieder heimgeschickt.*  
Christian had the reporter who photographed right back home sent
- f. *Christian hatte die Reporterin, die während der Untersuchungen fotografierte, gleich wieder heimgeschickt.*  
Christian had the reporter who during the investigation photographed right back home sent
- g. *Christian hatte die Reporterin, die ein Beweismittel fotografierte, gleich wieder heimgeschickt.*  
Christian had the reporter who a piece of evidence photographed right back home sent
- h. *Christian hatte die Reporterin, die während der Untersuchungen ein Beweismittel fotografierte, gleich wieder heimgeschickt.*  
Christian had the reporter who during the investigation a piece of evidence photographed right back home sent  
‘Christian had sent the reporter who was photographing (a piece of evidence) (during the investigation) right back home.’
- (22) a. *Leonie hatte die stehlende Jugendliche nur zufällig erwischt.*  
Leonie had the stealing teenager only coincidentally caught
- b. *Leonie hatte die im Supermarkt stehlende Jugendliche nur zufällig erwischt.*  
Leonie had the in-the supermarket stealing teenager only coincidentally caught
- c. *Leonie hatte die einen Kaugummi stehlende Jugendliche nur zufällig erwischt.*  
Leonie had the a chewing gum stealing teenager only coincidentally caught
- d. *Leonie hatte die im Supermarkt einen Kaugummi stehlende Jugendliche nur zufällig erwischt.*  
Leonie had the in-the supermarket a chewing gum stealing teenager only coincidentally caught

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- e. *Leonie hatte die Jugendliche, die stahl, nur zufällig erwischt.*  
 Leonie had the teenager who stole only coincidentally caught
- f. *Leonie hatte die Jugendliche, die im Supermarkt stahl, nur zufällig erwischt.*  
 Leonie had the teenager who in-the supermarket stole only coincidentally caught
- g. *Leonie hatte die Jugendliche, die einen Kaugummi stahl, nur zufällig erwischt.*  
 Leonie had the teenager who a chewing gum stole only coincidentally caught
- h. *Leonie hatte die Jugendliche, die im Supermarkt einen Kaugummi stahl, nur zufällig erwischt.*  
 Leonie had the teenager who in-the supermarket a chewing gum stole only coincidentally caught  
 ‘Leonie had only accidentally caught the teenager who was stealing (a piece of chewing gum) (in the supermarket).’
- (23) a. *Gabi hatte den angelnden Urlauber schon ziemlich bewundert.*  
 Gabi had the fishing vacationer already quite admired
- b. *Gabi hatte den am Fluss angelnden Urlauber schon ziemlich bewundert.*  
 Gabi had the at-the river fishing vacationer already quite admired
- c. *Gabi hatte den eine Forelle angelnden Urlauber schon ziemlich bewundert.*  
 Gabi had the a trout fishing vacationer already quite admired
- d. *Gabi hatte den am Fluss eine Forelle angelnden Urlauber schon ziemlich bewundert.*  
 Gabi had the at-the river a trout fishing vacationer already quite admired
- e. *Gabi hatte den Urlauber, der angelte, schon ziemlich bewundert.*  
 Gabi had the vacationer who fished already quite admired
- f. *Gabi hatte den Urlauber, der am Fluss angelte, schon ziemlich bewundert.*  
 Gabi had the vacationer who at-the river fished already quite admired
- g. *Gabi hatte den Urlauber, der eine Forelle angelte, schon ziemlich bewundert.*  
 Gabi had the vacationer who a trout fished already quite admired
- h. *Gabi hatte den Urlauber, der am Fluss eine Forelle angelte, schon ziemlich bewundert.*  
 Gabi had the vacationer who at-the river a trout fished already quite admired  
 ‘Gabi had quite admired the vacationer who was fishing (for a trout) (at the river).’
- (24) a. *Werner hatte den verlierenden Freund ganz schön ausgelacht.*  
 Werner had the losing friend quite pretty laughed-at
- b. *Werner hatte den in der Kneipe verlierenden Freund ganz schön ausgelacht.*  
 Werner had the in the bar losing friend quite pretty laughed-at
- c. *Werner hatte den ein Pokerspiel verlierenden Freund ganz schön ausgelacht.*  
 Werner had the a poker game losing friend quite pretty laughed-at

- d. *Werner hatte den in der Kneipe ein Pokerspiel verlierenden Freund ganz schön ausgelacht.*  
 Werner had the in the bar a poker game losing friend quite pretty laughed-at
- e. *Werner hatte den Freund, der verlor, ganz schön ausgelacht.*  
 Werner had the friend who lost quite pretty laughed-at
- f. *Werner hatte den Freund, der in der Kneipe verlor, ganz schön ausgelacht.*  
 Werner had the friend who in the bar lost quite pretty laughed-at
- g. *Werner hatte den Freund, der ein Pokerspiel verlor, ganz schön ausgelacht.*  
 Werner had the friend who a poker game lost quite pretty laughed-at
- h. *Werner hatte den Freund, der in der Kneipe ein Pokerspiel verlor, ganz schön ausgelacht.*  
 laughed-at  
 ‘Werner had laughed quite hard at the friend who was losing (a poker game) (in the pub).’
- (25) a. *Basti hatte die tanzende Cousine irgendwie kaum beachtet.*  
 Basti had the dancing cousin somehow barely noticed
- b. *Basti hatte die bei der Hochzeit tanzende Cousine irgendwie kaum beachtet.*  
 Basti had the at the wedding dancing cousin somehow barely noticed
- c. *Basti hatte die einen Walzer tanzende Cousine irgendwie kaum beachtet.*  
 Basti had the a waltz dancing cousin somehow barely noticed
- d. *Basti hatte die bei der Hochzeit einen Walzer tanzende Cousine irgendwie kaum beachtet.*  
 Basti had the at the wedding a waltz dancing cousin somehow barely noticed  
 noticed
- e. *Basti hatte die Cousine, die tanzte, irgendwie kaum beachtet.*  
 Basti had the cousin who danced somehow barely noticed
- f. *Basti hatte die Cousine, die bei der Hochzeit tanzte, irgendwie kaum beachtet.*  
 Basti had the cousin who at the wedding danced somehow barely noticed
- g. *Basti hatte die Cousine, die einen Walzer tanzte, irgendwie kaum beachtet.*  
 Basti had the cousin who a waltz danced somehow barely noticed
- h. *Basti hatte die Cousine, die bei der Hochzeit einen Walzer tanzte, irgendwie kaum beachtet.*  
 Basti had the cousin who at the wedding a waltz danced somehow barely noticed  
 noticed  
 ‘Basti had somehow barely noticed the cousin who was dancing (a waltz) (at the wedding).’
- (26) a. *Fritz hatte die singende Dame sehr gut gefunden.*  
 Fritz had the singing lady very good found
- b. *Fritz hatte die im Bierzelt singende Dame sehr gut gefunden.*  
 Fritz had the in-the beer tent singing lady very good found
- c. *Fritz hatte die ein Lied singende Dame sehr gut gefunden.*  
 Fritz had the a song singing lady very good found

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- d. *Fritz hatte die im Bierzelt ein Lied singende Dame sehr gut gefunden.*  
 Fritz had the in-the beer tent a song singing lady very good found
- e. *Fritz hatte die Dame, die sang, sehr gut gefunden.*  
 Fritz had the lady who sang very good found
- f. *Fritz hatte die Dame, die im Bierzelt sang, sehr gut gefunden.*  
 Fritz had the lady who in-the beer tent sang very good found
- g. *Fritz hatte die Dame, die ein Lied sang, sehr gut gefunden.*  
 Fritz had the lady who a song sang very good found
- h. *Fritz hatte die Dame, die im Bierzelt ein Lied sang, sehr gut gefunden.*  
 Fritz had the lady who in-the beer tent a song sang very good found  
 ‘Fritz had liked the lady who was singing (a song) (in the beer tent).’
- (27) a. *Mia hatte die bügelnde Oma ganz schön abgelenkt.*  
 Mia had the ironing grandma quite distracted
- b. *Mia hatte die im Wohnzimmer bügelnde Oma ganz schön abgelenkt.*  
 Mia had the in-the living room ironing grandma quite distracted
- c. *Mia hatte die ein Hemd bügelnde Oma ganz schön abgelenkt.*  
 Mia had the a shirt ironing grandma quite distracted
- d. *Mia hatte die im Wohnzimmer ein Hemd bügelnde Oma ganz schön abgelenkt.*  
 Mia had the in-the living room a shirt ironing grandma quite  
 distracted  
 distracted
- e. *Mia hatte die Oma, die bügelte, ganz schön abgelenkt.*  
 Mia had the grandma who ironed quite distracted
- f. *Mia hatte die Oma, die im Wohnzimmer bügelte, ganz schön abgelenkt.*  
 Mia had the grandma who in-the living room ironed quite distracted
- g. *Mia hatte die Oma, die ein Hemd bügelte, ganz schön abgelenkt.*  
 Mia had the grandma who a shirt ironed quite distracted
- h. *Mia hatte die Oma, die im Wohnzimmer ein Hemd bügelte, ganz schön abgelenkt.*  
 Mia had the grandma who in-the living room a shirt ironed quite  
 distracted  
 distracted  
 ‘Mia had quite distracted the grandma who was ironing (a shirt) (in the living) room.’
- (28) a. *Emilie hatte den lernenden Schüler wohl ziemlich genervt.*  
 Emilie had the learning student probably quite annoyed
- b. *Emilie hatte den in der Küche lernenden Schüler wohl ziemlich genervt.*  
 Emilie had the in the kitchen learning student probably quite annoyed
- c. *Emilie hatte den ein Gedicht lernenden Schüler wohl ziemlich genervt.*  
 Emilie had the a poem learning student probably quite annoyed
- d. *Emilie hatte den in der Küche ein Gedicht lernenden Schüler wohl ziemlich genervt.*  
 Emilie had the in the kitchen a poem learning student probably quite  
 annoyed  
 annoyed
- e. *Emilie hatte den Schüler, der lernte, wohl ziemlich genervt.*  
 Emilie had the student who learned probably quite annoyed

- f. *Emilie hatte den Schüler, der in der Küche lernte, wohl ziemlich genervt.*  
Emilie had the student who in the kitchen learned probably quite annoyed
- g. *Emilie hatte den Schüler, der ein Gedicht lernte, wohl ziemlich genervt.*  
Emilie had the student who a poem learned probably quite annoyed
- h. *Emilie hatte den Schüler, der in der Küche ein Gedicht lernte, wohl ziemlich genervt.*  
Emilie had the student who in the kitchen a poem learned probably quite annoyed  
'Emilie had probably been quite annoying to the student who was learning (a poem) (in the kitchen).'
- (29) a. *Philipp konnte die gestehende Verdächtige dann sofort festnehmen.*  
Philipp could the confessing suspect then immediatly arrest
- b. *Philipp konnte die nach kurzer Befragung gestehende Verdächtige dann sofort festnehmen.*  
Philipp could the after brief questioning confessing suspect then immediatly arrest
- c. *Philipp konnte die einen Diebstahl gestehende Verdächtige dann sofort festnehmen.*  
Philipp could the a theft confessing suspect then immediatly arrest
- d. *Philipp konnte die nach kurzer Befragung einen Diebstahl gestehende Verdächtige dann sofort festnehmen.*  
Philipp could the after brief questioning a theft confessing suspect then immediatly arrest
- e. *Philipp konnte die Verdächtige, die gestand, dann sofort festnehmen.*  
Philipp could the suspect who confessed then immediatly arrest
- f. *Philipp konnte die Verdächtige, die nach kurzer Befragung gestand, dann sofort festnehmen.*  
Philipp could the suspect who after brief questioning confessed then immediatly arrest
- g. *Philipp konnte die Verdächtige, die einen Diebstahl gestand, dann sofort festnehmen.*  
Philipp could the suspect who a theft confessed then immediatly arrest
- h. *Philipp konnte die Verdächtige, die nach kurzer Befragung einen Diebstahl gestand, dann sofort festnehmen.*  
Philipp could the suspect who after brief questioning a theft confessed then immediatly arrest  
'Philipp was then able to immediately arrest the suspect who was confessing (to theft) (after brief questioning).'
- (30) a. *Julius musste die fahrende Rentnerin noch etwas beruhigen.*  
Julius must the driving pensioner still a little calm down
- b. *Julius musste die auf der Landstraße fahrende Rentnerin noch etwas beruhigen.*  
Julius must the on the country road driving pensioner still a little calm down

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- c. *Julius musste die einen Mercedes fahrende Rentnerin noch etwas beruhigen.*  
 Julius must the a Mercedes driving pensioner still a little calm down
- d. *Julius musste die auf der Landstraße einen Mercedes fahrende Rentnerin noch etwas beruhigen.*  
 Julius must the on the country road a Mercedes driving pensioner still a little calm down
- e. *Julius musste die Rentnerin, die fuhr, noch etwas beruhigen.*  
 Julius must the pensioner who drove still a little calm down
- f. *Julius musste die Rentnerin, die auf der Landstraße fuhr, noch etwas beruhigen.*  
 Julius must the pensioner who on the country road drove still a little calm down
- g. *Julius musste die Rentnerin, die einen Mercedes fuhr, noch etwas beruhigen.*  
 Julius must the pensioner who a Mercedes drove still a little calm down
- h. *Julius musste die Rentnerin, die auf der Landstraße einen Mercedes fuhr, noch etwas beruhigen.*  
 Julius must the pensioner who on the country road a Mercedes drove still a little calm down  
 ‘Julius still had to calm down the pensioner who was driving (a Mercedes) (on the country road) a little.’
- (31) a. *Eva hatte die gewinnende Mitschülerin sehr laut angefeuert.*  
 Eva had the winning classmate very loudly cheered-for
- b. *Eva hatte die beim Sommerfest gewinnende Mitschülerin sehr laut angefeuert.*  
 Eva had the at-the summer party winning classmate very loudly cheered-for
- c. *Eva hatte die ein Spiel gewinnende Mitschülerin sehr laut angefeuert.*  
 Eva had the a game winning classmate very loudly cheered-for
- d. *Eva hatte die beim Sommerfest ein Spiel gewinnende Mitschülerin sehr laut angefeuert.*  
 Eva had the at-the summer party a game winning classmate very loudly cheered-for
- e. *Eva hatte die Mitschülerin, die gewann, sehr laut angefeuert.*  
 Eva had the classmate who won very loudly cheered-for
- f. *Eva hatte die Mitschülerin, die beim Sommerfest gewann, sehr laut angefeuert.*  
 Eva had the classmate who at-the summer party won very loudly cheered-for
- g. *Eva hatte die Mitschülerin, die ein Spiel gewann, sehr laut angefeuert.*  
 Eva had the classmate who a game won very loudly cheered-for
- h. *Eva hatte die Mitschülerin, die beim Sommerfest ein Spiel gewann, sehr laut angefeuert.*  
 Eva had the classmate who at-the summer party a game won very loudly cheered-for  
 ‘Eva had cheered very loudly for the classmate who was winning (a game) (at the summer party).’

- (32) a. *Marcel hatte die begleitende Gitarristin vorher schon getroffen.*  
Marcel had the accompanying guitarist before already met
- b. *Marcel hatte die beim Konzert begleitende Gitarristin vorher schon getroffen.*  
Marcel had the at-the concert accompanying guitarist before already met
- c. *Marcel hatte die einen Chor begleitende Gitarristin vorher schon getroffen.*  
Marcel had the a choir accompanying guitarist before already met
- d. *Marcel hatte die beim Konzert einen Chor begleitende Gitarristin vorher schon getroffen.*  
Marcel had the at-the concert a choir accompanying guitarist before  
already met
- e. *Marcel hatte die Gitarristin, die begleitete, vorher schon getroffen.*  
Marcel had the guitarist who accompanied before already met
- f. *Marcel hatte die Gitarristin, die beim Konzert begleitete, vorher schon getroffen.*  
Marcel had the guitarist who at-the concert accompanied before already  
met
- g. *Marcel hatte die Gitarristin, die einen Chor begleitete, vorher schon getroffen.*  
Marcel had the guitarist who a choir accompanied before already met
- h. *Marcel hatte die Gitarristin, die beim Konzert einen Chor begleitete, vorher schon getroffen.*  
Marcel had the guitarist who at-the concert a choir accompanied before  
already met  
'Marcel had already met the guitarist before who accompanied (a choir) (at the concert).'
- (33) a. *Simon hatte die störende Studentin schon länger gekannt.*  
Simon had the disturbing student quite some time known
- b. *Simon hatte die durch lautes Tippen störende Studentin schon länger gekannt.*  
Simon had the by loud typing disturbing student quite some time known
- c. *Simon hatte die ein Seminar störende Studentin schon länger gekannt.*  
Simon had the a seminar disturbing student quite some time known
- d. *Simon hatte die durch lautes Tippen ein Seminar störende Studentin schon länger gekannt.*  
Simon had the by loud typing a seminar disturbing student quite  
länger gekannt.  
some time known
- e. *Simon hatte die Studentin, die störte, schon länger gekannt.*  
Simon had the student who disturbed quite some time known
- f. *Simon hatte die Studentin, die durch lautes Tippen störte, schon länger gekannt.*  
Simon had the student who by loud typing disturbed quite some time  
known
- g. *Simon hatte die Studentin, die ein Seminar störte, schon länger gekannt.*  
Simon had the student who a seminar disturbed quite some time known
- h. *Simon hatte die Studentin, die durch lautes Tippen ein Seminar störte, schon länger gekannt.*  
Simon had the student who by loud typing a seminar disturbed quite  
länger gekannt.  
some time known

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‘Simon had known the student who was disrupting (a seminar) (by typing loudly) for quite some time’

- (34) a. *Lukas hatte die springende Sportlerin dabei ziemlich angespornt.*  
Lukas had the jumping athlete in the process quite spurred
- b. *Lukas hatte die beim Wettbewerb springende Sportlerin dabei ziemlich angespornt.*  
Lukas had the at-the competition jumping athlete in the process quite spurred
- c. *Lukas hatte die einen Rekord springende Sportlerin dabei ziemlich angespornt.*  
Lukas had the a record jumping athlete in the process quite spurred
- d. *Lukas hatte die beim Wettbewerb einen Rekord springende Sportlerin dabei ziemlich angespornt.*  
Lukas had the at-the competition a record jumping athlete in the process quite spurred
- e. *Lukas hatte die Sportlerin, die sprang, dabei ziemlich angespornt.*  
Lukas had the athlete who jumped in the process quite spurred
- f. *Lukas hatte die Sportlerin, die beim Wettbewerb sprang, dabei ziemlich angespornt.*  
Lukas had the athlete who at-the competition jumped in the process quite spurred
- g. *Lukas hatte die Sportlerin, die einen Rekord sprang, dabei ziemlich angespornt.*  
Lukas had the athlete who a record jumped in the process quite spurred
- h. *Lukas hatte die Sportlerin, die beim Wettbewerb einen Rekord sprang, dabei ziemlich angespornt.*  
Lukas had the athlete who at-the competition a record jumped in the process quite spurred  
‘Lukas had quite spurred the athlete who jumped (a record) (at the competition) in the process’
- (35) a. *Nora hatte den dekorierenden Verkäufer dann endlich angesprochen.*  
Nora had the decorating salesman then finally approached
- b. *Nora hatte den im Laden gegenüber dekorierenden Verkäufer dann endlich angesprochen.*  
Nora had the in-the store across the street decorating salesman then finally approached
- c. *Nora hatte den ein Schaufenster dekorierenden Verkäufer dann endlich angesprochen.*  
Nora had the a window decorating salesman then finally approached
- d. *Nora hatte den im Laden gegenüber ein Schaufenster dekorierenden Verkäufer dann endlich angesprochen.*  
Nora had the in-the store across the street a window decorating salesman then finally approached



- e. *Nora hatte den Verkäufer, der dekorierte, dann endlich angesprochen.*  
Nora had the salesman who decorates then finally approached
- f. *Nora hatte den Verkäufer, der im Laden gegenüber dekorierte, dann endlich angesprochen.*  
Nora had the salesman who in-the store across the street decorates then finally approached
- g. *Nora hatte den Verkäufer, der ein Schaufenster dekorierte, dann endlich angesprochen.*  
Nora had the salesman who a window decorates then finally approached
- h. *Nora hatte den Verkäufer, der im Laden gegenüber ein Schaufenster dekorierte, dann endlich angesprochen.*  
Nora had the salesman who in-the store across the street a window decorates then finally approached  
'Nora had finally approached the salesman who was decorating (a window) (in the store across the street).'
- (36) a. *Gustav hatte den pfeifenden Schaffner dabei möglichst gemieden.*  
Gustav had the whistling conductor thereby as much as possible avoided
- b. *Gustav hatte den während der Kontrolle pfeifenden Schaffner dabei möglichst gemieden.*  
Gustav had the during the control whistling conductor thereby as much as possible avoided
- c. *Gustav hatte den ein Lied pfeifenden Schaffner dabei möglichst gemieden.*  
Gustav had the a song whistling conductor thereby as much as possible avoided
- d. *Gustav hatte den während der Kontrolle ein Lied pfeifenden Schaffner dabei möglichst gemieden.*  
Gustav had the during the control a song whistling conductor thereby as much as possible avoided
- e. *Gustav hatte den Schaffner, der pfiß, dabei möglichst gemieden.*  
Gustav had the conductor who whistled thereby as much as possible avoided
- f. *Gustav hatte den Schaffner, der während der Kontrolle pfiß, dabei möglichst gemieden.*  
Gustav had the conductor who during the control whistled thereby as much as possible avoided
- g. *Gustav hatte den Schaffner, der ein Lied pfiß, dabei möglichst gemieden.*  
Gustav had the conductor who a song whistled thereby as much as possible avoided
- h. *Gustav hatte den Schaffner, der während der Kontrolle ein Lied pfiß, dabei möglichst gemieden.*  
Gustav had the conductor who during the control a song whistled thereby as much as possible avoided  
'Gustav had avoided the conductor who was whistling (a song) (during the inspection) as much as possible.'

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- (37) a. *Ralf hatte den diskutierenden Gast dann einfach ignoriert.*  
 Ralf had the discussing guest then simply ignored
- b. *Ralf hatte den an der Bar diskutierenden Gast dann einfach ignoriert.*  
 Ralf had the at the bar discussing guest then simply ignored
- c. *Ralf hatte den eine Theorie diskutierenden Gast dann einfach ignoriert.*  
 Ralf had the a theory discussing guest then simply ignored
- d. *Ralf hatte den an der Bar eine Theorie diskutierenden Gast dann einfach ignoriert.*  
 Ralf had the at the bar a theory discussing guest then simply ignored
- e. *Ralf hatte den Gast, der diskutierte, dann einfach ignoriert.*  
 Ralf had the guest who discussed then simply ignored
- f. *Ralf hatte den Gast, der an der Bar diskutierte, dann einfach ignoriert.*  
 Ralf had the guest who at the bar discussed then simply ignored
- g. *Ralf hatte den Gast, der eine Theorie diskutierte, dann einfach ignoriert.*  
 Ralf had the guest who a theory discussed then simply ignored
- h. *Ralf hatte den Gast, der an der Bar eine Theorie diskutierte, dann einfach ignoriert.*  
 Ralf had the guest who at the bar a theory discussed then simply ignored  
 ignored  
 ‘Ralf had then simply ignored the guest who was discussing (a theory) (at the bar)’
- (38) a. *Doris hatte den üben den Tänzer schon sehr bewundert.*  
 Doris had the practicing dancer really very admired
- b. *Doris hatte den bis spät abends üben den Tänzer schon sehr bewundert.*  
 Doris had the until late in the evening practicing dancer really very admired
- c. *Doris hatte den eine Choreographie üben den Tänzer schon sehr bewundert.*  
 Doris had the a choreography practicing dancer really very admired
- d. *Doris hatte den bis spät abends eine Choreographie üben den Tänzer schon sehr bewundert.*  
 Doris had the until late in the evening a choreography practicing dancer  
*schon sehr bewundert.*  
 really very admired
- e. *Doris hatte den Tänzer, der übte, schon sehr bewundert.*  
 Doris had the dancer who practiced really very admired
- f. *Doris hatte den Tänzer, der bis spät abends übte, schon sehr bewundert.*  
 Doris had the dancer who until late in the evening practiced really very  
*bewundert.*  
 admired
- g. *Doris hatte den Tänzer, der eine Choreographie übte, schon sehr bewundert.*  
 Doris had the dancer who a choreography practiced really very admired
- h. *Doris hatte den Tänzer, der bis spät abends eine Choreographie übte, schon sehr bewundert.*  
 Doris had the dancer who until late in the evening a choreography practiced  
*schon sehr bewundert.*  
 really very admired  
 ‘Doris really had admired the dancer who was practicing (a choreography) (until late in the evening) a lot’
- (39) a. *Felix hatte den feiernden Mitbewohner dann irgendwann angeschrien.*  
 Felix had the celebrating roommate then at some point yelled-at

- b. *Felix hatte den unter der Woche feiernden Mitbewohner dann irgendwann angeschrien.*  
Felix had the during the week celebrating roommate then at some point yelled-at
- c. *Felix hatte den eine Geburtstagsparty feiernden Mitbewohner dann irgendwann angeschrien.*  
Felix had the a birthday party celebrating roommate then at some point yelled-at
- d. *Felix hatte den unter der Woche eine Geburtstagsparty feiernden Mitbewohner dann irgendwann angeschrien.*  
Felix had the during the week a birthday party celebrating roommate then at some point yelled-at
- e. *Felix hatte den Mitbewohner, der feierte, dann irgendwann angeschrien.*  
Felix had the roommate who celebrated then at some point yelled-at
- f. *Felix hatte den Mitbewohner, der unter der Woche feierte, dann irgendwann angeschrien.*  
Felix had the roommate who during the week celebrated then at some point yelled-at
- g. *Felix hatte den Mitbewohner, der eine Geburtstagsparty feierte, dann irgendwann angeschrien.*  
Felix had the roommate who a birthday party celebrated then at some point yelled-at
- h. *Felix hatte den Mitbewohner, der unter der Woche eine Geburtstagsparty feierte, dann irgendwann angeschrien.*  
Felix had the roommate who during the week a birthday party celebrated then at some point yelled-at  
'Felix had then yelled at the roommate who was celebrating (a birthday party) (during the week) at some point'
- (40) a. *Anna hatte den verfolgenden Polizisten gar nicht gesehen.*  
Anna had the chasing policeman even not seen
- b. *Anna hatte den in der Innenstadt verfolgenden Polizisten gar nicht gesehen.*  
Anna had the in the city center chasing policeman even not seen
- c. *Anna hatte den ein Taxi verfolgenden Polizisten gar nicht gesehen.*  
Anna had the a cab chasing policeman even not seen
- d. *Anna hatte den in der Innenstadt ein Taxi verfolgenden Polizisten gar nicht gesehen.*  
Anna had the in the city center a cab chasing policeman even not seen
- e. *Anna hatte den Polizisten, der verfolgte, gar nicht gesehen.*  
Anna had the policeman who chased even not seen
- f. *Anna hatte den Polizisten, der in der Innenstadt verfolgte, gar nicht gesehen.*  
Anna had the policeman who in the city center chased even not seen
- g. *Anna hatte den Polizisten, der ein Taxi verfolgte, gar nicht gesehen.*  
Anna had the policeman who a cab chased even not seen

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- h. *Anna hatte den Polizisten, der in der Innenstadt ein Taxi verfolgte, gar nicht gesehen.*  
Anna had the policeman who in the city center a cab chased even not seen  
'Anna hadn't even seen the policeman who was chasing (a cab) (downtown).'

# Appendix B

## Appendix – Experiment 2

### Experimental items (Experiment 2)

- (1) a. *Wahrscheinlich wird die bastelnde Tochter Frank heute beschenken.*  
probably will the handcrafting daughter Frank today give a present
- b. *Wahrscheinlich wird die in der Kita bastelnde Tochter Frank heute beschenken.*  
probably will the in the kindergarden handcrafting daughter Frank today give a present
- c. *Wahrscheinlich wird die einen Kalender bastelnde Tochter Frank heute beschenken.*  
probably will the a calendar handcrafting daughter Frank today give a present
- d. *Wahrscheinlich wird die in der Kita einen Kalender bastelnde Tochter Frank heute beschenken.*  
probably will the in the kindergarden a calendar handcrafting daughter Frank today give a present
- e. *Wahrscheinlich wird die Tochter, die bastelt, Frank heute beschenken.*  
probably will the daughter who handcrafts Frank today give a present
- f. *Wahrscheinlich wird die Tochter, die in der Kita bastelt, Frank heute beschenken.*  
probably will the daughter who in the kindergarden handcrafts Frank today give a present
- g. *Wahrscheinlich wird die Tochter, die einen Kalender bastelt, Frank heute beschenken.*  
probably will the daughter who a calendar handcrafts Frank today give a present
- h. *Wahrscheinlich wird die Tochter, die in der Kita einen Kalender bastelt, Frank heute beschenken.*  
probably will the daughter who in the kindergarden a calendar handcrafts Frank today give a present

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‘The daughter who is handcrafting (a calendar) (at the kindergarden) will probably give Frank a present today’

- (2) a. *Sicherlich will die putzende Tante Erik später anrufen.*  
surely wants the cleaning aunt Erik later call
- b. *Sicherlich will die seit einer Weile putzende Tante Erik später anrufen.*  
surely wants the for a while cleaning aunt Erik later call
- c. *Sicherlich will die ein Regal putzende Tante Erik später anrufen.*  
surely wants the a shelf cleaning aunt Erik later call
- d. *Sicherlich will die seit einer Weile ein Regal putzende Tante Erik später anrufen.*  
surely wants the for a while a shelf cleaning aunt Erik later call
- e. *Sicherlich will die Tante, die putzt, Erik später anrufen.*  
surely wants the aunt who cleans Erik later call
- f. *Sicherlich will die Tante, die seit einer Weile putzt, Erik später anrufen.*  
surely wants the aunt who for a while cleans Erik later call
- g. *Sicherlich will die Tante, die ein Regal putzt, Erik später anrufen.*  
surely wants the aunt who a shelf cleans Erik later call
- h. *Sicherlich will die Tante, die seit einer Weile ein Regal putzt, Erik später anrufen.*  
surely wants the aunt who for a while a shelf cleans Erik later  
call  
‘The aunt who has been cleaning (a shelf) (for a while) surely wants to call Erik later.’
- (3) a. *Jedenfalls wird die malende Nichte Harald wieder besuchen.*  
anyway wants the drawing niece Harald again visit
- b. *Jedenfalls wird die im Wohnzimmer malende Nichte Harald wieder besuchen.*  
anyway wants the in-the living room drawing niece Harald again visit
- c. *Jedenfalls wird die ein Bild malende Nichte Harald wieder besuchen.*  
anyway wants the a picture drawing niece Harald again visit
- d. *Jedenfalls wird die im Wohnzimmer ein Bild malende Nichte Harald wieder besuchen.*  
anyway wants the in-the living room a picture drawing niece Harald again  
visit
- e. *Jedenfalls wird die Nichte, die malt, Harald wieder besuchen.*  
anyway wants the niece who draws Harald again visit
- f. *Jedenfalls wird die Nichte, die im Wohnzimmer malt, Harald wieder besuchen.*  
anyway wants the niece who in-the living room draws Harald again visit
- g. *Jedenfalls wird die Nichte, die ein Bild malt, Harald wieder besuchen.*  
anyway wants the niece who a picture draws Harald again visit
- h. *Jedenfalls wird die Nichte, die im Wohnzimmer ein Bild malt, Harald wieder besuchen.*  
anyway wants the niece who in-the living room a picture draws Harald  
again visit  
‘Anyway, the niece who is painting (a picture) (in the living room) will visit Harald again’

- (4)
- a. *Vielleicht muss der aufräumende Angestellte Lisa bald verlassen.*  
maybe must the cleaning-up employee Lisa soon leave
  - b. *Vielleicht muss der seit zwei Stunden aufräumende Angestellte Lisa bald verlassen.*  
maybe must the for two hours cleaning-up employee Lisa soon leave
  - c. *Vielleicht muss der einen Papierstapel aufräumende Angestellte Lisa bald verlassen.*  
maybe must the a stack of papers cleaning-up employee Lisa soon leave
  - d. *Vielleicht muss der seit zwei Stunden einen Papierstapel aufräumende Angestellte Lisa bald verlassen.*  
maybe must the for two hours a stack of papers cleaning-up employee Lisa soon leave
  - e. *Vielleicht muss der Angestellte, der aufräumt, Lisa bald verlassen.*  
maybe must the employee who cleans-up Lisa soon leave
  - f. *Vielleicht muss der Angestellte, der seit zwei Stunden aufräumt, Lisa bald verlassen.*  
maybe must the employee who for two hours cleans-up Lisa soon leave
  - g. *Vielleicht muss der Angestellte, der einen Papierstapel aufräumt, Lisa bald verlassen.*  
maybe must the employee who a stack of papers cleans-up Lisa soon leave
  - h. *Vielleicht muss der Angestellte, der seit zwei Stunden einen Papierstapel aufräumt, Lisa bald verlassen.*  
maybe must the employee who for two hours a stack of papers cleans-up Lisa soon leave  
'Maybe the employee who has been cleaning up (a stack of papers) (for two hours) will have to leave Lisa soon'
- (5)
- a. *Sicherlich hat der essende Junge Christine irgendwo gesehen.*  
surely has the eating boy Christine somewhere seen
  - b. *Sicherlich hat der im Park essende Junge Christine irgendwo gesehen.*  
surely has the in-the park eating boy Christine somewhere seen
  - c. *Sicherlich hat der ein Eis essende Junge Christine irgendwo gesehen.*  
surely has the an ice cream eating boy Christine somewhere seen
  - d. *Sicherlich hat der im Park ein Eis essende Junge Christine irgendwo gesehen.*  
surely has the in-the park an ice cream eating boy Christine somewhere seen
  - e. *Sicherlich hat der Junge, der isst, Christine irgendwo gesehen.*  
surely has the boy who eats Christine somewhere seen
  - f. *Sicherlich hat der Junge, der im Park isst, Christine irgendwo gesehen.*  
surely has the boy who in-the park eats Christine somewhere seen
  - g. *Sicherlich hat der Junge, der ein Eis isst, Christine irgendwo gesehen.*  
surely has the boy who an ice cream eats Christine somewhere seen

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- h. *Sicherlich hat der Junge, der im Park ein Eis isst, Christine irgendwo gesehen.*  
surely has the boy who in-the park an ice cream eats Christine somewhere  
seen  
‘Surely the boy who is eating (an ice cream) (in the park) has seen Christine somewhere’
- (6) a. *Natürlich hat der lesende Rentner Clara freundlich begrüßt.*  
of course has the reading retiree Clara kindly greeted
- b. *Natürlich hat der auf der Liege lesende Rentner Clara freundlich begrüßt.*  
of course has the on the recliner reading retiree Clara kindly greeted
- c. *Natürlich hat der ein Buch lesende Rentner Clara freundlich begrüßt.*  
of course has the a book reading retiree Clara kindly greeted
- d. *Natürlich hat der auf der Liege ein Buch lesende Rentner Clara freundlich begrüßt.*  
of course has the on the recliner a book reading retiree Clara kindly greeted
- e. *Natürlich hat der Rentner, der liest, Clara freundlich begrüßt.*  
of course has the retiree who reads Clara kindly greeted
- f. *Natürlich hat der Rentner, der auf der Liege liest, Clara freundlich begrüßt.*  
of course has the retiree who on the recliner reads Clara kindly greeted
- g. *Natürlich hat der Rentner, der ein Buch liest, Clara freundlich begrüßt.*  
of course has the retiree who a book reads Clara kindly greeted
- h. *Natürlich hat der Rentner, der auf der Liege ein Buch liest, Clara freundlich begrüßt.*  
of course has the retiree who on the recliner a book reads Clara kindly  
greeted  
‘Of course, the retiree who is reading (a book) (on the recliner) kindly greeted Clara’
- (7) a. *Heute wird der rauchende Dozent Julia kaum treffen.*  
today will the smoking lecturer Julia hardly meet
- b. *Heute wird der vor der Uni rauchende Dozent Julia kaum treffen.*  
today will the in front of the university smoking lecturer Julia hardly meet
- c. *Heute wird der eine Zigarette rauchende Dozent Julia kaum treffen.*  
today will the a cigarette smoking lecturer Julia hardly meet
- d. *Heute wird der vor der Uni eine Zigarette rauchende Dozent Julia kaum treffen.*  
today will the in front of the university a cigarette smoking lecturer Julia  
hardly meet
- e. *Heute wird der Dozent, der raucht, Julia kaum treffen.*  
today will the lecturer who smokes Julia hardly meet
- f. *Heute wird der Dozent, der vor der Uni raucht, Julia kaum treffen.*  
today will the lecturer who in front of the university smokes Julia hardly meet
- g. *Heute wird der Dozent, der eine Zigarette raucht, Julia kaum treffen.*  
today will the lecturer who a cigarette smokes Julia hardly meet
- h. *Heute wird der Dozent, der vor der Uni eine Zigarette raucht, Julia kaum treffen.*  
today will the lecturer who in front of the university a cigarette smokes Julia  
hardly meet



‘Today the lecturer who is smoking (a cigarette) (in front of the university) will hardly meet Julia’

- (8) a. *Bestimmt hat der renovierende Nachbar Michaela sehr geärgert.*  
surely has the renovating neighbor Michaela very annoyed
- b. *Bestimmt hat der am Sonntag renovierende Nachbar Michaela sehr geärgert.*  
surely has the on Sunday renovating neighbor Michaela very annoyed
- c. *Bestimmt hat der ein Zimmer renovierende Nachbar Michaela sehr geärgert.*  
surely has the a room renovating neighbor Michaela very annoyed
- d. *Bestimmt hat der am Sonntag ein Zimmer renovierende Nachbar Michaela sehr geärgert.*  
surely has the on Sunday a room renovating neighbor Michaela very annoyed  
annoyed
- e. *Bestimmt hat der Nachbar, der renoviert, Michaela sehr geärgert.*  
surely has the neighbor who renovates Michaela very annoyed
- f. *Bestimmt hat der Nachbar, der am Sonntag renoviert, Michaela sehr geärgert.*  
surely has the neighbor who on Sunday renovates Michaela very annoyed
- g. *Bestimmt hat der Nachbar, der ein Zimmer renoviert, Michaela sehr geärgert.*  
surely has the neighbor who a room renovates Michaela very annoyed
- h. *Bestimmt hat der Nachbar, der am Sonntag ein Zimmer renoviert, Michaela sehr geärgert.*  
surely has the neighbor who on Sunday a room renovates Michaela very annoyed  
annoyed  
‘Surely the neighbor who is renovating (a room) (on Sunday) has annoyed Michaela very much’
- (9) a. *Vorhin hat die einkaufende Nachbarin Martin sofort erkannt.*  
earlier has the buying neighbor Martin immediately recognized
- b. *Vorhin hat die beim Bäcker einkaufende Nachbarin Martin sofort erkannt.*  
earlier has the at-the bakery buying neighbor Martin immediately recognized
- c. *Vorhin hat die ein Brot einkaufende Nachbarin Martin sofort erkannt.*  
earlier has the a loaf of bread buying neighbor Martin immediately recognized  
recognized
- d. *Vorhin hat die beim Bäcker ein Brot einkaufende Nachbarin Martin sofort erkannt.*  
earlier has the at-the bakery a loaf of bread buying neighbor Martin immediately recognized
- e. *Vorhin hat die Nachbarin, die einkauft, Martin sofort erkannt.*  
earlier has the neighbor who buys Martin immediately recognized
- f. *Vorhin hat die Nachbarin, die beim Bäcker einkauft, Martin sofort erkannt.*  
earlier has the neighbor who at-the bakery buys Martin immediately recognized  
recognized

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- g. *Vorhin hat die Nachbarin, die ein Brot einkauft, Martin sofort erkannt.*  
 earlier has the neighbor who a loaf of bread buys Martin immediately recognized
- h. *Vorhin hat die Nachbarin, die beim Bäcker ein Brot einkauft, Martin sofort erkannt.*  
 earlier has the neighbor who at-the bakery a loaf of bread buys Martin immediately recognized  
 ‘Earlier, the neighbor who is buying (a loaf of bread) (at the bakery) immediately recognized Martin’
- (10) a. *Heute will der kündigende Architekt Laura nicht sehen.*  
 today wants the quitting architect Laura not see
- b. *Heute will der aus Frust kündigende Architekt Laura nicht sehen.*  
 today wants the out of frustration quitting architect Laura not see
- c. *Heute will der einen Bürojob kündigende Architekt Laura nicht sehen.*  
 today wants the an office job quitting architect Laura not see
- d. *Heute will der aus Frust einen Bürojob kündigende Architekt Laura nicht sehen.*  
 today wants the out of frustration an office job quitting architect Laura not see  
 see
- e. *Heute will der Architekt, der kündigt, Laura nicht sehen.*  
 today wants the architect who quits Laura not see
- f. *Heute will der Architekt, der aus Frust kündigt, Laura nicht sehen.*  
 today wants the architect who out of frustration quits Laura not see
- g. *Heute will der Architekt, der einen Bürojob kündigt, Laura nicht sehen.*  
 today wants the architect who an office job quits Laura not see
- h. *Heute will der Architekt, der aus Frust einen Bürojob kündigt, Laura nicht sehen.*  
 today wants the architect who out of frustration an office job quits Laura not see  
 not see  
 ‘Today the architect who is quitting (an office job) (out of frustration) does not want to see Laura’
- (11) a. *Monatlang hat die studierende Bekannte Dominik nicht gesehen.*  
 for months has the studying acquaintance Dominik not seen
- b. *Monatlang hat die in der Hauptstadt studierende Bekannte Dominik nicht gesehen.*  
 for months has the in the capital studying acquaintance Dominik not seen  
 seen
- c. *Monatlang hat die eine Naturwissenschaft studierende Bekannte Dominik nicht gesehen.*  
 for months has the a natural science studying acquaintance Dominik not seen  
 seen

- d. *Monatelang hat die in der Hauptstadt eine Naturwissenschaft studierende Bekannte Dominik nicht gesehen.*  
 for months has the in the capital a natural science studying  
 acquaintance Dominik not seen
- e. *Monatelang hat die Bekannte, die studiert, Dominik nicht gesehen.*  
 for months has the acquaintance who studies Dominik not seen
- f. *Monatelang hat die Bekannte, die in der Hauptstadt studiert, Dominik nicht gesehen.*  
 for months has the acquaintance who in the capital studies Dominik not  
 seen
- g. *Monatelang hat die Bekannte, die eine Naturwissenschaft studiert, Dominik nicht gesehen.*  
 for months has the acquaintance who a natural science studies Dominik  
 not seen
- h. *Monatelang hat die Bekannte, die in der Hauptstadt eine Naturwissenschaft studiert, Dominik nicht gesehen.*  
 for months has the acquaintance who in the capital a natural science  
 studies Dominik not seen  
 ‘For months, the acquaintance who is studying (a natural science) (in the capital) did not see Dominik.’
- (12) a. *Nachher will der spielende Enkel Maria noch besuchen.*  
 afterwards wants the playing grandson Maria still visit
- b. *Nachher will der mit der Schwester spielende Enkel Maria noch besuchen.*  
 afterwards wants the with the sister playing grandson Maria still visit
- c. *Nachher will der ein Videospiel spielende Enkel Maria noch besuchen.*  
 afterwards wants the a video game playing grandson Maria still visit
- d. *Nachher will der mit der Schwester ein Videospiel spielende Enkel Maria noch besuchen.*  
 afterwards wants the with the sister a video game playing grandson Maria  
 still visit
- e. *Nachher will der Enkel, der spielt, Maria noch besuchen.*  
 afterwards wants the grandson who plays Maria still visit
- f. *Nachher will der Enkel, der mit der Schwester spielt, Maria noch besuchen.*  
 afterwards wants the grandson who with the sister plays Maria still visit
- g. *Nachher will der Enkel, der ein Videospiel spielt, Maria noch besuchen.*  
 afterwards wants the grandson who a video game plays Maria still visit
- h. *Nachher will der Enkel, der mit der Schwester ein Videospiel spielt, Maria noch besuchen.*  
 afterwards wants the grandson who with the sister a video game plays  
 Maria still visit  
 ‘Afterwards the grandson who is playing (a video game) (with his sister) still wants to visit Maria.’
- (13) a. *Morgen wird der betende Mönch Andrea endlich kennenlernen.*  
 tomorrow will the praying monk Andrea finally meet

- 
- b. *Morgen wird der vor dem Gottesdienst betende Mönch Andrea endlich kennenlernen.*  
tomorrow will the before the service praying monk Andrea finally  
*kennenlernen.*  
meet
- c. *Morgen wird der einen Rosenkranz betende Mönch Andrea endlich kennenlernen.*  
tomorrow will the a rosary praying monk Andrea finally meet
- d. *Morgen wird der vor dem Gottesdienst einen Rosenkranz betende Mönch Andrea endlich kennenlernen.*  
tomorrow will the before the service a rosary praying monk  
*Andrea endlich kennenlernen.*  
Andrea finally meet
- e. *Morgen wird der Mönch, der betet, Andrea endlich kennenlernen.*  
tomorrow will the monk who prays Andrea finally meet
- f. *Morgen wird der Mönch, der vor dem Gottesdienst betet, Andrea endlich kennenlernen.*  
tomorrow will the monk who before the service prays Andrea finally  
*kennenlernen.*  
meet
- g. *Morgen wird der Mönch, der einen Rosenkranz betet, Andrea endlich kennenlernen.*  
tomorrow will the monk who a rosary prays Andrea finally  
*kennenlernen.*  
meet
- h. *Morgen wird der Mönch, der vor dem Gottesdienst einen Rosenkranz betet, Andrea endlich kennenlernen.*  
tomorrow will the monk who before the service a rosary prays  
*Andrea endlich kennenlernen.*  
Andrea finally meet  
‘Tomorrow, the monk who is praying (a rosary) (before the service) will finally meet  
Andrea’
- (14) a. *Fast hätte die tippende Jugendliche Robert nicht gesehen.*  
almost had the typing teenager Robert not seen
- b. *Fast hätte die auf dem Smartphone tippende Jugendliche Robert nicht gesehen.*  
almost had the on the smartphone typing teenager Robert not seen
- c. *Fast hätte die eine Nachricht tippende Jugendliche Robert nicht gesehen.*  
almost had the a message typing teenager Robert not seen
- d. *Fast hätte die auf dem Smartphone eine Nachricht tippende Jugendliche Robert nicht gesehen.*  
almost had the on the smartphone a message typing teenager Robert  
*nicht gesehen.*  
not seen
- e. *Fast hätte die Jugendliche, die tippt, Robert nicht gesehen.*  
almost had the teenager who types Robert not seen
- f. *Fast hätte die Jugendliche, die auf dem Smartphone tippt, Robert nicht gesehen.*  
almost had the teenager who on the smartphone types Robert not seen
- g. *Fast hätte die Jugendliche, die eine Nachricht tippt, Robert nicht gesehen.*  
almost had the teenager who a message types Robert not seen
- h. *Fast hätte die Jugendliche, die auf dem Smartphone eine Nachricht tippt, Robert nicht gesehen.*  
almost had the teenager who on the smartphone a message types  
*Robert nicht gesehen.*  
Robert not seen

‘The teenager who is typing (a message) (on the smartphone) almost did not see Robert’

- (15) a. *Wahrscheinlich hat die unterrichtende Referendarin Max gerne gemocht.*  
probably has the teaching trainee teacher Max much liked
- b. *Wahrscheinlich hat die seit einer Woche unterrichtende Referendarin Max gerne gemocht.*  
probably has the for a week teaching trainee teacher Max much liked
- c. *Wahrscheinlich hat die ein Wahlfach unterrichtende Referendarin Max gerne gemocht.*  
probably has the an elective subject teaching trainee teacher Max much liked
- d. *Wahrscheinlich hat die seit einer Woche ein Wahlfach unterrichtende Referendarin Max gerne gemocht.*  
probably has the for a week an elective subject teaching trainee teacher Max much liked
- e. *Wahrscheinlich hat die Referendarin, die unterrichtet, Max gerne gemocht.*  
probably has the trainee teacher who teaches Max much liked
- f. *Wahrscheinlich hat die Referendarin, die seit einer Woche unterrichtet, Max gerne gemocht.*  
probably has the trainee teacher who for a week teaches Max much liked
- g. *Wahrscheinlich hat die Referendarin, die ein Wahlfach unterrichtet, Max gerne gemocht.*  
probably has the trainee teacher who an elective subject teaches Max much liked
- h. *Wahrscheinlich hat die Referendarin, die seit einer Woche ein Wahlfach unterrichtet, Max gerne gemocht.*  
probably has the trainee teacher who for a week an elective subject teaches Max much liked  
‘The trainee teacher who has been teaching (an elective subject) (for a week) probably liked Max’
- (16) a. *Natürlich will die backende Nachbarin Peter später besuchen.*  
of course wants the baking neighbor Peter later visit
- b. *Natürlich will die am Vormittag backende Nachbarin Peter später besuchen.*  
of course wants the in-the morning baking neighbor Peter later visit
- c. *Natürlich will die einen Apfelkuchen backende Nachbarin Peter später besuchen.*  
of course wants the an apple pie baking neighbor Peter later visit
- d. *Natürlich will die am Vormittag einen Apfelkuchen backende Nachbarin Peter später besuchen.*  
of course wants the in-the morning an apple pie baking neighbor Peter later visit
- e. *Natürlich will die Nachbarin, die backt, Peter später besuchen.*  
of course wants the neighbor who bakes Peter later visit

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- f. *Natürlich will die Nachbarin, die am Vormittag backt, Peter später besuchen.*  
of course wants the neighbor who in-the morning bakes Peter later visit
- g. *Natürlich will die Nachbarin, die einen Apfelkuchen backt, Peter später besuchen.*  
of course wants the neighbor who an apple pie bakes Peter later  
visit
- h. *Natürlich will die Nachbarin, die am Vormittag einen Apfelkuchen backt, Peter später besuchen.*  
of course wants the neighbor who in-the morning an apple pie bakes  
Peter later visit  
‘Of course, the neighbor who is baking (an apple pie) (in the morning) wants to visit  
Peter later’
- (17) a. *Leider kann die abhörende Agentin Dieter nicht leiden.*  
unfortunately can the listening agent Dieter not stand
- b. *Leider kann die im Nebenraum abhörende Agentin Dieter nicht leiden.*  
unfortunately can the in-the next room listening agent Dieter not stand
- c. *Leider kann die ein Telefonat abhörende Agentin Dieter nicht leiden.*  
unfortunately can the a phone call listening agent Dieter not stand
- d. *Leider kann die im Nebenraum ein Telefonat abhörende Agentin Dieter nicht leiden.*  
unfortunately can the in-the next room a phone call listening agent Dieter  
not stand
- e. *Leider kann die Agentin, die abhört, Dieter nicht leiden.*  
unfortunately can the agent who listens Dieter not stand
- f. *Leider kann die Agentin, die im Nebenraum abhört, Dieter nicht leiden.*  
unfortunately can the agent who in-the next room listens Dieter not stand
- g. *Leider kann die Agentin, die ein Telefonat abhört, Dieter nicht leiden.*  
unfortunately can the agent who a phone call listens Dieter not stand
- h. *Leider kann die Agentin, die im Nebenraum ein Telefonat abhört, Dieter nicht leiden.*  
unfortunately can the agent who in-the next room a phone call listens  
Dieter not stand  
‘Unfortunately, the agent who is listening (to a phone call) (in the next room) doesn’t  
like Dieter.’
- (18) a. *Jetzt will der spülende Onkel Sandra nicht stören.*  
now wants the (dish-)washing uncle Sandra not disturb
- b. *Jetzt will der nach der Party spülende Onkel Sandra nicht stören.*  
now wants the after the party (dish-)washing uncle Sandra not disturb
- c. *Jetzt will der eine Schüssel spülende Onkel Sandra nicht stören.*  
now wants the a bowl washing uncle Sandra not disturb
- d. *Jetzt will der nach der Party eine Schüssel spülende Onkel Sandra nicht stören.*  
now wants the after the party a bowl washing uncle Sandra not disturb
- e. *Jetzt will der Onkel, der spült, Sandra nicht stören.*  
now wants the uncle who (dish-)washes Sandra not disturb

- f. *Jetzt will der Onkel, der nach der Party spült, Sandra nicht stören.*  
now wants the uncle who after the party (dish-)washes Sandra not disturb
- g. *Jetzt will der Onkel, der eine Schüssel spült, Sandra nicht stören.*  
now wants the uncle who a bowl washes Sandra not disturb
- h. *Jetzt will der Onkel, der nach der Party eine Schüssel spült, Sandra nicht stören.*  
now wants the uncle who after the party a bowl washes Sandra not disturb  
disturb  
'The uncle who is washing (a bowl) (after the party) does not want to disturb Sandra now'
- (19) a. *Heute will der korrigierende Dozent Nicole noch sprechen.*  
today wants the correcting lecturer Nicole still speak
- b. *Heute will der zum ersten Mal korrigierende Dozent Nicole noch sprechen.*  
today wants the for-the first time correcting lecturer Nicole still speak
- c. *Heute will der eine Klausur korrigierende Dozent Nicole noch sprechen.*  
today wants the an exam correcting lecturer Nicole still speak
- d. *Heute will der zum ersten Mal eine Klausur korrigierende Dozent Nicole noch sprechen.*  
today wants the for-the first time an exam correcting lecturer Nicole still speak  
speak
- e. *Heute will der Dozent, der korrigiert, Nicole noch sprechen.*  
today wants the lecturer who corrects Nicole still speak
- f. *Heute will der Dozent, der zum ersten Mal korrigiert, Nicole noch sprechen.*  
today wants the lecturer who for-the first time corrects Nicole still speak
- g. *Heute will der Dozent, der eine Klausur korrigiert, Nicole noch sprechen.*  
today wants the lecturer who an exam corrects Nicole still speak
- h. *Heute will der Dozent, der zum ersten Mal eine Klausur korrigiert, Nicole noch sprechen.*  
today wants the lecturer who for-the first time an exam corrects Nicole still speak  
still speak  
'The lecturer who is correcting (an exam) (for the first time) still wants to speak to Nicole today'
- (20) a. *Vorher hatte der zeichnende Künstler Helena kurz beobachtet.*  
previously had the drawing artist Helena briefly observed
- b. *Vorher hatte der im Museum zeichnende Künstler Helena kurz beobachtet.*  
previously had the in-the museum drawing artist Helena briefly observed
- c. *Vorher hatte der eine Statue zeichnende Künstler Helena kurz beobachtet.*  
previously had the a statue drawing artist Helena briefly observed
- d. *Vorher hatte der im Museum eine Statue zeichnende Künstler Helena kurz beobachtet.*  
previously had the in-the museum a statue drawing artist Helena briefly observed  
observed
- e. *Vorher hatte der Künstler, der zeichnet, Helena kurz beobachtet.*  
previously had the artist who draws Helena briefly observed

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- f. *Vorher hatte der Künstler, der im Museum zeichnet, Helena kurz beobachtet.*  
 previously had the artist who in-the museum draws Helena briefly observed
- g. *Vorher hatte der Künstler, der eine Statue zeichnet, Helena kurz beobachtet.*  
 previously had the artist who a statue draws Helena briefly observed
- h. *Vorher hatte der Künstler, der im Museum eine Statue zeichnet, Helena kurz beobachtet.*  
 previously had the artist who in-the museum a statue draws Helena briefly observed  
 'Previously, the artist who is drawing (a statue) (in the museum) had briefly observed Helena'
- (21) a. *Leider hatte die fotografierende Reporterin Christian wieder heimgeschickt.*  
 unfortunately had the photographing reporter Christian again sent home
- b. *Leider hatte die während der Untersuchungen fotografierende Reporterin Christian wieder heimgeschickt.*  
 unfortunately had the during the investigation photographing reporter Christian again sent home
- c. *Leider hatte die ein Beweismittel fotografierende Reporterin Christian wieder heimgeschickt.*  
 unfortunately had the a piece of evidence photographing reporter Christian again sent home
- d. *Leider hatte die während der Untersuchungen ein Beweismittel fotografierende Reporterin Christian wieder heimgeschickt.*  
 unfortunately had the during the investigation a piece of evidence photographing reporter Christian again sent home
- e. *Leider hatte die Reporterin, die fotografierte, Christian wieder heimgeschickt.*  
 unfortunately had the reporter who photographed Christian again sent home
- f. *Leider hatte die Reporterin, die während der Untersuchungen fotografierte, Christian wieder heimgeschickt.*  
 unfortunately had the reporter who during the investigation photographed Christian again sent home
- g. *Leider hatte die Reporterin, die ein Beweismittel fotografierte, Christian wieder heimgeschickt.*  
 unfortunately had the reporter who a piece of evidence photographed Christian again sent home
- h. *Leider hatte die Reporterin, die während der Untersuchungen ein Beweismittel fotografierte, Christian wieder heimgeschickt.*  
 unfortunately had the reporter who during the investigation a piece of evidence photographed Christian again sent home  
 'Unfortunately, the reporter who was photographing (a piece of evidence) (during the investigation) had sent Christian home again'
- (22) a. *Sicherlich hatte die stehlende Jugendliche Patrick nicht gesehen.*  
 surely had the stealing teenager Patrick not seen



- b. *Sicherlich hatte die im Supermarkt stehlende Jugendliche Patrick nicht gesehen.*  
surely had the in-the supermarket stealing teenager Patrick not seen
- c. *Sicherlich hatte die einen Kaugummi stehlende Jugendliche Patrick nicht gesehen.*  
surely had the a chewing gum stealing teenager Patrick not seen
- d. *Sicherlich hatte die im Supermarkt einen Kaugummi stehlende Jugendliche Patrick nicht gesehen.*  
surely had the in-the supermarket a chewing gum stealing teenager  
Patrick not seen
- e. *Sicherlich hatte die Jugendliche, die stahl, Patrick nicht gesehen.*  
surely had the teenager who stole Patrick not seen
- f. *Sicherlich hatte die Jugendliche, die im Supermarkt stahl, Patrick nicht gesehen.*  
surely had the teenager who in-the supermarket stole Patrick not  
seen
- g. *Sicherlich hatte die Jugendliche, die einen Kaugummi stahl, Patrick nicht gesehen.*  
surely had the teenager who a chewing gum stole Patrick not  
seen
- h. *Sicherlich hatte die Jugendliche, die im Supermarkt einen Kaugummi stahl, Patrick nicht gesehen.*  
surely had the teenager who in-the supermarket a chewing gum stole  
Patrick not seen  
'Surely the teenager who was stealing (a piece of chewing gum) (in the supermarket)  
had not seen Patrick'
- (23) a. *Bestimmt hat der angelnde Urlauber Gabi ziemlich beeindruckt.*  
surely has the fishing vacationer Gabi quite impressed
- b. *Bestimmt hat der am Fluss angelnde Urlauber Gabi ziemlich beeindruckt.*  
surely has the at-the river fishing vacationer Gabi quite impressed
- c. *Bestimmt hat der eine Forelle angelnde Urlauber Gabi ziemlich beeindruckt.*  
surely has the a trout fishing vacationer Gabi quite impressed
- d. *Bestimmt hat der am Fluss eine Forelle angelnde Urlauber Gabi ziemlich beeindruckt.*  
surely has the at-the river a trout fishing vacationer Gabi quite  
impressed
- e. *Bestimmt hat der Urlauber, der angelte, Gabi ziemlich beeindruckt.*  
surely has the vacationer who fished Gabi quite impressed
- f. *Bestimmt hat der Urlauber, der am Fluss angelte, Gabi ziemlich beeindruckt.*  
surely has the vacationer who at-the river fished Gabi quite impressed
- g. *Bestimmt hat der Urlauber, der eine Forelle angelte, Gabi ziemlich beeindruckt.*  
surely has the vacationer who a trout fished Gabi quite impressed
- h. *Bestimmt hat der Urlauber, der am Fluss eine Forelle angelte, Gabi ziemlich beeindruckt.*  
surely has the vacationer who at-the river a trout fished Gabi quite  
impressed  
'Surely the vacationer who was fishing (for a trout) (at the river) impressed Gabi quite  
a bit'

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- (24) a. *Offensichtlich hatte der verlierende Freund Tina nicht gemocht.*  
obviously had the losing friend Tina not liked
- b. *Offensichtlich hatte der in der Kneipe verlierende Freund Tina nicht gemocht.*  
obviously had the in the pub losing friend Tina not liked
- c. *Offensichtlich hatte der ein Pokerspiel verlierende Freund Tina nicht gemocht.*  
obviously had the a poker game losing friend Tina not liked
- d. *Offensichtlich hatte der in der Kneipe ein Pokerspiel verlierende Freund Tina nicht gemocht.*  
obviously had the in the pub a poker game losing friend Tina not liked  
liked
- e. *Offensichtlich hatte der Freund, der verlor, Tina nicht gemocht.*  
obviously had the friend who lost Tina not liked
- f. *Offensichtlich hatte der Freund, der in der Kneipe verlor, Tina nicht gemocht.*  
obviously had the friend who in the pub lost Tina not liked
- g. *Offensichtlich hatte der Freund, der ein Pokerspiel verlor, Tina nicht gemocht.*  
obviously had the friend who a poker game lost Tina not liked
- h. *Offensichtlich hatte der Freund, der in der Kneipe ein Pokerspiel verlor, Tina nicht gemocht.*  
obviously had the friend who in the pub a poker game lost Tina not liked  
not liked  
'Obviously, the friend who was losing (a poker game) (in the pub) had not liked Tina'
- (25) a. *Irgendwie hatte die tanzende Cousine Basti kaum beachtet.*  
somehow had the dancing cousin Basti barely noticed
- b. *Irgendwie hatte die bei der Hochzeit tanzende Cousine Basti kaum beachtet.*  
somehow had the at the wedding dancing cousin Basti barely noticed
- c. *Irgendwie hatte die einen Walzer tanzende Cousine Basti kaum beachtet.*  
somehow had the a waltz dancing cousin Basti barely noticed
- d. *Irgendwie hatte die bei der Hochzeit einen Walzer tanzende Cousine Basti kaum beachtet.*  
somehow had the at the wedding a waltz dancing cousin Basti barely noticed  
noticed
- e. *Irgendwie hatte die Cousine, die tanzte, Basti kaum beachtet.*  
somehow had the cousin who danced Basti barely noticed
- f. *Irgendwie hatte die Cousine, die bei der Hochzeit tanzte, Basti kaum beachtet.*  
somehow had the cousin who at the wedding danced Basti barely noticed
- g. *Irgendwie hatte die Cousine, die einen Walzer tanzte, Basti kaum beachtet.*  
somehow had the cousin who a waltz danced Basti barely noticed
- h. *Irgendwie hatte die Cousine, die bei der Hochzeit einen Walzer tanzte, Basti kaum beachtet.*  
somehow had the cousin who at the wedding a waltz danced Basti barely noticed  
barely noticed  
'Somehow the cousin who was dancing (a waltz) (at the wedding) had barely noticed Basti'
- (26) a. *Damals hatte die singende Dame Fritz gut gefunden.*  
at that time had the singing lady Fritz good found

- b. *Damals hatte die im Bierzelt singende Dame Fritz gut gefunden.*  
 at that time had the in-the beer tent singing lady Fritz good found
- c. *Damals hatte die ein Lied singende Dame Fritz gut gefunden.*  
 at that time had the a song singing lady Fritz good found
- d. *Damals hatte die im Bierzelt ein Lied singende Dame Fritz gut gefunden.*  
 at that time had the in-the beer tent a song singing lady Fritz good found
- e. *Damals hatte die Dame, die sang, Fritz gut gefunden.*  
 at that time had the lady who sang Fritz good found
- f. *Damals hatte die Dame, die im Bierzelt sang, Fritz gut gefunden.*  
 at that time had the lady who in-the beer tent sang Fritz good found
- g. *Damals hatte die Dame, die ein Lied sang, Fritz gut gefunden.*  
 at that time had the lady who a song sang Fritz good found
- h. *Damals hatte die Dame, die im Bierzelt ein Lied sang, Fritz gut gefunden.*  
 found  
 ‘At that time, the lady who was singing (a song) (in the beer tent) had found Fritz good’
- (27) a. *Gestern hatte die bügelnde Oma Ben ziemlich ausgeschimpft.*  
 yesterday had the ironing grandma Ben quite scolded
- b. *Gestern hatte die im Wohnzimmer bügelnde Oma Ben ziemlich ausgeschimpft.*  
 scolded
- c. *Gestern hatte die ein Hemd bügelnde Oma Ben ziemlich ausgeschimpft.*  
 yesterday had the a shirt ironing grandma Ben quite scolded
- d. *Gestern hatte die im Wohnzimmer ein Hemd bügelnde Oma Ben ziemlich ausgeschimpft.*  
 scolded
- e. *Gestern hatte die Oma, die bügelte, Ben ziemlich ausgeschimpft.*  
 yesterday had the grandma who ironed Ben quite scolded
- f. *Gestern hatte die Oma, die im Wohnzimmer bügelte, Ben ziemlich ausgeschimpft.*  
 scolded
- g. *Gestern hatte die Oma, die ein Hemd bügelte, Ben ziemlich ausgeschimpft.*  
 yesterday had the grandma who a shirt ironed Ben quite scolded
- h. *Gestern hatte die Oma, die im Wohnzimmer ein Hemd bügelte, Ben ziemlich ausgeschimpft.*  
 quite scolded  
 ‘Yesterday, the grandma who was ironing (a shirt) (in the living room) had scolded Ben quite a bit’

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- (28) a. *Selten hatte der lernende Schüler Emilie so genervt.*  
rarely had the learning student Emilie so annoyed
- b. *Selten hatte der in der Küche lernende Schüler Emilie so genervt.*  
rarely had the in the kitchen learning student Emilie so annoyed
- c. *Selten hatte der ein Gedicht lernende Schüler Emilie so genervt.*  
rarely had the a poem learning student Emilie so annoyed
- d. *Selten hatte der in der Küche ein Gedicht lernende Schüler Emilie so genervt.*  
rarely had the in the kitchen a poem learning student Emilie so annoyed
- e. *Selten hatte der Schüler, der lernte, Emilie so genervt.*  
rarely had the student who learned Emilie so annoyed
- f. *Selten hatte der Schüler, der in der Küche lernte, Emilie so genervt.*  
rarely had the student who in the kitchen learned Emilie so annoyed
- g. *Selten hatte der Schüler, der ein Gedicht lernte, Emilie so genervt.*  
rarely had the student who a poem learned Emilie so annoyed
- h. *Selten hatte der Schüler, der in der Küche ein Gedicht lernte, Emilie so genervt.*  
rarely had the student who in the kitchen a poem learned Emilie so annoyed  
'The student who was learning (a poem) (in the kitchen) had rarely annoyed Emilie so much'
- (29) a. *Tatsächlich konnte die gestehende Verdächtige Philipp nicht belügen.*  
in fact could the confessing suspect Philipp not lie-to
- b. *Tatsächlich konnte die nach kurzer Befragung gestehende Verdächtige Philipp nicht belügen.*  
in fact could the after brief questioning confessing suspect Philipp not lie-to
- c. *Tatsächlich konnte die einen Diebstahl gestehende Verdächtige Philipp nicht belügen.*  
in fact could the a theft confessing suspect Philipp not lie-to
- d. *Tatsächlich konnte die nach kurzer Befragung einen Diebstahl gestehende Verdächtige Philipp nicht belügen.*  
in fact could the after brief questioning a theft confessing suspect Philipp not lie-to
- e. *Tatsächlich konnte die Verdächtige, die gestand, Philipp nicht belügen.*  
in fact could the suspect who confessed Philipp not lie-to
- f. *Tatsächlich konnte die Verdächtige, die nach kurzer Befragung gestand, Philipp nicht belügen.*  
in fact could the suspect who after brief questioning confessed Philipp not lie-to
- g. *Tatsächlich konnte die Verdächtige, die einen Diebstahl gestand, Philipp nicht belügen.*  
in fact could the suspect who a theft confessed Philipp not lie-to
- h. *Tatsächlich konnte die Verdächtige, die nach kurzer Befragung einen Diebstahl gestand, Philipp nicht belügen.*  
in fact could the suspect who after brief questioning a theft confessed Philipp not lie-to

‘In fact, the suspect who (after brief questioning) confessed (to theft) could not lie to Philip’

- (30) a. *Pünktlich konnte die fahrende Rentnerin Julius nicht erreichen.*  
on time could the driving pensioner Julius not reach
- b. *Pünktlich konnte die auf der Landstraße fahrende Rentnerin Julius nicht erreichen.*  
on time could the on the country road driving pensioner Julius not reach
- c. *Pünktlich konnte die einen Mercedes fahrende Rentnerin Julius nicht erreichen.*  
on time could the a mercedes driving pensioner Julius not reach
- d. *Pünktlich konnte die auf der Landstraße einen Mercedes fahrende Rentnerin Julius nicht erreichen.*  
on time could the on the country road a mercedes driving pensioner Julius not reach
- e. *Pünktlich konnte die Rentnerin, die fuhr, Julius nicht erreichen.*  
on time could the pensioner who drove Julius not reach
- f. *Pünktlich konnte die Rentnerin, die auf der Landstraße fuhr, Julius nicht erreichen.*  
on time could the pensioner who on the country road drove Julius not reach
- g. *Pünktlich konnte die Rentnerin, die einen Mercedes fuhr, Julius nicht erreichen.*  
on time could the pensioner who a mercedes drove Julius not reach
- h. *Pünktlich konnte die Rentnerin, die auf der Landstraße einen Mercedes fuhr, Julius nicht erreichen.*  
on time could the pensioner who on the country road a mercedes drove Julius not reach  
‘The pensioner who was driving (a Mercedes) (on the country road) could not reach Julius on time’
- (31) a. *Später hatte die gewinnende Mitschülerin Christoph glücklich umarmt.*  
later had the winning classmate Christoph happily hugged
- b. *Später hatte die beim Sommerfest gewinnende Mitschülerin Christoph glücklich umarmt.*  
later had the at the summer party winning classmate Christoph happily hugged
- c. *Später hatte die ein Spiel gewinnende Mitschülerin Christoph glücklich umarmt.*  
later had the a game winning classmate Christoph happily hugged
- d. *Später hatte die beim Sommerfest ein Spiel gewinnende Mitschülerin Christoph glücklich umarmt.*  
later had the at the summer party a game winning classmate Christoph happily hugged
- e. *Später hatte die Mitschülerin, die gewann, Christoph glücklich umarmt.*  
later had the classmate who won Christoph happily hugged

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- f. *Später hatte die Mitschülerin, die beim Sommerfest gewann, Christoph glücklich umarmt.*  
 later had the classmate who at the summer party won  
 Christoph happily hugged
- g. *Später hatte die Mitschülerin, die ein Spiel gewann, Christoph glücklich umarmt.*  
 later had the classmate who a game won Christoph happily hugged
- h. *Später hatte die Mitschülerin, die beim Sommerfest ein Spiel gewann, Christoph glücklich umarmt.*  
 later had the classmate who at the summer party a game  
 won Christoph happily hugged  
 ‘Later, the classmate who won (a game) (at the summer party) had hugged Christoph happily’
- (32) a. *Gestern hat die begleitende Gitarristin Marcel mehrfach getroffen.*  
 yesterday has the accompanying guitarist Marcel several times met
- b. *Gestern hat die beim Konzert begleitende Gitarristin Marcel mehrfach getroffen.*  
 yesterday has the at-the concert accompanying guitarist Marcel several times  
 met
- c. *Gestern hat die einen Chor begleitende Gitarristin Marcel mehrfach getroffen.*  
 yesterday has the a choir accompanying guitarist Marcel several times  
 met
- d. *Gestern hat die beim Konzert einen Chor begleitende Gitarristin Marcel mehrfach getroffen.*  
 yesterday has the at-the concert a choir accompanying guitarist Marcel  
 several times met
- e. *Gestern hat die Gitarristin, die begleitete, Marcel mehrfach getroffen.*  
 yesterday has the guitarist who accompanied Marcel several times met
- f. *Gestern hat die Gitarristin, die beim Konzert begleitete, Marcel mehrfach getroffen.*  
 yesterday has the guitarist who at-the concert accompanied Marcel several times  
 met
- g. *Gestern hat die Gitarristin, die einen Chor begleitete, Marcel mehrfach getroffen.*  
 yesterday has the guitarist who a choir accompanied Marcel several times  
 met
- h. *Gestern hat die Gitarristin, die beim Konzert einen Chor begleitete, Marcel mehrfach getroffen.*  
 yesterday has the guitarist who at-the concert a choir accompanied Marcel  
 several times met  
 ‘The guitarist who accompanied (a choir) (at the concert) met Marcel several times  
 yesterday’
- (33) a. *Anscheinend hat die störende Studentin Simon gut gekannt.*  
 apparently has the disrupting student Simon well known
- b. *Anscheinend hat die durch lautes Tippen störende Studentin Simon gut gekannt.*  
 apparently has the by loudly typing disrupting student Simon well known

- c. *Anscheinend hat die ein Seminar störende Studentin Simon gut gekannt.*  
apparently has the a seminar disrupting student Simon well known
- d. *Anscheinend hat die durch lautes Tippen ein Seminar störende Studentin Simon gut gekannt.*  
apparently has the by loudly typing a seminar disrupting student Simon well known
- e. *Anscheinend hat die Studentin, die störte, Simon gut gekannt.*  
apparently has the student who disrupted Simon well known
- f. *Anscheinend hat die Studentin, die durch lautes Tippen störte, Simon gut gekannt.*  
apparently has the student who by loudly typing disrupted Simon well known
- g. *Anscheinend hat die Studentin, die ein Seminar störte, Simon gut gekannt.*  
apparently has the student who a seminar disrupted Simon well known
- h. *Anscheinend hat die Studentin, die durch lautes Tippen ein Seminar störte, Simon gut gekannt.*  
apparently has the student who by loudly typing a seminar disrupted Simon well known  
'Apparently, the student who was disrupting (a seminar) (by typing loudly) knew Simon well'
- (34) a. *Angeblich hatte die springende Sportlerin Lukas richtig fasziniert.*  
allegedly had the jumping athlete Lukas really fascinated
- b. *Angeblich hatte die beim Wettbewerb springende Sportlerin Lukas richtig fasziniert.*  
allegedly had the at-the competition jumping athlete Lukas really fascinated
- c. *Angeblich hatte die einen Rekord springende Sportlerin Lukas richtig fasziniert.*  
allegedly had the a record jumping athlete Lukas really fascinated
- d. *Angeblich hatte die beim Wettbewerb einen Rekord springende Sportlerin Lukas richtig fasziniert.*  
allegedly had the at-the competition a record jumping athlete Lukas really fascinated
- e. *Angeblich hatte die Sportlerin, die sprang, Lukas richtig fasziniert.*  
allegedly had the athlete who jumped Lukas really fascinated
- f. *Angeblich hatte die Sportlerin, die beim Wettbewerb sprang, Lukas richtig fasziniert.*  
allegedly had the athlete who at-the competition jumped Lukas really fascinated
- g. *Angeblich hatte die Sportlerin, die einen Rekord sprang, Lukas richtig fasziniert.*  
allegedly had the athlete who a record jumped Lukas really fascinated
- h. *Angeblich hatte die Sportlerin, die beim Wettbewerb einen Rekord sprang, Lukas richtig fasziniert.*  
allegedly had the athlete who at-the competition a record jumped Lukas really fascinated  
'Allegedly, the athlete who was jumping (a record) (at the competition) had really fascinated Lukas'

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- (35) a. *Fast hätte der dekorierende Verkäufer Nora nicht angesprochen.*  
almost had the decorating salesman Nora not addressed
- b. *Fast hätte der im Laden gegenüber dekorierende Verkäufer Nora nicht angesprochen.*  
almost had the in-the store across the street decorating salesman Nora not addressed
- c. *Fast hätte der ein Schaufenster dekorierende Verkäufer Nora nicht angesprochen.*  
almost had the a window decorating salesman Nora not addressed
- d. *Fast hätte der im Laden gegenüber ein Schaufenster dekorierende Verkäufer Nora nicht angesprochen.*  
almost had the in-the store across the street a window decorating salesman Nora not addressed
- e. *Fast hätte der Verkäufer, der dekorierte, Nora nicht angesprochen.*  
almost had the salesman who decorated Nora not addressed
- f. *Fast hätte der Verkäufer, der im Laden gegenüber dekorierte, Nora nicht angesprochen.*  
almost had the salesman who in-the store across the street decorated Nora not addressed
- g. *Fast hätte der Verkäufer, der ein Schaufenster dekorierte, Nora nicht angesprochen.*  
almost had the salesman who a window decorated Nora not addressed
- h. *Fast hätte der Verkäufer, der im Laden gegenüber ein Schaufenster dekorierte, Nora nicht angesprochen.*  
almost had the salesman who in-the store across the street a window decorated Nora not addressed  
'The salesman who was decorating (a window) (in the store across the street) almost didn't address Nora'
- (36) a. *Glücklicherweise hatte der pfeifende Schaffner Sarah nicht gesehen.*  
fortunately had the whistling conductor Sarah not seen
- b. *Glücklicherweise hatte der während der Kontrolle pfeifende Schaffner Sarah nicht gesehen.*  
fortunately had the during the control whistling conductor Sarah not seen
- c. *Glücklicherweise hatte der ein Lied pfeifende Schaffner Sarah nicht gesehen.*  
fortunately had the a song whistling conductor Sarah not seen
- d. *Glücklicherweise hatte der während der Kontrolle ein Lied pfeifende Schaffner Sarah nicht gesehen.*  
fortunately had the during the control a song whistling conductor Sarah not seen
- e. *Glücklicherweise hatte der Schaffner, der pfiff, Sarah nicht gesehen.*  
fortunately had the conductor who whistled Sarah not seen
- f. *Glücklicherweise hatte der Schaffner, der während der Kontrolle pfiff, Sarah nicht gesehen.*  
fortunately had the conductor who during the control whistled Sarah not seen



- g. *Glücklicherweise hatte der Schaffner, der ein Lied pfiß, Sarah nicht gesehen.*  
 fortunately had the conductor who a song whistled Sarah not seen
- h. *Glücklicherweise hatte der Schaffner, der während der Kontrolle ein Lied pfiß, Sarah nicht gesehen.*  
 fortunately had the conductor who during the control a song whistled Sarah not seen  
 ‘Fortunately, the conductor who was whistling (a song) (during the control) had not seen Sarah’
- (37) a. *Irgendwann hatte der diskutierende Gast Bianca einfach ignoriert.*  
 at some point had the discussing guest Bianca simply ignored
- b. *Irgendwann hatte der an der Bar diskutierende Gast Bianca einfach ignoriert.*  
 at some point had the at the bar discussing guest Bianca simply ignored
- c. *Irgendwann hatte der eine Theorie diskutierende Gast Bianca einfach ignoriert.*  
 at some point had the a theory discussing guest Bianca simply ignored
- d. *Irgendwann hatte der an der Bar eine Theorie diskutierende Gast Bianca einfach ignoriert.*  
 at some point had the at the bar a theory discussing guest Bianca simply ignored
- e. *Irgendwann hatte der Gast, der diskutierte, Bianca einfach ignoriert.*  
 at some point had the guest who discussed Bianca simply ignored
- f. *Irgendwann hatte der Gast, der an der Bar diskutierte, Bianca einfach ignoriert.*  
 at some point had the guest who at the bar discussed Bianca simply ignored
- g. *Irgendwann hatte der Gast, der eine Theorie diskutierte, Bianca einfach ignoriert.*  
 at some point had the guest who a theory discussed Bianca simply ignored
- h. *Irgendwann hatte der Gast, der an der Bar eine Theorie diskutierte, Bianca einfach ignoriert.*  
 at some point had the guest who at the bar a theory discussed Bianca simply ignored  
 ‘At some point the guest who was discussing (a theory) (at the bar) had simply ignored Bianca’
- (38) a. *Eigentlich hatte der übende Tänzer Doris sehr beeindruckt.*  
 actually had the practicing dancer Doris very impressed
- b. *Eigentlich hatte der bis spät abends übende Tänzer Doris sehr beeindruckt.*  
 actually had the until late in the evening practicing dancer Doris very impressed
- c. *Eigentlich hatte der eine Choreographie übende Tänzer Doris sehr beeindruckt.*  
 actually had the a choreography practicing dancer Doris very impressed
- d. *Eigentlich hatte der bis spät abends eine Choreographie übende Tänzer Doris sehr beeindruckt.*  
 actually had the until late in the evening a choreography practicing dancer Doris very impressed

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- e. *Eigentlich hatte der Tänzer, der übte, Doris sehr beeindruckt.*  
 actually had the dancer who practiced Doris very impressed
- f. *Eigentlich hatte der Tänzer, der bis spät abends übte, Doris sehr beeindruckt.*  
 actually had the dancer who until late in the evening practiced Doris very impressed
- g. *Eigentlich hatte der Tänzer, der eine Choreographie übte, Doris sehr beeindruckt.*  
 actually had the dancer who a choreography practiced Doris very impressed
- h. *Eigentlich hatte der Tänzer, der bis spät abends eine Choreographie übte, Doris sehr beeindruckt.*  
 actually had the dancer who until late in the evening a choreography practiced Doris very impressed  
 ‘Actually, the dancer who was practicing (a choreography) (until late in the evening) had impressed Doris very much’
- (39) a. *Sicherlich hatte der feiernde Mitbewohner Luise sehr geärgert.*  
 surely had the celebrating roommate Luise very annoyed
- b. *Sicherlich hatte der unter der Woche feiernde Mitbewohner Luise sehr geärgert.*  
 surely had the during the week celebrating roommate Luise very annoyed
- c. *Sicherlich hatte der eine Party feiernde Mitbewohner Luise sehr geärgert.*  
 surely had the a party celebrating roommate Luise very annoyed
- d. *Sicherlich hatte der unter der Woche eine Party feiernde Mitbewohner Luise sehr geärgert.*  
 surely had the during the week a party celebrating roommate Luise very annoyed
- e. *Sicherlich hatte der Mitbewohner, der feierte, Luise sehr geärgert.*  
 surely had the roommate who celebrated Luise very annoyed
- f. *Sicherlich hatte der Mitbewohner, der unter der Woche feierte, Luise sehr geärgert.*  
 surely had the roommate who during the week celebrated Luise very annoyed
- g. *Sicherlich hatte der Mitbewohner, der eine Party feierte, Luise sehr geärgert.*  
 surely had the roommate who a party celebrated Luise very annoyed
- h. *Sicherlich hatte der Mitbewohner, der unter der Woche eine Party feierte, Luise sehr geärgert.*  
 surely had the roommate who during the week a party celebrated Luise very annoyed  
 ‘Surely the roommate who was celebrating (a party) (during the week) had annoyed Luise very much’
- (40) a. *Offensichtlich hatte der verfolgende Polizist Anna nicht gesehen.*  
 apparently had the chasing policeman Anna not seen

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- b. *Offensichtlich hatte der in der Innenstadt verfolgende Polizist Anna nicht gesehen.*  
apparently had the in the city center chasing policeman Anna not seen
- c. *Offensichtlich hatte der ein Taxi verfolgende Polizist Anna nicht gesehen.*  
apparently had the a cab chasing policeman Anna not seen
- d. *Offensichtlich hatte der in der Innenstadt ein Taxi verfolgende Polizist Anna nicht gesehen.*  
apparently had the in the city center a cab chasing policeman Anna not seen
- e. *Offensichtlich hatte der Polizist, der verfolgte, Anna nicht gesehen.*  
apparently had the policeman who chased Anna not seen
- f. *Offensichtlich hatte der Polizist, der in der Innenstadt verfolgte, Anna nicht gesehen.*  
apparently had the policeman who in the city center chased Anna not seen
- g. *Offensichtlich hatte der Polizist, der ein Taxi verfolgte, Anna nicht gesehen.*  
apparently had the policeman who a cab chased Anna not seen
- h. *Offensichtlich hatte der Polizist, der in der Innenstadt ein Taxi verfolgte, Anna nicht gesehen.*  
apparently had the policeman who in the city center a cab chased Anna not seen  
'Apparently, the policeman who was chasing (a cab) (in the city center) had not seen Anna'

# Appendix C

## Appendix – Experiment 3

### Experimental items (Experiment 3)

- (1) a. *Christine hat erfahren, dass der im Park essende Schüler schon irgendwo anders gesehen wurde.*  
Christine has learned that the in-the park eating student already somewhere  
*anders gesehen wurde.*  
else seen was
- b. *Christine hat erfahren, dass der ein Eis essende Schüler schon irgendwo anders gesehen wurde.*  
Christine has learned that the an ice cream eating student already somewhere  
*anders gesehen wurde.*  
else seen was
- c. *Christine hat erfahren, dass der Schüler, der im Park isst, schon irgendwo anders gesehen wurde.*  
Christine has learned that the student who in-the park eats already somewhere  
*anders gesehen wurde.*  
else seen was
- d. *Christine hat erfahren, dass der Schüler, der ein Eis isst, schon irgendwo anders gesehen wurde.*  
Christine has learned that the student who an ice cream eats already somewhere  
*anders gesehen wurde.*  
else seen was  
'Christine has learned that the student who is eating in the park/ ice cream has already  
been seen somewhere else'
- (2) a. *Erik hat gesehen, dass die seit Stunden putzende Tante bereits am Vormittag angerufen hatte.*  
Erik has seen that the for hours cleaning aunt already in-the morning  
*angerufen hatte.*  
called has
- b. *Erik hat gesehen, dass die ein Regal putzende Tante bereits am Vormittag angerufen hatte.*  
Erik has seen that the a shelf cleaning aunt already in-the morning  
*angerufen hatte.*  
called has

- c. *Erik hat gesehen, dass die Tante, die seit Stunden putzt, bereits am Vormittag*  
 Erik has seen that the aunt who for hours cleans already in-the morning  
*angerufen hatte.*  
 called has
- d. *Erik hat gesehen, dass die Tante, die ein Regal putzt, bereits am Vormittag*  
 Erik has seen that the aunt who a shelf cleans already in-the morning  
*angerufen hatte.*  
 called has  
 ‘Erik saw that the aunt who was cleaning for hours/ a shelf had already called in the morning.’
- (3) a. *Lisa hat bemerkt, dass die im Wohnzimmer malende Nichte nicht immer*  
 Lisa has noticed that the in-the living room painting niece not always  
*durchgehend beaufsichtigt wird.*  
 throughout supervised is
- b. *Lisa hat bemerkt, dass die ein Portrait malende Nichte nicht immer durchgehend*  
 Lisa has noticed that the a portrait painting niece not always throughout  
*beaufsichtigt wird.*  
 supervised is
- c. *Lisa hat bemerkt, dass die Nichte, die im Wohnzimmer malt, nicht immer*  
 Lisa has noticed that the niece who in-the living room paints not always  
*durchgehend beaufsichtigt wird.*  
 throughout supervised is
- d. *Lisa hat bemerkt, dass die Nichte, die ein Portrait malt, nicht immer durchgehend*  
 Lisa has noticed that the niece who a portrait paints not always throughout  
*beaufsichtigt wird.*  
 supervised is  
 ‘Lisa has noticed that the niece who is painting in the living room/ a portrait is not always supervised throughout’
- Question: *Bemerkst Lisa, dass die Nichte nicht unter ständiger Aufsicht steht?*  
 ‘Does Lisa notice that the niece is not under permanent supervision?’
- (4) a. *Julia hat erzählt, dass der am Eingang rauchende Dozent oft von Kollegen*  
 Julia has told that the at the entrance smoking lecturer often by  
*ignoriert wird.*  
 colleagues ignored is
- b. *Julia hat erzählt, dass der eine Zigarette rauchende Dozent oft von Kollegen*  
 Julia has told that the a cigarette smoking lecturer often by colleagues  
*ignoriert wird.*  
 ignored is
- c. *Julia hat erzählt, dass der Dozent, der am Eingang raucht, oft von Kollegen*  
 Julia has told that the lecturer who at-the entrance smokes often by colleagues  
*ignoriert wird.*  
 ignored is
- d. *Julia hat erzählt, dass der Dozent, der eine Zigarette raucht, oft von Kollegen*  
 Julia has told that the lecturer who a cigarette smokes often by colleagues  
*ignoriert wird.*  
 ignored is

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‘Julia told that the lecturer who is smoking at the entrance/ a cigarette is often ignored by colleagues’

- (5) a. *Diana hat gesagt, dass der im Ausland studierende Bekannte länger nicht daheim gewesen ist.*  
Diana has said that the abroad studying acquaintance for some time not home been has
- b. *Diana hat gesagt, dass der eine Sprache studierende Bekannte länger nicht daheim gewesen ist.*  
Diana has said that the a language studying acquaintance for some time not home been has
- c. *Diana hat gesagt, dass der Bekannte, der im Ausland studiert, länger nicht daheim gewesen ist.*  
Diana has said that the acquaintance who abroad studies for some time not home been has
- d. *Diana hat gesagt, dass der Bekannte, der eine Sprache studiert, länger nicht daheim gewesen ist.*  
Diana has said that the acquaintance who a language studies for some time not home been has  
‘Diana has said that the acquaintance who is studying abroad/ a language has not been home for some time’

- (6) a. *Heinz hat gehört, dass der mit Begeisterung spielende Enkel früh nach Hause gehen muss.*  
Heinz has heard that the with enthusiasm playing grandson early home go must
- b. *Heinz hat gehört, dass der ein Videospiele spielende Enkel früh nach Hause gehen muss.*  
Heinz has heard that the a video game playing grandson early home go must
- c. *Heinz hat gehört, dass der Enkel, der mit Begeisterung spielt, früh nach Hause gehen muss.*  
Heinz has heard that the grandson who with enthusiasm plays early home go must
- d. *Heinz hat gehört, dass der Enkel, der ein Videospiele spielt, früh nach Hause gehen muss.*  
Heinz has heard that the grandson who a video game plays early home go must  
‘Heinz heard that the grandson who is playing with enthusiasm/ a video game has to go home early’

Question: Darf der Enkel heute lange bleiben?

‘Is the grandson allowed to stay longer today?’

- (7) a. *Andreas hat vermutet, dass die im Gottesdienst betende Nonne dabei nicht gerne gestört wird.*  
Andreas has suspected that the during the service praying nun in that moment not gladly disturbed is

- b. *Andreas hat vermutet, dass die einen Rosenkranz betende Nonne dabei*  
 Andreas has suspected that the a rosary praying nun in that moment  
*nicht gerne gestört wird.*  
 not gladly disturbed is
- c. *Andreas hat vermutet, dass die Nonne, die im Gottesdienst betet,*  
 Andreas has suspected that the nun who during the service prays  
*dabei nicht gerne gestört wird.*  
 in that moment not gladly disturbed is
- d. *Andreas hat vermutet, dass die Nonne, die einen Rosenkranz betet, dabei*  
 Andreas has suspected that the nun who a rosary prays in that moment  
*nicht gerne gestört wird.*  
 not gladly disturbed is  
 ‘Andreas suspected that the nun who is praying during the service/ a rosary does not  
 like to be disturbed.’
- (8) a. *Jasmin hat beobachtet, dass der ohne Unterbrechung tippende Teenager fast*  
 Jasmin has observed that the without stopping typing teenager almost  
*am Zebrastreifen angefahren wurde.*  
 at-the crosswalk hit was
- b. *Jasmin hat beobachtet, dass der eine Nachricht tippende Teenager fast am*  
 Jasmin has observed that the a message typing teenager almost at-the  
*Zebrastreifen angefahren wurde.*  
 crosswalk hit was
- c. *Jasmin hat beobachtet, dass der Teenager, der ohne Unterbrechung tippte, fast*  
 Jasmin has observed that the teenager who without stopping typed almost  
*am Zebrastreifen angefahren wurde.*  
 at-the crosswalk hit was
- d. *Jasmin hat beobachtet, dass der Teenager, der eine Nachricht tippte, fast am*  
 Jasmin has observed that the teenager who a message typed almost at-the  
*Zebrastreifen angefahren wurde.*  
 crosswalk hit was  
 ‘Jasmine observed that the teenager who was typing without stopping/ a message was  
 almost hit at the crosswalk.’
- (9) a. *Nora hat festgestellt, dass der im Schaufenster dekorierende Verkäufer ständig*  
 Nora has noticed that the in-the shop window decorating salesman constantly  
*von Kunden angesprochen wird.*  
 by costumers approached is
- b. *Nora hat festgestellt, dass der ein Schaufenster dekorierende Verkäufer ständig*  
 Nora has noticed that the a shop window decorating salesman constantly  
*von Kunden angesprochen wird.*  
 by costumers approached is
- c. *Nora hat festgestellt, dass der Verkäufer, der im Schaufenster dekorierte,*  
 Nora has noticed that the salesman who in-the shop window decorates  
*ständig von Kunden angesprochen wird.*  
 constantly by costumers approached is

- 
- d. *Nora hat festgestellt, dass der Verkäufer, der ein Schaufenster dekorierte,*  
Nora has noticed that the salesman who a shop window decorates  
*ständig von Kunden angesprochen wird.*  
constantly by costumers approached is  
'Nora has noticed that the salesman who was decorating in the shop window/ a shop  
window is constantly approached by customers'

- (10) a. *Helena hat bemerkt, dass der im Museum zeichnende Künstler argwöhnisch*  
Helena has noticed that the in-the museum drawing artist suspiciously  
*vom Museumswächter beobachtet wird.*  
by-the museum guards watched is
- b. *Helena hat bemerkt, dass der eine Statue zeichnende Künstler argwöhnisch vom*  
Helena has noticed that the a statue drawing artist suspiciously by-the  
*Museumswächter beobachtet wird.*  
museum guards watched is
- c. *Helena hat bemerkt, dass der Künstler, der im Museum zeichnet, argwöhnisch*  
Helena has noticed that the artist who in-the museum draws suspiciously  
*vom Museumswächter beobachtet wird.*  
by-the museum guards watched is
- d. *Helena hat bemerkt, dass der Künstler, der eine Statue zeichnet, argwöhnisch*  
Helena has noticed that the artist who a statue draws suspiciously  
*vom Museumswächter beobachtet wird.*  
by-the museum guards watched is  
'Helena has noticed that the artist who is drawing in the museum/ a statue is being  
watched suspiciously by the museum guard'

Question: Beobachtet jemand den Künstler beim Zeichnen?

'Does anyone watch the artist while drawing?'

- (11) a. *Christian hat gehofft, dass die am Unfallort fotografierende*  
Christian has hoped that the at-the scene of the accident photographing  
*Reporterin möglichst bald wieder verschwinden würde.*  
reporter possibly soon again disappear would
- b. *Christian hat gehofft, dass die ein Beweismittel fotografierende Reporterin*  
Christian has hoped that the a piece of evidence photographing reporter  
*möglichst bald wieder verschwinden würde.*  
possibly soon again disappear would
- c. *Christian hat gehofft, dass die Reporterin, die am Unfallort*  
Christian has hoped that the reporter who at-the scene of the accident  
*fotografierte, möglichst bald wieder verschwinden würde.*  
photographed possibly soon again disappear would
- d. *Christian hat gehofft, dass die Reporterin, die ein Beweismittel fotografierte,*  
Christian has hoped that the reporter who a piece of evidence photographed  
*möglichst bald wieder verschwinden würde.*  
possibly soon again disappear would  
'Christian hoped that the reporter who is photographing at the scene of the accident/  
a piece of evidence would disappear as soon as possible'



- (12) a. *Basti hat gehört, dass die mit Hingabe tanzende Cousine eigentlich gar nicht kommen wollte.*  
Basti has heard that the with devotion dancing cousin actually at all not come wanted
- b. *Basti hat gehört, dass die einen Walzer tanzende Cousine eigentlich gar nicht kommen wollte.*  
Basti has heard that the a waltz dancing cousin actually at all not come wanted
- c. *Basti hat gehört, dass die Cousine, die mit Hingabe tanzte, eigentlich gar nicht kommen wollte.*  
Basti has heard that the cousin who with devotion danced actually at all not come wanted
- d. *Basti hat gehört, dass die Cousine, die einen Walzer tanzte, eigentlich gar nicht kommen wollte.*  
Basti has heard that the cousin who a waltz danced actually at all not come wanted  
'Basti heard that the cousin who was dancing with devotion/ a waltz actually didn't want to come.'
- Question: Hat Basti gehört, dass die Cousine eigentlich nicht kommen wollte?  
'Has Basti heard that the cousin actually didn't want to come?'
- (13) a. *Mia hat erzählt, dass die im Wohnzimmer bügelnde Oma immer wieder dabei abgelenkt wurde.*  
Mia has told that the in-the living room ironing grandma always again in the process distracted was
- b. *Mia hat erzählt, dass die einen Hosenanzug bügelnde Oma immer wieder dabei abgelenkt wurde.*  
Mia has told that the a pantsuit ironing grandma always again in the process distracted was
- c. *Mia hat erzählt, dass die Oma, die im Wohnzimmer bügelte, immer wieder dabei abgelenkt wurde.*  
Mia has told that the grandma who in-the living room ironed always again in the process distracted was
- d. *Mia hat erzählt, dass die Oma, die einen Hosenanzug bügelte, immer wieder dabei abgelenkt wurde.*  
Mia has told that the grandma who a pantsuit ironed always again in the process distracted was  
'Mia told that the grandma who was ironing in the living room/ a pantsuit kept getting distracted in the process.'
- (14) a. *Julius hat gehofft, dass die mit Mühe fahrende Rentnerin langsam mehr Sicherheit bekommen würde.*  
Julius has hoped that the with difficulty driving pensioner slowly more security gain would
- b. *Julius hat gehofft, dass die einen Mercedes fahrende Rentnerin langsam mehr Sicherheit bekommen würde.*  
Julius has hoped that the a Mercedes driving pensioner slowly more security gain would

- 
- c. *Julius hat gehofft, dass die Rentnerin, die mit Mühe fuhr, langsam mehr Sicherheit bekommen würde.*  
 Julius has hoped that the pensioner who with difficulty drove slowly more security gain would
- d. *Julius hat gehofft, dass die Rentnerin, die einen Mercedes fuhr, langsam mehr Sicherheit bekommen würde.*  
 Julius has hoped that the pensioner who a Mercedes drove slowly more security gain would  
 ‘Julius hoped that the pensioner who was driving with difficulty/ a Mercedes would slowly become more secure’
- (15) a. *Marcel hat erfahren, dass die beim Konzert begleitende Gitarristin schon mehrmals hier gespielt hat.*  
 Marcel has learned that the at-the concert accompanying guitarist already several times here played has
- b. *Marcel hat erfahren, dass die einen Chor begleitende Gitarristin schon mehrmals hier gespielt hat.*  
 Marcel has learned that the a choir accompanying guitarist already several times here played has
- c. *Marcel hat erfahren, dass die Gitarristin, die beim Konzert begleitet, schon mehrmals hier gespielt hat.*  
 Marcel has learned that the guitarist who at-the concert accompanied already several times here played has
- d. *Marcel hat erfahren, dass die Gitarristin, die einen Chor begleitet, schon mehrmals hier gespielt hat.*  
 Marcel has learned that the guitarist who a choir accompanied already several times here played has  
 ‘Marcel learned that the guitarist who is accompanying at the concert/ a choir has played here several times.’
- Question: Spielt die Gitarristin zum ersten Mal hier?  
 ‘Does the guitarist play here for the first time?’
- (16) a. *Gustav hat mitbekommen, dass der im Abteil pfeifende Schaffner nicht besonders genau kontrolliert hatte.*  
 Gustav has noticed that the in-the compartment whistling conductor not very carefully checked had
- b. *Gustav hat mitbekommen, dass der ein Lied pfeifende Schaffner nicht besonders genau kontrolliert hatte.*  
 Gustav has noticed that the a song whistling conductor not very carefully checked had
- c. *Gustav hat mitbekommen, dass der Schaffner, der im Abteil pfiff, nicht besonders genau kontrolliert hatte.*  
 Gustav has noticed that the conductor who in-the compartment whistled not very carefully checked had
- d. *Gustav hat mitbekommen, dass der Schaffner, der ein Lied pfiff, nicht besonders genau kontrolliert hatte.*  
 Gustav has noticed that the conductor who a song whistled not very carefully checked had

‘Gustav noticed that the conductor whistling in the compartment/ a song had not checked very carefully.’

- (17) a. *Ralf hat festgestellt, dass der am Tresen diskutierende Gast kaum bei*  
Ralf has noticed that the at-the bar discussing guest hardly to  
*Gegenargumenten zugehört hat.*  
counterarguments listened has
- b. *Ralf hat festgestellt, dass der eine Theorie diskutierende Gast kaum bei*  
Ralf has noticed that the a theory discussing guest hardly to  
*Gegenargumenten zugehört hat.*  
counterarguments listened has
- c. *Ralf hat festgestellt, dass der Gast, der am Tresen diskutierte, kaum bei*  
Ralf has noticed that the guest who at-the bar discussed hardly to  
*Gegenargumenten zugehört hat.*  
counterarguments listened has
- d. *Ralf hat festgestellt, dass der Gast, der eine Theorie diskutierte, kaum bei*  
Ralf has noticed that the guest who a theory discussed hardly to  
*Gegenargumenten zugehört hat.*  
counterarguments listened has  
‘Ralf noticed that the guest who was discussing at the bar/ a theory hardly listened  
to counterarguments.’
- (18) a. *Felix hat gesagt, dass der am Mittwoch feiernde Mitbewohner dann*  
Felix has said that the on Wednesday celebrating roommate then  
*irgendwann laut geschrien hat.*  
at some point loudly shouted has
- b. *Felix hat gesagt, dass der eine Party feiernde Mitbewohner dann irgendwann*  
Felix has said that the a party celebrating roommate then at some point  
*laut geschrien hat.*  
loudly shouted has
- c. *Felix hat gesagt, dass der Mitbewohner, der am Mittwoch feierte, dann*  
Felix has said that the roommate who on Wednesday celebrated then  
*irgendwann laut geschrien hat.*  
at some point loudly shouted has
- d. *Felix hat gesagt, dass der Mitbewohner, der eine Party feierte, dann*  
Felix has said that the roommate who a party celebrated then  
*irgendwann laut geschrien hat.*  
at some point loudly shouted has  
‘Felix said that the roommate who was celebrating on Wednesday/ a party then at  
some point shouted loudly.’
- Question: Hat der Mitbewohner gefeiert?  
‘Did the roommate celebrate?’
- (19) a. *Paul hat vermutet, dass der in Ruhe lesende Rentner sicherlich von vielen*  
Paul has suspected that the in peace reading pensioner certainly by many  
*beneidet wird.*  
envied is

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- b. *Paul hat vermutet, dass der ein Buch lesende Rentner sicherlich von vielen beneidet wird.*  
 Paul has suspected that the a book reading pensioner certainly by many  
*beneidet wird.*  
 envied is
- c. *Paul hat vermutet, dass der Rentner, der in Ruhe las, sicherlich von vielen beneidet wird.*  
 Paul has suspected that the pensioner who in peace read certainly by many  
*beneidet wird.*  
 envied is
- d. *Paul hat vermutet, dass der Rentner, der ein Buch las, sicherlich von vielen beneidet wird.*  
 Paul has suspected that the pensioner who a book read certainly by many  
*beneidet wird.*  
 envied is  
 ‘Paul has suspected that the pensioner who was reading in peace/ a book is certainly  
 envied by many.’

Question: Beneiden vermutlich viele den Rentner?

‘Do presumably many envy the pensioner’

- (20) a. *Michaela hat gesehen, dass die beim Bäcker einkaufende Nachbarin früh am Morgen losgegangen ist.*  
 Micheala has seen that the at-the bakery shopping neighbor early in-the  
*Morgen losgegangen ist.*  
 morning left has
- b. *Michaela hat gesehen, dass die ein Brot einkaufende Nachbarin früh am Morgen losgegangen ist.*  
 Micheala has seen that the a loaf of bread shopping neighbor early in-the  
*Morgen losgegangen ist.*  
 morning left has
- c. *Michaela hat gesehen, dass die Nachbarin, die beim Bäcker einkaufte, früh am Morgen losgegangen ist.*  
 Micheala has seen that the neighbor who at-the bakery shopped early  
*am Morgen losgegangen ist.*  
 in-the morning left has
- d. *Michaela hat gesehen, dass die Nachbarin, die ein Brot einkaufte, früh am Morgen losgegangen ist.*  
 Micheala has seen that the neighbor who a loaf of bread shopped early  
*am Morgen losgegangen ist.*  
 in-the morning left has  
 ‘Michaela has seen that the neighbor who was shopping at the bakery/ a loaf of bread  
 left early in the morning.’
- (21) a. *Gabi hat behauptet, dass der am Fluss angelnde Urlauber gerne bis Sonnenuntergang sitzen bleibt.*  
 Gabi has claimed that the at-the river fishing vacationer gladly until  
*Sonnenuntergang sitzen bleibt.*  
 sunset sit stays
- b. *Gabi hat behauptet, dass der eine Forelle angelnde Urlauber gerne bis Sonnenuntergang sitzen bleibt.*  
 Gabi has claimed that the a trout fishing vacationer gladly until  
*Sonnenuntergang sitzen bleibt.*  
 sunset sit stays
- c. *Gabi hat behauptet, dass der Urlauber, der am Fluss angelte, gerne bis Sonnenuntergang sitzen bleibt.*  
 Gabi has claimed that the vacationer who at-the river fished gladly until  
*Sonnenuntergang sitzen bleibt.*  
 sunset sit stays

- d. *Gabi hat behauptet, dass der Urlauber, der eine Forelle angelte, gerne bis Sonnenuntergang sitzen bleibt.*  
 Gabi has claimed that the vacationer who a trout fished gladly until sunset sit stays  
 ‘Gabi has claimed that the vacationer who was fishing at the river/ a trout likes to sit until sunset.’

Question: Hat Gabi verneint, dass der Urlauber gerne bis Sonnenuntergang sitzen bleibt?  
 ‘Did Gabi negate that the vacationer likes to sit until sunset?’

- (22) a. *Harald hat gemeint, dass die seit Stunden aufräumende Angestellte wahrscheinlich sehr bald entlassen wird.*  
 Harald has meant that the for hours cleaning-up employee probably very soon fired is
- b. *Harald hat gemeint, dass die einen Papierstapel aufräumende Angestellte wahrscheinlich sehr bald entlassen wird.*  
 Harald has meant that the a stack of papers cleaning-up employee probably very soon fired is
- c. *Harald hat gemeint, dass die Angestellte, die seit Stunden aufräumt, wahrscheinlich sehr bald entlassen wird.*  
 Harald has meant that the employee who for hours cleans-up probably very soon fired is
- d. *Harald hat gemeint, dass die Angestellte, die einen Papierstapel aufräumt, wahrscheinlich sehr bald entlassen wird.*  
 Harald has meant that the employee who a stack of papers cleans-up probably very soon fired is  
 ‘Harald has meant that the employee who is cleaning up for hours/ a stack of papers will probably be fired very soon.’
- (23) a. *Leonie hat erfahren, dass die im Supermarkt stehlende Jugendliche nur zufällig dabei erwischt wurde.*  
 Leonie has learned that the in-the supermarket stealing teenager only by accident in the process caught was
- b. *Leonie hat erfahren, dass die einen Kaugummi stehlende Jugendliche nur zufällig dabei erwischt wurde.*  
 Leonie has learned that the a chewing gum stealing teenager only by accident in the process caught was
- c. *Leonie hat erfahren, dass die Jugendliche, die im Supermarkt stahl, nur zufällig dabei erwischt wurde.*  
 Leonie has learned that the teenager who in-the supermarket stole only by accident in the process caught was
- d. *Leonie hat erfahren, dass die Jugendliche, die einen Kaugummi stahl, nur zufällig dabei erwischt wurde.*  
 Leonie has learned that the teenager who a chewing gum stole only by accident in the process caught was  
 ‘Leonie learned that the teenager who was stealing in the supermarket/ a piece of chewing gum was caught doing so only by accident.’

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Question: Hat die Jugendliche versucht etwas zu stehlen?

‘Did the teenager try to steal something?’

- (24) a. *Simon hat bemerkt, dass die durch Zwischenrufe störende Studentin schon häufiger auffällig geworden ist.*  
Simon has noticed that the by shouting interrupting student already earlier conspicuous been has
- b. *Simon hat bemerkt, dass die ein Seminar störende Studentin schon häufiger auffällig geworden ist.*  
Simon has noticed that the a seminar interrupting student already earlier conspicuous been has
- c. *Simon hat bemerkt, dass die Studentin, die durch Zwischenrufe störte, schon häufiger auffällig geworden ist.*  
Simon has noticed that the student who by shouting interrupted already earlier conspicuous been has
- d. *Simon hat bemerkt, dass die Studentin, die ein Seminar störte, schon häufiger auffällig geworden ist.*  
Simon has noticed that the student who a seminar interrupted already earlier conspicuous been has  
‘Simon noticed that the student who was interrupting by shouting/ a seminar had a history of being conspicuous.’

Question: Ist die Studentin eine ruhige Zuhörerin?

‘Is the student a quiet listener?’

# Appendix D

## Appendix – Experiment 4 and 5

### Experimental items (Experiment 4 and 5)

- (1) a. *Peter hat im Park bei schönem Wetter gesehen, dass der ein Eis essende Schüler gemütlich auf einer Bank gesessen hat.*  
Peter has in-the park during nice weather seen that the an ice cream eating student cozily on a bench sat has
- b. *Peter hat gesehen, dass der im Park bei schönem Wetter ein Eis essende Schüler gemütlich auf einer Bank gesessen hat.*  
Peter has seen that the in-the park during nice weather an ice cream eating student cozily on a bench sat has
- c. *Peter hat im Park bei schönem Wetter gesehen, dass der Schüler, der ein Eis aß, gemütlich auf einer Bank gesessen hat.*  
Peter has in-the park during nice weather seen that the student who an ice cream ate cozily on a bench sat has
- d. *Peter hat gesehen, dass der Schüler, der im Park bei schönem Wetter ein Eis aß, gemütlich auf einer Bank gesessen hat.*  
Peter has seen that the student who in-the park during nice weather an ice cream ate cozily on a bench sat has  
'In the park during nice weather, Peter has seen that the student who was eating ice cream was sitting cozily on a bench/Peter has seen that the student who was eating ice cream in the park during nice weather was sitting cozily on a bench'
- Question: Hat der Schüler ein Brötchen gegessen?  
'Did the student eat a sandwich?'
- (2) a. *Lisa hat am Abend auf der Terrasse bemerkt, dass der eine Kerze anzündende Kellner fröhlich bei der Arbeit gepfiffen hat.*  
Lisa has in-the evening on the terrace noticed that the a candle lightening waiter happily at work whistled has
- b. *Lisa hat bemerkt, dass der am Abend auf der Terrasse eine Kerze anzündende Kellner fröhlich bei der Arbeit gepfiffen hat.*  
Lisa has noticed that the in-the evening on the terrace a candle lightening waiter happily at work whistled has

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- c. *Lisa hat am Abend auf der Terrasse bemerkt, dass der Kellner, der eine Kerze anzündete, fröhlich bei der Arbeit gepfiffen hat.*  
 Lisa has in-the evening on the terrace noticed that the waiter who a candle lightened happily at work whistled has
- d. *Lisa hat bemerkt, dass der Kellner, der am Abend auf der Terrasse eine Kerze anzündete, fröhlich bei der Arbeit gepfiffen hat.*  
 Lisa has noticed that the waiter who in-the evening on the terrace a candle lightened happily at work whistled has  
 ‘Lisa has noticed in the evening on the terrace that the waiter who was lighting a candle was whistling happily at work./ Lisa has noticed that the waiter who was lighting a candle in the evening on the terrace was whistling happily at work.’
- (3) a. *Frank hat im Wohnzimmer spät am Abend beobachtet, dass der ein Bild malende Künstler ungeduldig auf eine gute Idee gewartet hat.*  
 Frank has in-the living room late in-the evening observed that the a picture painting artist impatiently for a good idea waited has.
- b. *Frank hat beobachtet, dass der im Wohnzimmer spät am Abend ein Bild malende Künstler ungeduldig auf eine gute Idee gewartet hat.*  
 Frank has observed that the in-the living room late in-the evening a picture painting artist impatiently for a good idea waited has.
- c. *Frank hat im Wohnzimmer spät am Abend beobachtet, dass der Künstler, der ein Bild malte, ungeduldig auf eine gute Idee gewartet hat.*  
 Frank has in-the living room late in-the evening observed that the artist who a picture painted impatiently for a good idea waited has.
- d. *Frank hat beobachtet, dass der Künstler, der im Wohnzimmer spät am Abend ein Bild malte, ungeduldig auf eine gute Idee gewartet hat.*  
 Frank has observed that the artist who in-the living room late in-the evening a picture painted impatiently for a good idea waited has.  
 ‘Frank observed in the living room late in the evening that the artist who was painting a picture was waiting impatiently for a good idea./ Frank observed that the artist who was painting a picture in the living room late at night was impatiently waiting for a good idea.’
- (4) a. *Christine hat beim Warten in der Wohnung erfahren, dass der ein Regal aufbauende Schreiner bald in den Urlaub fahren wird.*  
 Christine has while waiting in the apartment learned that the a shelf assembling carpenter soon on vacation go will
- b. *Christine hat erfahren, dass der seit einer Weile mit Begeisterung ein Regal aufbauende Schreiner bald in den Urlaub fahren wird.*  
 Christine has learned that the for a while with enthusiasm a shelf assembling carpenter soon on vacation go will
- c. *Christine hat beim Warten in der Wohnung erfahren, dass der Schreiner, der ein Regal aufbaut, bald in den Urlaub fahren wird.*  
 Christine has while waiting in the apartment learned that the carpenter who a shelf assembles soon on vacation go will



- d. *Christine hat erfahren, dass der Schreiner, der seit einer Weile mit Begeisterung ein Regal aufbaut, bald in den Urlaub fahren wird.*  
 Christine has learned that the carpenter who for a while with enthusiasm a shelf assembles soon on vacation go will  
 ‘While waiting in the apartment, Christine learned that the carpenter who is assembling a shelf will soon be going on vacation./ Christine has learned that the carpenter, who has been assembling a shelf with enthusiasm for a while, will soon be going on vacation.’

Question: Baut der Schreiner ein Regal auf?

‘Did the carpenter assemble a shelf’

- (5) a. *Martin hat am Feierabend nach vielen Meetings gehofft, dass der ein Buch lesende Manager sich langsam von dem Stress erholen würde.*  
 Martin has at-the end of the day after many meetings hoped that the a book reading mamanger himself slowly from the stress recover would
- b. *Martin hat gehofft, dass der im Urlaub seit längerem wieder ein Buch lesende Manager sich langsam von dem Stress erholen würde.*  
 Martin has hoped that the on vacation since a long time again a book reading mamanger himself slowly from the stress recover would
- c. *Martin hat am Feierabend nach vielen Meetings gehofft, dass der Manager, der ein Buch las, sich langsam von dem Stress erholen würde.*  
 Martin has at-the end of the day after many meetings hoped that the manager who a book read himself slowly from the stress recover would
- d. *Martin hat gehofft, dass der Manager, der im Urlaub seit längerem wieder ein Buch las, sich langsam von dem Stress erholen würde.*  
 Martin has hoped that the manager who on vacation since a long time again a book read himself slowly from the stress recover would  
 ‘At the end of the day after many meetings, Martin hoped that the manager who was reading a book would slowly recover from the stress./ Martin had hoped that the manager who was reading a book on vacation after a long time would slowly recover from the stress.’

Question: Hat der Manager die Zeitung gelesen?

‘Did the manager read the newspaper?’

- (6) a. *Julia hat am Vormittag auf dem Balkon vermutet, dass der eine Zigarette rauchende Angestellte sich davor über einen Kollegen geärgert hat.*  
 Jutta has in-the morning on the balcony suspected that the a cigarette smoking employee himself beforehand about a colleague annoyed has
- b. *Julia hat vermutet, dass der am Vormittag auf dem Balkon eine Zigarette rauchende Angestellte sich davor über einen Kollegen geärgert hat.*  
 Jutta has suspected that the in-the morning on the balcony a cigarette smoking employee himself beforehand about a colleague annoyed has
- c. *Julia hat am Vormittag auf dem Balkon vermutet, dass der Angestellte, der eine Zigarette rauchte, sich davor über einen Kollegen geärgert hat.*  
 Jutta has in-the morning on the balcony suspected that the employee who a cigarette smoked himself beforehand about a colleague annoyed has

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- d. *Julia hat vermutet, dass der Angestellte, der am Vormittag auf dem Balkon eine Zigarette rauchte, sich davor über einen Kollegen geärgert hat.*  
Julia has suspected that the employee who in-the morning on the balcony a cigarette smoked himself beforehand about a colleague annoyed has  
'Julia suspected on the balcony in the morning that the employee who was smoking a cigarette had been annoyed with a colleague beforehand./ Julia suspected that the employee who smoked a cigarette on the balcony in the morning had been annoyed with a colleague beforehand.'

Question: Hat sich der Angestellte über seinen Chef geärgert?

'Had the employee been annoyed with his boss?'

- (7) a. *Heinz hat am Sonntag in der Innenstadt gehört, dass der ein Zimmer streichende Familienvater lautstark über den Vormieter geflucht hat.*  
Heinz has on Sunday in the city center heard that the a room painting family father loudly about the previous tenant cursed has
- b. *Heinz hat gehört, dass der am Sonntag in der Innenstadt ein Zimmer streichende Familienvater lautstark über den Vormieter geflucht hat.*  
Heinz has heard that the on Sunday in the city center a room painting family father loudly about the previous tenant cursed has
- c. *Heinz hat am Sonntag in der Innenstadt gehört, dass der Familienvater, der ein Zimmer strich, lautstark über den Vormieter geflucht hat.*  
Heinz has on Sunday in the city center heard that the family father who a room painted loudly about the previous tenant cursed has
- d. *Heinz hat gehört, dass der Familienvater, der am Sonntag in der Innenstadt ein Zimmer strich, lautstark über den Vormieter geflucht hat.*  
Heinz has heard that the family father who on Sunday in the city center a room painted loudly about the previous tenant cursed has  
'In the city center on Sunday, Heinz has heard that the father of the family who was painting a room was cursing loudly about the previous tenant./ Heinz has heard that the father of the family who was painting a room in the city center on Sunday was cursing loudly about the previous tenant.'

Question: Hat Heinz den Familienvater fluchen gehört?

'Did Heinz hear the father of the family cursing?'

- (8) a. *Diana hat am Morgen vor der Arbeit bemerkt, dass der ein Brot kaufende Nachbar leise auf dem Weg gesummt hat.*  
Diana has in-the morning before the work noticed that the a loaf of bread buying neighbor quietly on the way hummed has
- b. *Diana hat bemerkt, dass der noch schnell vor der Arbeit ein Brot kaufende Nachbar leise auf dem Weg gesummt hat.*  
Diana has noticed that the yet quickly before the work a loaf of bread buying neighbor quietly on the way hummed has
- c. *Diana hat am Morgen vor der Arbeit bemerkt, dass der Nachbar, der ein Brot kaufte, leise auf dem Weg gesummt hat.*  
Diana has in-the morning before the work noticed that the neighbor who a loaf of bread bought quietly on the way hummed has

- d. *Diana hat bemerkt, dass der Nachbar, der noch schnell vor der Arbeit ein Brot kaufte, leise auf dem Weg gesummt hat.*  
 Diana has noticed that the neighbor who yet quickly before the work a loaf of bread bought quietly on the way hummed has  
 ‘In the morning before work, Diana noticed that the neighbor who was buying a loaf of bread quietly hummed on the way./ Diana noticed that the neighbor who was quickly buying a loaf of bread before going to work quietly hummed on the way.’

Question: Hat der Nachbar gesummt?

‘Was the neighbor humming?’

- (9) a. *Andreas hat lange Zeit bei jeder Gelegenheit erzählt, dass der eine Arbeit suchende Frisör sich ständig über das Jobangebot geärgert hat.*  
 Andreas has long time at every opportunity told that the a job searching hairdresser himself constantly about the job offers annoyed has
- b. *Andreas hat erzählt, dass der lange Zeit in der Umgebung eine Arbeit suchende Frisör sich ständig über das Jobangebot geärgert hat.*  
 Andreas has told that the long time in the area a job searching hairdresser himself constantly about the job offers annoyed has
- c. *Andreas hat lange Zeit bei jeder Gelegenheit erzählt, dass der Frisör, der eine Arbeit suchte, sich ständig über das Jobangebot geärgert hat.*  
 Andreas has long time at every opportunity told that the hairdresser who a job searched himself constantly about the job offers annoyed has
- d. *Andreas hat erzählt, dass der Frisör, der lange Zeit in der Umgebung eine Arbeit suchte, sich ständig über das Jobangebot geärgert hat.*  
 Andreas has told that the hairdresser who long time in the area a job searched himself constantly about the job offers annoyed has  
 ‘Andreas has long told at every opportunity that the hairdresser who was looking for a job was constantly annoyed with the job offer./ Andreas has told that the hairdresser who was looking for a job in the area for a long time was constantly annoyed with the job offers.’

Question: Hat sich der Lehrer über das Jobangebot geärgert?

‘Was the teacher annoyed with the job offers?’

- (10) a. *Jasmin hat am Telefon von der Mutter erfahren, dass der eine Naturwissenschaft studierende Cousin sich leicht auf dem Heimweg verletzt hat.*  
 Jasmin has on-the phone from the mother learned that the a natural science studying cousin himself slightly on the way home injured has
- b. *Jasmin hat erfahren, dass der in der Hauptstadt seit Kurzem eine Naturwissenschaft studierende Cousin sich leicht auf dem Heimweg verletzt hat.*  
 Jasmin has learned that the in the capital since recently a natural science studying cousin himself slightly on the way home injured has

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- c. *Jasmin hat am Telefon von der Mutter erfahren, dass der Cousin, der eine Naturwissenschaft studiert, sich leicht auf dem Heimweg verletzt hat.*  
 Jasmin has on-the phone from the mother learned that the cousin who a natural science studies himself slightly on the way home injured has
- d. *Jasmin hat erfahren, dass der Cousin, der in der Hauptstadt seit Kurzem eine Naturwissenschaft studiert, sich leicht auf dem Heimweg verletzt hat.*  
 Jasmin has learned that the cousin who in the capital since recently a natural science studies himself slightly on the way home injured has  
 ‘Jasmin learned from her mother on the phone that her cousin who is studying a natural science has slightly injured himself on the way home./ Jasmin has learned that the cousin who has recently started studying a natural science in the capital has slightly injured himself on the way home.’
- (11) a. *Fabian hat am Nachmittag bei der Tante gesehen, dass der ein Videospiele spielende Teenager wirklich jedes Mal gewonnen hat.*  
 Fabian has in-the afternoon at the aunt seen that the a video game playing teenager really every time won has
- b. *Fabian hat gesehen, dass der mit der Schwester am Nachmittag ein Videospiele spielende Teenager wirklich jedes Mal gewonnen hat.*  
 Fabian has seen that the with the sister in-the afternoon a video game playing teenager really every time won has
- c. *Fabian hat am Nachmittag bei der Tante gesehen, dass der Teenager, der ein Videospiele spielte, wirklich jedes Mal gewonnen hat.*  
 Fabian has in-the afternoon at the aunt seen that the teenager who a video game played really every time won has
- d. *Fabian hat gesehen, dass der Teenager, der mit der Schwester am Nachmittag ein Videospiele spielte, wirklich jedes Mal gewonnen hat.*  
 Fabian has seen that the teenager who with the sister in-the afternoon a video game played really every time won has  
 ‘Fabian saw in the afternoon at the aunt that the teenager who was playing a video game really won every time./ Fabian saw that the teenager who was playing a video game with the sister in the afternoon really won every time.’
- (12) a. *Sandra hat am Sonntag vor dem Gottesdienst vermutet, dass der eine Beichte ablegende Großvater sich etwas vor dem Priester gefürchtet hat.*  
 Sandra has on Sunday before the service suspected that the a confession making grandfather himself a little of the priest frightened has
- b. *Sandra hat vermutet, dass der am Sonntag vor dem Gottesdienst eine Beichte ablegende Großvater sich etwas vor dem Priester gefürchtet hat.*  
 Sandra has suspected that the on Sunday before the service a confession making grandfather himself a little of the priest frightened has
- c. *Sandra hat am Sonntag vor dem Gottesdienst vermutet, dass der Großvater, der eine Beichte ablegte, sich etwas vor dem Priester gefürchtet hat.*  
 Sandra has on Sunday before the service suspected that the grandfather who a confession made himself a little of the priest frightened has

- d. *Sandra hat vermutet, dass der Großvater, der am Sonntag vor dem Gottesdienst eine Beichte ablegte, sich etwas vor dem Priester gefürchtet hat.*  
Sandra has suspected that the grandfather who on Sunday before the service a confession made himself a little of the priest frightened has ‘Sandra suspected on Sunday before the service that the grandfather who was making a confession was a little afraid of the priest./ Sandra suspected that the grandfather who was making a confession before the service on Sunday was a little afraid of the priest.’
- (13) a. *Philipp hat am Mittag bei schlechtem Wetter gemeint, dass der eine Torte backende Konditor bestimmt vom nächsten Urlaub geträumt hat.*  
Philipp has at noon during bad weather meant that the a cake baking pastry chef surely of-the next vacation dreamed has
- b. *Philipp hat gemeint, dass der am Mittag bei schlechtem Wetter eine Torte backende Konditor bestimmt vom nächsten Urlaub geträumt hat.*  
Philipp has meant that the at noon during bad weather a cake baking pastry chef surely of-the next vacation dreamed has
- c. *Philipp hat am Mittag bei schlechtem Wetter gemeint, dass der Konditor, der eine Torte backte, bestimmt vom nächsten Urlaub geträumt hat.*  
Philipp has at noon during bad weather meant that the pastry chef who a cake baked surely of-the next vacation dreamed has
- d. *Philipp hat gemeint, dass der Konditor, der am Mittag bei schlechtem Wetter eine Torte backte, bestimmt vom nächsten Urlaub geträumt hat.*  
Philipp has meant that the pastry chef who at noon during bad weather a cake baked surely of-the next vacation dreamed has ‘Philipp said at noon during bad weather that the pastry chef who was baking a cake surely dreamed of the next vacation./ Philipp said that the pastry chef who was baking a cake at noon during bad weather must have been dreaming of the next vacation.’
- (14) a. *Ingrid hat am Nachmittag in der Teeküche gesagt, dass der ein Telefonat führende Kollege relativ laut in den Hörer geschrien hat.*  
Ingrid has in-the afternoon in the kitchenette said that the a phone call making colleague relatively loudly into the receiver shouted has
- b. *Ingrid hat gesagt, dass der im Nebenraum wenige Minuten lang ein Telefonat führende Kollege relativ laut in den Hörer geschrien hat.*  
Ingrid has said that the in-the next room few minutes long a phone call making colleague relatively loudly into the receiver shouted has
- c. *Ingrid hat am Nachmittag in der Teeküche gesagt, dass der Kollege, der ein Telefonat führte, relativ laut in den Hörer geschrien hat.*  
Ingrid has in-the afternoon in the kitchenette said that the colleague who a phone call made relatively loudly into the receiver shouted has
- d. *Ingrid hat gesagt, dass der Kollege, der im Nebenraum wenige Minuten lang ein Telefonat führte, relativ laut in den Hörer geschrien hat.*  
Ingrid has said that the colleague who in-the next room few minutes long a phone call made relatively loudly into the receiver shouted has ‘Ingrid said in the afternoon in the kitchenette that the colleague who was on the phone shouted relatively loudly into the receiver./ Ingrid said that the colleague who

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was on a phone call in the next room for a few minutes shouted relatively loudly into the receiver.’

- (15) a. *Werner hat am Freitag an einer Bucht gesehen, dass der eine Forelle fangende Tourist dabei behaglich in der Sonne gesessen hat.*  
Werner has on Friday at a bay seen that the a trout catching tourist while doing so comfortably in the sun sat has
- b. *Werner hat gesehen, dass der am Freitag an einer Bucht eine Forelle fangende Tourist dabei behaglich in der Sonne gesessen hat.*  
Werner has seen that the on Friday at a bay a trout catching tourist while doing so comfortably in the sun sat has
- c. *Werner hat am Freitag an einer Bucht gesehen, dass der Tourist, der eine Forelle fing, dabei behaglich in der Sonne gesessen hat.*  
Werner has on Friday at a bay seen that the tourist who a trout caught while doing so comfortably in the sun sat has
- d. *Werner hat gesehen, dass der Tourist, der am Freitag an einer Bucht eine Forelle fing, dabei behaglich in der Sonne gesessen hat.*  
Werner has seen that the tourist who on Friday at a bay a trout caught while doing so comfortably in the sun sat has  
‘Werner saw on Friday at a bay that the tourist who was catching a trout was sitting comfortably in the sun while doing so./ Werner saw that the tourist who was catching a trout at a bay on Friday was sitting comfortably in the sun while doing so.’

Question: Hat Werner den Touristen im Schatten sitzen sehen?

‘Did Werner see the tourist sit in the shadow?’

- (16) a. *Gabi hat bei der Feier am Samstag beobachtet, dass der eine Rede haltende Vater freudig das Brautpaar mit netten Worten beglückt hat.*  
Gabi has at the party on Saturday observed that the a speech giving father joyfully the bride and groom with kind words graced has
- b. *Gabi hat beobachtet, dass der bei der Feier am Samstag eine Rede haltende Vater freudig das Brautpaar mit netten Worten beglückt hat.*  
Gabi has observed that the at the party on Saturday a speech giving father joyfully the bride and groom with kind words graced has
- c. *Gabi hat bei der Feier am Samstag beobachtet, dass der Vater, der eine Rede hielt, freudig das Brautpaar mit netten Worten beglückt hat.*  
Gabi has at the party on Saturday observed that the father who a speech gave joyfully the bride and groom with kind words graced has
- d. *Gabi hat beobachtet, dass der Vater, der bei der Feier am Samstag eine Rede hielt, freudig das Brautpaar mit netten Worten beglückt hat.*  
Gabi has observed that the father who at the party on Saturday a speech gave joyfully the bride and groom with kind words graced has  
‘Gabi observed at the celebration on Saturday that the father who was giving a speech joyfully graced the bride and groom with kind words./ Gabi observed that the father who was giving a speech at the ceremony on Saturday joyfully graced the bride and groom with kind words.’

- (17) a. *Marcel hat spät am Abend im Bierzelt festgestellt, dass der ein Lied singende Betrunkene lauter als alle anderen gegrölt hat.*  
 Marcel has late in-the evening in-the beer tent noticed that the a song singing drunk louder than all others bawled has
- b. *Marcel hat festgestellt, dass der mit Freunden spät am Abend ein Lied singende Betrunkene lauter als alle anderen gegrölt hat.*  
 Marcel has noticed that the with friends late in-the evening a song singing drunk louder than all others bawled has
- c. *Marcel hat spät am Abend im Bierzelt festgestellt, dass der Betrunkene, der ein Lied sang, lauter als alle anderen gegrölt hat.*  
 Marcel has late in-the evening in-the beer tent noticed that the drunk who a song sang louder than all others bawled has
- d. *Marcel hat festgestellt, dass der Betrunkene, der mit Freunden spät am Abend ein Lied sang, lauter als alle anderen gegrölt hat.*  
 Marcel has noticed that the drunk who with friends late in-the evening a song sang louder than all others bawled has  
 ‘Marcel noticed late at night in the beer tent that the drunk who was singing a song was bawling louder than everyone else./ Marcel noticed that the drunk who was singing a song with friends late at night was bawling louder than everyone else.’
- (18) a. *Eva hat in der Küche am Nachmittag erzählt, dass der ein Gedicht schreibende Schriftsteller sich später mit einem Stück Kuchen belohnen wird.*  
 Eva has in the kitchen in-the afternoon told that the a poem writing writer himself later with a piece of cake reward will
- b. *Eva hat erzählt, dass der in der Küche am Nachmittag ein Gedicht schreibende Schriftsteller sich später mit einem Stück Kuchen belohnen wird.*  
 Eva has told that the in the kitchen in-the afternoon a poem writing writer himself later with a piece of cake reward will
- c. *Eva hat in der Küche am Nachmittag erzählt, dass der Schriftsteller, der ein Gedicht schreibt, sich später mit einem Stück Kuchen belohnen wird.*  
 Eva has in the kitchen in-the afternoon told that the writer who a poem wrote himself later with a piece of cake reward will
- d. *Eva hat erzählt, dass der Schriftsteller, der in der Küche am Nachmittag ein Gedicht schreibt, sich später mit einem Stück Kuchen belohnen wird.*  
 Eva has told that the writer who in the kitchen in-the afternoon a poem wrote himself later with a piece of cake reward will  
 ‘Eva told in the kitchen in the afternoon that the writer who is writing a poem will reward himself with a piece of cake later./ Eva told that the writer who is writing a poem in the kitchen in the afternoon will reward himself with a piece of cake later.’
- (19) a. *Lukas hat heute morgen an der Uni gehört, dass der ein Seminar besuchende Student gerne bei gutem Wetter klettern will.*  
 Lukas has this morning at the university heard that the a seminar attending student gladly in good weather climb wants
- b. *Lukas hat gehört, dass der heute Morgen an der Uni ein Seminar besuchende Student gerne bei gutem Wetter klettern will.*  
 Lukas has heard that the this morning at the university a seminar attending student gladly in good weather climb wants

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- c. *Lukas hat heute morgen an der Uni gehört, dass der Student, der ein Seminar besucht, gerne bei gutem Wetter klettern will.*  
 Lukas has this morning at the university heard that the student who a seminar attends gladly in good weather climb wants
- d. *Lukas hat gehört, dass der Student, der heute Morgen an der Uni ein Seminar besucht, gerne bei gutem Wetter klettern will.*  
 Lukas has heard that the student who this morning at the university a seminar attends gladly in good weather climb wants  
 ‘Luke heard this morning at the university that the student who is attending a seminar would like to climb in good weather./ Lukas has heard that the student who is attending a seminar at the university this morning would like to go climbing in good weather.’

Question: Will der Student gerne wandern gehen?

‘Does the student want to go hiking?’

- (20) a. *Nora hat beim Wettbewerb an diesem Wochenende gesagt, dass der eine Bestleistung erbringende Sportler schon für das nächste Turnier trainieren muss.*  
 Nora has at-the competition at this weekend said that the a best performance giving athlete already for the next tournament train must
- b. *Nora hat gesagt, dass der beim Wettbewerb an diesem Wochenende eine Bestleistung erbringende Sportler schon für das nächste Turnier trainieren muss.*  
 Nora has said that the at-the competition at this weekend a best performance giving athlete already for the next tournament train must
- c. *Nora hat beim Wettbewerb an diesem Wochenende gesagt, dass der Sportler, der eine Bestleistung erbrachte, schon für das nächste Turnier trainieren muss.*  
 Nora has at-the competition at this weekend said that the athlete who a best performance gave already for the next tournament train must
- d. *Nora hat gesagt, dass der Sportler, der beim Wettbewerb an diesem Wochenende eine Bestleistung erbrachte, schon für das nächste Turnier trainieren muss.*  
 Nora has said that the athlete who at-the competition at this weekend a best performance gave already for the next tournament train must  
 ‘Nora said at this weekend’s competition that the athlete who gave a best performance must already be training for the next tournament./ Nora said that the athlete who gave a best performance at this weekend’s competition must already be training for the next tournament.’
- (21) a. *Ralf hat seit Kurzem von einem Kollegen erfahren, dass der ein Schaufensterputzende Azubi abends für die Prüfung lernen wird.*  
 Ralf has since recently from a colleague learned that the a shop window cleaning apprentice in the evening for the exam learn will



- b. *Ralf hat erfahren, dass der im Augenblick im Laden gegenüber ein Schaufenster putzende Azubi abends für die Prüfung lernen wird.*  
 Ralf has learned that the in-the moment in-the store opposite a shop window cleaning apprentice in the evening for the exam learn will
- c. *Ralf hat seit Kurzem von einem Kollegen erfahren, dass der Azubi, der ein Schaufenster putzt, abends für die Prüfung lernen wird.*  
 Ralf has since recently from a colleague learned that the apprentice who a shop window cleans in the evening for the exam learn will
- d. *Ralf hat erfahren, dass der Azubi, der im Augenblick im Laden gegenüber ein Schaufenster putzt, abends für die Prüfung lernen wird.*  
 Ralf has learned that the apprentice who in-the moment in-the store opposite a shop window cleans in the evening for the exam learn will  
 ‘Ralf has recently learned from a colleague that the apprentice who is cleaning a shop window will study for the exam in the evening./ Ralf has learned that the apprentice who is currently cleaning a shop window in the store across the street will be studying for the exam in the evening.’

Question: Bezweifelt Ralf, dass der Azubi abends lernen wird?

‘Does Ralf doubt that the apprentice will learn in the evening?’

- (22) a. *Doris hat am Morgen bei schönem Wetter gehofft, dass der eine Melodie pfeifende Rentner dann auf der Terasse frühstücken würde.*  
 Doris has in-the morning while nice weather hoped that the a tune whistling pensioner then on the terrace breakfast have would
- b. *Doris hat gehofft, dass der im Garten in der Sonne eine Melodie pfeifende Rentner dann auf der Terasse frühstücken würde.*  
 Doris has hoped that the in-the garden in the sun a tune whistling pensioner then on the terrace breakfast have would
- c. *Doris hat am Morgen bei schönem Wetter gehofft, dass der Rentner, der eine Melodie pfiß, dann auf der Terasse frühstücken würde.*  
 Doris has in-the morning while nice weather hoped that the pensioner who a tune whistled then on the terrace breakfast have would
- d. *Doris hat gehofft, dass der Rentner, der im Garten in der Sonne eine Melodie pfiß, dann auf der Terasse frühstücken würde.*  
 Doris has hoped that the pensioner who in-the garden in the sun a tune whistled then on the terrace breakfast have would  
 ‘Doris hoped in the morning, when the weather was nice, that the pensioner who was whistling a tune would then have breakfast on the terrace./ Doris hoped that the pensioner who was whistling a tune in the sun in the garden would then have breakfast on the terrace.’

Question: Pfiß der Rentner?

‘Did the pensioner whistle?’

- (23) a. *Felix hat nach dem Auftritt mit Sicherheit erfahren, dass der eine Choreographie einstudierende Tänzer gerade erst mit der Karriere begonnen hat.*  
 Felix has after the performance with certainty learned that the a choreography rehearsing dancer only just with the career started has

- 
- b. *Felix hat erfahren, dass der bis spät abends mit Konzentration eine Choreographie einstudierende Tänzer gerade erst mit der Karriere begonnen hat.*  
 Felix has learned that the until late in the evening with concentration a choreography rehearsing dancer only just with the career started has
- c. *Felix hat nach dem Auftritt mit Sicherheit erfahren, dass der Tänzer, der eine Choreographie einstudierte, gerade erst mit der Karriere begonnen hat.*  
 a choreography rehearsed only just with the career started has
- d. *Felix hat erfahren, dass der Tänzer, der bis spät abends mit Konzentration eine Choreographie einstudierte, gerade erst mit der Karriere begonnen hat.*  
 started has  
 ‘Felix certainly learned after the performance that the dancer who was rehearsing a choreography just started his career./ Felix has learned that the dancer who was rehearsing a choreography with concentration until late at night has just started his career.’

- (24) a. *Anna hat unter der Woche im Wohnheim gemeint, dass der eine Party veranstaltende Mitbewohner sich wirklich über die Beschwerde gewundert hat.*  
 havng roommate himself really about the complaint wondered has
- b. *Anna hat gemeint, dass der unter der Woche im Wohnheim eine Party veranstaltende Mitbewohner sich wirklich über die Beschwerde gewundert hat.*  
 havng roommate himself really about the complaint wondered has
- c. *Anna hat unter der Woche im Wohnheim gemeint, dass der Mitbewohner, der eine Party veranstaltete, sich wirklich über die Beschwerde gewundert hat.*  
 a party had himself really about the complaint wondered has
- d. *Anna hat gemeint, dass der Mitbewohner, der unter der Woche im Wohnheim eine Party veranstaltete, sich wirklich über die Beschwerde gewundert hat.*  
 a party had himself really about the complaint wondered has  
 ‘Anna meant during the week in the dorm that the roommate who was having a party was really wondering about the complaint./ Anna meant that the roommate who was having a party in the dorm during the week was really wondering about the complaint.’

Question: Hat der Mitbewohner eine Party veranstaltet?

‘Was the roommate having a party?’

# Appendix E

## Appendix – Experiment 6

### Experimental items (Experiment 6)

- (1) a. *Lisa will den die im Wohnzimmer malende Nichte betreuenden Mitbewohner am liebsten heiraten.*  
Lisa wants the the in-the living room drawing niece taking care roommate the  
most marry
- b. *Lisa will den die kleine Nichte im Wohnzimmer betreuenden Mitbewohner am liebsten heiraten.*  
Lisa wants the the little niece in-the living room taking care roommate the  
most marry
- c. *Lisa will den Mitbewohner, der die Nichte, die im Wohnzimmer malt, betreut, am liebsten heiraten.*  
Lisa wants the roommate who the niece who in-the living room draws  
takes care the most marry
- d. *Lisa will den Mitbewohner, der die kleine Nichte im Wohnzimmer betreut, am liebsten heiraten.*  
Lisa wants the roommate who the little niece in-the living room takes care  
the most marry  
'Lisa wants to marry the roommate who is taking care of the niece who is painting in  
the living room most of all./ Lisa wants to marry the roommate who is taking care of  
the little niece in the living room most of all.'
- (2) a. *Ingrid will den die im roten Haus wohnende Nachbarin besuchenden Onkel später noch anrufen.*  
Ingrid wants the the in-the red house living neighbor visiting uncle  
later still call
- b. *Ingrid will den die nette Nachbarin im roten Haus besuchenden Onkel später noch anrufen.*  
Ingrid wants the the nice neighbor in-the red house visiting uncle later  
still call

- 
- c. *Ingrid will den Onkel, der die Nachbarin, die im roten Haus wohnt, besucht, später noch anrufen.*  
 Ingrid wants the uncle who the neighbor who in-the red house lives visits  
*später noch anrufen.*  
 later still call
- d. *Ingrid will den Onkel, der die nette Nachbarin im roten Haus besucht, später noch anrufen.*  
 Ingrid wants the uncle who the nice neighbor in-the red house visits later  
*noch anrufen.*  
 still call  
 ‘Ingrid wants to call the uncle who is visiting the nice neighbor in the red house later./  
 Ingrid wants to call the uncle who is visiting the neighbor who lives in the red house  
 later.’
- (3) a. *Nina konnte den die in der Kita bastelnde Tochter abholenden Bruder noch nicht erreichen.*  
 Nina could the the in the kindergarden handcrafting daughter picking up brother  
*noch nicht erreichen.*  
 yet not reach
- b. *Nina konnte den die jüngste Tochter von der Kita abholenden Bruder noch nicht erreichen.*  
 Nina could the the youngest daughter from the kindergarden picking up brother  
*noch nicht erreichen.*  
 yet not reach
- c. *Nina konnte den Bruder, der die Tochter, die in der Kita bastelt, abholt, noch nicht erreichen.*  
 Nina could the brother who the daughter who in the kindergarden handcrafts  
*abholt, noch nicht erreichen.*  
 picks up yet not reach
- d. *Nina konnte den Bruder, der die jüngste Tochter von der Kita abholt, noch nicht erreichen.*  
 Nina could the brother who the youngest daughter from the kindergarden picks up  
*noch nicht erreichen.*  
 yet not reach  
 ‘Nina has not yet been able to reach the brother who is picking up the daughter who is  
 doing handicrafts at the kindergarden./ Nina has not yet been able to reach the brother  
 who is picking up the youngest daughter from the kindergarden.’
- (4) a. *Martin hat den die im Garten spielende Enkelin umarmenden Opa heute Morgen kennengelernt.*  
 Martin has the the in-the garden playing granddaughter hugging grandpa  
*heute Morgen kennengelernt.*  
 today morning met
- b. *Martin hat den die vierjährige Enkelin im Garten umarmenden Opa heute Morgen kennengelernt.*  
 Martin has the the four-year-old granddaughter in-the garden hugging grandpa  
*heute Morgen kennengelernt.*  
 today morning met
- c. *Martin hat den Opa, der die Enkelin, die im Garten spielte, umarmte, heute Morgen kennengelernt.*  
 Martin has the grandpa who the granddaughter who in-the garden played hugged  
*heute Morgen kennengelernt.*  
 today morning met
- d. *Martin hat den Opa, der die vierjährige Enkelin im Garten umarmte, heute Morgen kennengelernt.*  
 Martin has the grandpa who the four-year-old granddaughter in-the garden  
*umarmte, heute Morgen kennengelernt.*  
 hugged today morning met

‘Martin met the grandpa who was hugging the granddaughter who was playing in the garden this morning./ Martin met the grandpa who was hugging the four-year-old granddaughter in the garden this morning.’

- (5) a. *Michaela hat die den auf dem Smartphone tippenden Teenager anschreiende*  
 Michaela has the the on the smartphone typing teenager yelling-at  
*Radfahlerin von Weitem gehört.*  
 cyclist from a distance heard
- b. *Michaela hat die den unachtsamen Teenager an der Ampel anschreiende*  
 Michaela has the the unwary teenager at the traffic light yelling-at  
*Radfahlerin von Weitem gehört.*  
 cyclist from a distance heard
- c. *Michaela hat die Radfahlerin, die den Teenager, der auf dem Smartphone tippte,*  
 Michaela has the cyclist who the cyclist who on the smartphone typed  
*anschrie, von Weitem gehört.*  
 yelled-at from a distance heard
- d. *Michaela hat die Radfahlerin, die den unachtsamen Teenager an der Ampel*  
 Michaela has the cyclist who the unwary teenager at the traffic light  
*anschrie, von Weitem gehört.*  
 yelled-at from a distance heard  
 ‘Michaela heard the cyclist who was yelling at the teenager who was typing on the  
 smartphone from a distance./ Michaela heard the cyclist who was yelling at the unwary  
 teenager at the traffic light from a distance.’
- (6) a. *Laura hat den die am Nachmittag arbeitende Tante anrufenden Sohn heute*  
 Laura has the the in-the afternoon working aunt calling son today  
*kaum gesehen.*  
 hardly seen
- b. *Laura hat den die verhasste Tante am Nachmittag anrufenden Sohn heute kaum*  
 Laura has the the hated aunt in-the afternoon calling son today hardly  
*gesehen.*  
 seen
- c. *Laura hat den Sohn, der die Tante, die am Nachmittag arbeitet, anruft, heute*  
 Laura has the son who the aunt who in-the afternoon works called today  
*kaum gesehen.*  
 hardly seen
- d. *Laura hat den Sohn, der die verhasste Tante am Nachmittag anruft, heute*  
 Laura has the son who the hated aunt in-the afternoon called today  
*kaum gesehen.*  
 hardly seen  
 ‘Laura has hardly seen the son who is calling the aunt who is working in the afternoon  
 today./ Laura has hardly seen the son who is calling the hated aunt in the afternoon  
 today.’
- (7) a. *Paul wird die den seit einer Woche unterrichtenden Professor ausfragende*  
 Paul will the the since a week teaching professor questioning  
*Studentin heute noch ansprechen.*  
 student today still adress

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- b. *Paul wird die den engagierten Professor nach dem Kurs ausfragende Studentin heute noch ansprechen.*  
 Paul will the the dedicated professor after the course questioning student  
*heute noch ansprechen.*  
 today still address
- c. *Paul wird die Studentin, die den Professor, der seit einer Woche unterrichtet, ausfragt, heute noch ansprechen.*  
 Paul will the student who the professor who since a week teaches  
*ausfragt, heute noch ansprechen.*  
 questions today still address
- d. *Paul wird die Studentin, die den engagierten Professor nach dem Kurs ausfragt, heute noch ansprechen.*  
 Paul will the student who the dedicated professor after the course questions  
*heute noch ansprechen.*  
 today still address  
 ‘Paul will address the student who is questioning the professor who has been teaching for a week later today./ Paul will address the student who is questioning the dedicated professor after the course later today.’
- (8) a. *Diana konnte den die im Nebenraum telefonierende Kollegin belauschenden Mann wirklich nicht ignorieren.*  
 Diana could the the in-the next room telephoning colleague eavesdropping  
*Mann wirklich nicht ignorieren.*  
 man really not ignore
- b. *Diana konnte den die langjährige Kollegin im Nebenraum belauschenden Mann wirklich nicht ignorieren.*  
 Diana could the the longtime colleague in-the next room eavesdropping man  
*wirklich nicht ignorieren.*  
 really not ignore
- c. *Diana konnte den Mann, der die Kollegin, die im Nebenraum telefonierte, belauschte, wirklich nicht ignorieren.*  
 Diana could the man who the colleague who in-the next room telephoned  
*belauschte, wirklich nicht ignorieren.*  
 eavesdropped really not ignore
- d. *Diana konnte den Mann, der die langjährige Kollegin im Nebenraum belauschte, wirklich nicht ignorieren.*  
 Diana could the man who the longtime colleague in-the next room  
*belauschte, wirklich nicht ignorieren.*  
 eavesdropped really not ignore  
 ‘Diana really couldn’t ignore the man who was eavesdropping on the colleague who was on the phone in the next room./ Diana really couldn’t ignore the man who was eavesdropping on the longtime colleague in the next room.’
- (9) a. *Andreas konnte den die auf einer Parkbank sitzende Frau zeichnenden Künstler lange nicht finden.*  
 Andreas could the the on a park bench sitting woman drawing artist  
*lange nicht finden.*  
 long not find
- b. *Andreas konnte den die ältere Frau auf einer Parkbank zeichnenden Künstler lange nicht finden.*  
 Andreas could the the elderly woman on a park bench drawing artist  
*lange nicht finden.*  
 long not find
- c. *Andreas konnte den Künstler, der die Frau, die auf einer Parkbank saß, zeichnete, lange nicht finden.*  
 Andreas could the artist who the woman who on a park bench sat  
*zeichnete, lange nicht finden.*  
 drew long not find

- d. *Andreas konnte den Künstler, der die ältere Frau auf einer Parkbank zeichnete, lange nicht finden.*  
 Andreas could the artist who the elderly woman on a park bench  
 drew long not find  
 ‘Andreas could not find the artist who was drawing the woman who was sitting on a park bench for a long time./ Andreas could not find the artist who was drawing the elderly woman on a park bench for a long time.’
- (10) a. *Heinz hat den die am Tatort eintreffende Reporterin begrüßenden Kommissar heute nicht erwartet.*  
 Heinz has the the at-the crime scene arriving reporter greeting  
 commissioner today not expected
- b. *Heinz hat den die neugierige Reporterin am Tatort begrüßenden Kommissar heute nicht erwartet.*  
 Heinz has the the curious reporter at-the crime scene greeting  
 commissioner today not expected
- c. *Heinz hat den Kommissar, der die Reporterin, die am Tatort eintraf, begrüßte, heute nicht erwartet.*  
 Heinz has the commissioner who the reporter who at-the crime scene arrived  
 greeted today not expected
- d. *Heinz hat den Kommissar, der die neugierige Reporterin am Tatort begrüßte, heute nicht erwartet.*  
 Heinz has the commissioner who the curious reporter at-the crime scene  
 greeted today not expected  
 ‘Heinz did not expect the commissioner who was greeting the reporter who was arriving at the scene today./ Heinz did not expect the commissioner who was greeting the curious reporter at the crime scene today.’
- (11) a. *Anna will den die im Drogeriemarkt herumlaufende Diebin erwischnenden Mitarbeiter dann auch belohnen.*  
 Anna wants the the in-the drugstore running thief catching  
 employee then also reward
- b. *Anna will den die geschickte Diebin im Drogeriemarkt erwischnenden Mitarbeiter dann auch belohnen.*  
 Anna wants the the clever thief in-the drugstore catching  
 employee then also reward
- c. *Anna will den Mitarbeiter, der die Diebin, die im Drogeriemarkt herumlieft, erwischte, dann auch belohnen.*  
 Anna wants the employee who the thief who in-the drugstore ran  
 caught then also reward
- d. *Anna will den Mitarbeiter, der die geschickte Diebin im Drogeriemarkt erwischte, dann auch belohnen.*  
 Anna wants the employee who the clever thief in-the drugstore  
 caught then also reward  
 ‘Anna then wants to reward the employee who was catching the thief running around the drugstore./ Anna then wants to reward the employee who was catching the clever thief in the drugstore.’

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- (12) a. *Fabian kann den die auf der Hochzeit tanzende Trauzeugin beobachtenden Cousin*  
 Fabian can the the at the wedding dancing maid of honor watching cousin  
*gar nicht leiden.*  
 at all not stand
- b. *Fabian kann den die hübsche Trauzeugin auf der Hochzeit beobachtenden Cousin*  
 Fabian can the the pretty maid of honor at the wedding watching cousin  
*gar nicht leiden.*  
 at all not stand
- c. *Fabian kann den Cousin, der die Trauzeugin, die auf der Hochzeit tanzt,*  
 Fabian can the cousin who the maid of honor who at the wedding dances  
*beobachtet, gar nicht leiden.*  
 watches at all not stand
- d. *Fabian kann den Cousin, der die hübsche Trauzeugin auf der Hochzeit*  
 Fabian can the cousin who the pretty maid of honor at the wedding  
*beobachtet, gar nicht leiden.*  
 watches at all not stand  
 ‘Fabian can’t stand the cousin who is watching the maid of honor who is dancing at  
 the wedding./ Fabian can’t stand the cousin who is watching the pretty maid of honor  
 at the wedding.’
- (13) a. *Sebastian hat die den im Laden dekorierenden Verkäufer ansprechende*  
 Sebastian has the the in-the store decorating salesman addressing  
*Hausfrau gestern Abend besucht.*  
 housewife yesterday evening visited
- b. *Sebastian hat die den freundlichen Verkäufer im Laden ansprechende Hausfrau*  
 Sebastian has the the friendly salesman in-the store addressing housewife  
*gestern Abend besucht.*  
 yesterday evening visited
- c. *Sebastian hat die Hausfrau, die den Verkäufer, der im Laden dekoriert,*  
 Sebastian has the housewife who the salesman who in-the store decorates  
*anspricht, gestern Abend besucht.*  
 yesterday evening visited
- d. *Sebastian hat die Hausfrau, die den freundlichen Verkäufer im Laden*  
 Sebastian has the housewife who the friendly salesman in-the store  
*anspricht, gestern Abend besucht.*  
 addresses yesterday evening visited  
 ‘Sebastian visited the housewife who is addressing the salesman decorating in the store  
 last night./ Sebastian visited the housewife who is addressing the friendly salesman in  
 the store last night.’
- (14) a. *Helena hat die den am See angelnden Rentner beneidende Joggerin länger*  
 Helena has the the at-the lake fishing pensioner envying jogger long time  
*nicht gesehen.*  
 not seen
- b. *Helena hat die den entspannten Rentner am See beneidende Joggerin länger*  
 Helena has the the relaxed pensioner at-the lake envying jogger long time  
*nicht gesehen.*  
 not seen



- c. *Helena hat die Joggerin, die den Rentner, der am See angelte, beneidete,*  
 Helena has the jogger who the pensioner who at-the lake fished envied  
*länger nicht gesehen.*  
 long time not seen
- d. *Helena hat die Joggerin, die den entspannten Rentner am See beneidete,*  
 Helena has the jogger who the relaxed pensioner at-the lake envied  
*länger nicht gesehen.*  
 long time not seen  
 ‘Helena has not seen the jogger who envied the pensioner who was fishing at the lake  
 for a long time./ Helena has not seen the jogger who envied the relaxed pensioner by  
 the lake for a long time.’
- (15) a. *Christian hat die den beim Poker verlierenden Freund auslachende Kellnerin*  
 Christian has the the at poker losing friend laughing-at waitress  
*schon länger gekannt.*  
 already for some time known
- b. *Christian hat die den bedauernswerten Freund beim Poker auslachende Kellnerin*  
 Christian has the the unfortunate friend at poker laughing-at waitress  
*schon länger gekannt.*  
 already for some time known
- c. *Christian hat die Kellnerin, die den Freund, der beim Poker verlor, auslachte,*  
 Christian has the waitress who the friend who at poker lost laughed-at  
*schon länger gekannt.*  
 already for some time known
- d. *Christian hat die Kellnerin, die den bedauernswerten Freund beim Poker*  
 Christian has the waitress who the unfortunate friend at poker  
*auslachte, schon länger gekannt.*  
 laughed-at already for some time known  
 ‘Christian has known the waitress who was laughing at the friend who lost at poker for  
 some time./ Christian has known the waitress who was laughing at the unfortunate  
 friend at poker for some time.’
- (16) a. *Lukas hat die den beim Wettbewerb gewinnenden Mitschüler anfeuernde Freundin*  
 Lukas has the the at-the competition winning classmate cheering-on friend  
*dann später begleitet.*  
 then later accompanied
- b. *Lukas hat die den beliebten Mitschüler beim Wettbewerb anfeuernde Freundin*  
 Lukas has the the popular classmate at-the competition cheering-on friend  
*dann später begleitet.*  
 then later accompanied
- c. *Lukas hat die Freundin, die den Mitschüler, der beim Wettbewerb gewann,*  
 Lukas has the friend who the classmate who at-the competition won  
*anfeuerte, dann später begleitet.*  
 cheered-on then later accompanied
- d. *Lukas hat die Freundin, die den beliebten Mitschüler beim Wettbewerb*  
 Lukas has the friend who the popular classmate at-the competition  
*anfeuerte, dann später begleitet.*  
 cheered-on then later accompanied

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‘Lukas then later accompanied the friend who was cheering on the classmate who won the competition./ Lukas then later accompanied the friend who was cheering on the popular classmate at the competition.’

- (17) a. *Emilie konnte den die zum Unfallort fahrende Polizistin rufenden*  
Emilie could the the to-the scene of the accident driving officer calling  
*Unfallgegner schließlich noch beruhigen.*  
other party finally still calm-down
- b. *Emilie konnte den die erfahrene Polizistin zum Unfallort rufenden*  
Emilie could the the experienced officer to-the scene of the accident calling  
*Unfallgegner schließlich noch beruhigen.*  
other party finally still calm-down
- c. *Emilie konnte den Unfallgegner, der die Polizistin, die zum*  
Emilie could the other party who the officer who to-the  
*Unfallort fuhr, rief, schließlich noch beruhigen.*  
scene of the accident drove called finally still calm-down
- d. *Emilie konnte den Unfallgegner, der die erfahrene Polizistin zum*  
Emilie could the other party who the experienced officer to-the  
*Unfallort rief, schließlich noch beruhigen.*  
scene of the accident called finally still calm-down  
‘Emilie was finally able to calm down the other party who was calling the policewoman who was driving to the scene of the accident./ Emilie was eventually able to calm down the other party who was calling the experienced police officer to the scene of the accident.’
- (18) a. *Simon wollte die den an der Bar diskutierenden Gast ignorierende Barkeeperin*  
Simon wanted the the at the bar discussing guest ignoring bartender  
*nicht mehr stören.*  
not longer bother
- b. *Simon wollte die den betrunkenen Gast an der Bar ignorierende Barkeeperin nicht*  
Simon wanted the the drunk guest at the bar ignoring bartender not  
*mehr stören.*  
longer bother
- c. *Simon wollte die Barkeeperin, die den Gast, der an der Bar diskutierte,*  
Simon wanted the bartender who the guest who at the bar discussed  
*ignorierte, nicht mehr stören.*  
ignored not longer bother
- d. *Simon wollte die Barkeeperin, die den betrunkenen Gast an der Bar ignorierte,*  
Simon wanted the bartender who the drunk guest at the bar ignored  
*nicht mehr stören.*  
not longer bother  
‘Simon didn’t want to bother the bartender who ignored the guest who was discussing at the bar any longer./ Simon didn’t want to bother the bartender who ignored the drunken guest at the bar any longer.’

- (19) a. *Katja hatte den die im Zelt schlafende Urlauberin erschreckenden  
Katja had the the in-the tent sleeping vacationer frightening  
Motorradfahrer schon vorher gesehen.  
motorcyclist already before seen*
- b. *Katja hatte den die müde Urlauberin in der Nacht erschreckenden Motorradfahrer  
Katja had the the tired vacationer in the night frightening motorcyclist  
schon vorher gesehen.  
already before seen*
- c. *Katja hatte den Motorradfahrer, der die Urlauberin, die im Zelt schlief,  
Katja had the motorcyclist who the vacationer who in-the tent slept  
erschreckte, schon vorher gesehen.  
frightened already before seen*
- d. *Katja hatte den Motorradfahrer, der die müde Urlauberin in der Nacht erschreckte,  
Katja had the motorcyclist who the tired vacationer in the night frightened  
schon vorher gesehen.  
already before seen  
'Katja had already seen the motorcyclist who scared the vacationer who was sleeping  
in the tent./ Katja had seen the motorcyclist who scared the tired vacationer in the  
night before.'*
- (20) a. *Volker musste den die seit zwei Wochen hustende Patientin untersuchenden Arzt  
Volker had-to the the for two weeks coughing patient examining doctor  
leider kurz unterbrechen.  
unfortunately briefly interrupt*
- b. *Volker musste den die verunsicherte Patientin wegen einer Erkältung  
Volker had-to the the unsettled patient because-of a cold  
untersuchenden Arzt leider kurz unterbrechen.  
examining doctor unfortunately briefly interrupt*
- c. *Volker musste den Arzt, der die Patientin, die seit zwei Wochen hustete,  
Volker had-to the doctor who the patient who for two weeks coughed  
untersuchte, leider kurz unterbrechen.  
examined unfortunately briefly interrupt*
- d. *Volker musste den Arzt, der die verunsicherte Patientin wegen einer  
Volker had-to the doctor who the unsettled patient because-of a  
Erkältung untersuchte, leider kurz unterbrechen.  
cold examined unfortunately briefly interrupt  
'Volker unfortunately had to briefly interrupt the doctor who was examining the pa-  
tient who had been coughing for two weeks./ Volker unfortunately had to briefly  
interrupt the doctor who was examining the unsettled patient for a cold.'*

# Appendix F

## Appendix – Experiment 7

### Experimental items (Experiment 7)

- (1) a. *Frank will die einen aus Fotos bestehenden Kalender bastelnde Tochter jetzt langsam abholen.*  
Frank wants the a of photos consisting calendar handcrafting daughter now slowly pick-up
- b. *Frank will die im neuen Kindergarten einen Kalender bastelnde Tochter jetzt langsam abholen.*  
Frank wants the in-the new kindergarden a calendar handcrafting daughter now slowly pick-up
- c. *Frank will die Tochter, die einen Kalender, der aus Fotos besteht, bastelt, jetzt langsam abholen.*  
Frank wants the daughter who a calendar that of photos consists handcrafts now slowly pick-up
- d. *Frank will die Tochter, die im neuen Kindergarten einen Kalender bastelt, jetzt langsam abholen.*  
Frank wants the daughter who in-the new kindergarden a calendar handcrafts now slowly pick-up  
'Frank now wants to slowly pick up the daughter who is making a calendar consisting of photos./ Frank now wants to slowly pick up the daughter who is making a calendar in the new kindergarden.'
- (2) a. *Erik will die ein zum Mobiliar passendes Regal putzende Tante jetzt gleich anrufen.*  
Erik wants the a to-the furniture fitting shelf cleaning aunt now soon call
- b. *Erik will die seit einer Weile ein Regal putzende Tante jetzt gleich anrufen.*  
Erik wants the for a while a shelf cleaning aunt now soon call
- c. *Erik will die Tante, die ein Regal, das zum Mobiliar passt, putzt, jetzt gleich anrufen.*  
Erik wants the aunt who a shelf that to-the furniture fits cleans now soon call

- d. *Erik will die Tante, die seit einer Weile ein Regal putzt, jetzt gleich anrufen.*  
 Erik wants the aunt who for a while a shelf cleans now soon call  
 ‘Erik wants to call the aunt who is cleaning a shelf that matches the furniture right now./ Erik wants to call the aunt who has been cleaning a shelf for a while right now.’
- (3) a. *Ingrid will die einen nach Zimt duftenden Apfelkuchen backende Nachbarin*  
 Ingrid want the a like cinnamon smelling apple pie baking neighbor  
*später noch besuchen.*  
 later still visit
- b. *Ingrid will die am frühen Morgen einen Apfelkuchen backende Nachbarin später*  
 Ingrid want the in-the early morning an apple pie baking neighbor later  
*noch besuchen.*  
 still visit
- c. *Ingrid will die Nachbarin, die einen Apfelkuchen, der nach Zimt duftet,*  
 Ingrid want the neighbor who an apple pie that like cinnamon smells  
*backt, später noch besuchen.*  
 bakes later still visit
- d. *Ingrid will die Nachbarin, die am frühen Morgen einen Apfelkuchen backt,*  
 Ingrid want the neighbor who in-the early morning an apple pie bakes  
*später noch besuchen.*  
 later still visit  
 ‘Ingrid wants to visit the neighbor who is baking an apple pie that smells of cinnamon later./ Ingrid wants to visit the neighbor who is baking an apple pie early in the morning later.’
- (4) a. *Harald muss die einen seit Wochen herumliegenden Papierstapel aufräumende*  
 Harald must the a cor weeks laying around pile of papers cleaning-up  
*Angestellte wahrscheinlich bald entlassen.*  
 employee probably soon fire
- b. *Harald muss die seit mehreren Stunden einen Papierstapel aufräumende Angestellte*  
 Harald must the for several hours a pile of papers cleaning-up employee  
*wahrscheinlich bald entlassen.*  
 probably soon fire
- c. *Harald muss die Angestellte, die einen Papierstapel, der seit Wochen herumliegt,*  
 Harald must the employee who a pile of papers that since weeks lays around  
*aufräumt, wahrscheinlich bald entlassen.*  
 cleans-up probably soon fire
- d. *Harald muss die Angestellte, die seit mehreren Stunden einen Papierstapel*  
 Harald must the employee who for several hours a pile of papers  
*aufräumt, wahrscheinlich bald entlassen.*  
 cleans-up probably soon fire  
 ‘Harald will probably soon have to fire the employee who is cleaning up a pile of paper that has been lying around for weeks./ Harald will probably soon have to fire the employee who has been cleaning up a pile of papers for several hours.’

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- (5) a. *Christine hat den ein ins Schwimmbecken tropfendes Eis essenden Jungen schon irgendwo gesehen.*  
Christine has the an in-the swimming pool dripping ice cream eating boy  
already somewhere seen
- b. *Christine hat den im nahegelegenen Schwimmbad ein Eis essenden Jungen schon irgendwo gesehen.*  
Christine has the in-the nearby swimming pool an ice cream eating  
boy already somewhere seen
- c. *Christine hat den Jungen, der ein Eis, dass ins Schwimmbecken tropft, isst, schon irgendwo gesehen.*  
Christine has the boy who an ice cream that in-the pool drips eats  
already somewhere seen
- d. *Christine hat den Jungen, der im nahegelegenen Schwimmbad ein Eis isst, schon irgendwo gesehen.*  
Christine has the boy who in-the nearby swimming pool an ice cream  
eats already somewhere seen  
'Christine has already seen the boy who is eating an ice cream that is dripping into the pool somewhere./ Christine has already seen the boy who is eating an ice cream in the nearby swimming pool somewhere.'
- (6) a. *Martin muss den ein seit Jahren leerstehendes Zimmer renovierenden Nachbarn doch wirklich hassen.*  
Martin must the a for years vacant standing room renovating neighbor  
yet really hate
- b. *Martin muss den am späten Nachmittag ein Zimmer renovierenden Nachbarn doch wirklich hassen.*  
Martin must the in-the late afternoon a room renovating neighbor yet  
really hate
- c. *Martin muss den Nachbarn, der ein Zimmer, das seit Jahren leersteht, renoviert, doch wirklich hassen.*  
Martin must the neighbor who a room that for years vacant stands  
renovates yet really hate
- d. *Martin muss den Nachbarn, der am späten Nachmittag ein Zimmer renoviert, doch wirklich hassen.*  
Martin must the neighbor who in-the late afternoon a room renovates  
yet really hate  
'Martin must really hate the neighbor who is renovating a room that has been vacant for years./ Martin must really hate the neighbor who is renovating a room in the late afternoon after all.'
- (7) a. *Helena hatte die ein im Museum hängendes Kunstwerk abzeichnende Künstlerin ein bisschen beobachtet.*  
Helena had the a in-the museum hanging piece of art sketching artist  
a bit watched
- b. *Helena hatte die im städtischen Museum ein Kunstwerk abzeichnende Künstlerin ein bisschen beobachtet.*  
Helena had the in-the city museum a piece of art sketching artist  
a bit watched

- c. *Helena hatte die Künstlerin, die ein Kunstwerk, das im Museum hängt, abzeichnet, ein bisschen beobachtet.*  
Helena had the artist who a piece of art that in-the museum hangs sketched a bit watched
- d. *Helena hatte die Künstlerin, die im städtischen Museum ein Kunstwerk abzeichnet, ein bisschen beobachtet.*  
Helena had the artist who in-the city museum a piece of art sketched a bit watched  
'Helena had been watching the artist who is sketching a piece of art hanging in the museum for a bit./ Helena had been watching the artist who is sketching a piece of art in the city museum for a bit.'
- (8) a. *Sandra will den eine am Boden schimmelnde Schüssel spülenden Onkel gerade nicht stören.*  
Sandra wants the a on-the floor molding bowl washing uncle now not disturb
- b. *Sandra will den nach der Geburtstagsparty eine Schüssel spülenden Onkel gerade nicht stören.*  
Sandra wants the after the birthday party a bowl washing uncle now not disturb
- c. *Sandra will den Onkel, der eine Schüssel, die am Boden schimmelt, spült, gerade nicht stören.*  
Sandra wants the uncle who a bowl that on-the floor molds washes now not disturb
- d. *Sandra will den Onkel, der nach der Geburtstagsparty eine Schüssel spült, gerade nicht stören.*  
Sandra wants the uncle who after the birthday party a bowl washes now not disturb  
'Sandra doesn't want to disturb the uncle who is washing a bowl that is moldy on the floor right now./ Sandra does not want to disturb the uncle who is washing a bowl after the birthday party right now.'
- (9) a. *Gabi hatte den eine am Haken zappelnde Forelle angelnden Urlauber schon ziemlich bewundert.*  
Gabi had the a at-the hook wriggling trout fishing vacationer pretty quite admired
- b. *Gabi hatte den am ruhigen Flussufer eine Forelle angelnden Urlauber schon ziemlich bewundert.*  
Gabi had the at-the quiet river bank a trout fishing vacationer pretty quite admired
- c. *Gabi hatte den Urlauber, der eine Forelle, die am Haken zappelte, angelte, schon ziemlich bewundert.*  
Gabi had the vacationer who a trout that at-the hook wriggled fished pretty quite admired
- d. *Gabi hatte den Urlauber, der am ruhigen Flussufer eine Forelle angelte, schon ziemlich bewundert.*  
Gabi had the vacationer who at-the quiet river bank a trout fished pretty quite admired

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‘Gabi had quite admired the vacationer who was fishing for a trout that was wriggling on the hook./ Gabi had quite admired the vacationer who was fishing for a trout on the quiet river bank.’

- (10) a. *Eva hatte den ein beim Sommerfest stattfindendes Spiel gewinnenden Mitschüler*  
Eva had the a at-the summer party taking place game winning classmate  
*sehr laut angefeuert.*  
very loudly cheered
- b. *Eva hatte den beim alljährlichen Sommerfest ein Spiel gewinnenden Mitschüler*  
Eva had the at-the annual summer party a game winning classmate  
*sehr laut angefeuert.*  
very loudly cheered
- c. *Eva hatte den Mitschüler, der ein Spiel, das beim Sommerfest stattfand,*  
Eva had the classmate who a game that at-the summer party took place  
*gewann, sehr laut angefeuert.*  
won very loudly cheered
- d. *Eva hatte den Mitschüler, der beim alljährlichen Sommerfest ein Spiel gewann,*  
Eva had the classmate who at-the annual summer party a game won  
*sehr laut angefeuert.*  
very loudly cheered  
‘Eva had cheered very loudly for the classmate who was winning a game that was taking place at the summer party./ Eva had cheered very loudly for the classmate was winning won a game at the annual summer party.’
- (11) a. *Lukas hatte die einen seit Jahren bestehenden Rekord brechende Sportlerin sehr*  
Lukas had the a for years standing record braking athlete very  
*erfolgreich angespornt.*  
successfully spurred
- b. *Lukas hatte die beim internationalen Wettbewerb einen Rekord brechende*  
Lukas had the at-the international competition a record braking  
*Sportlerin sehr erfolgreich angespornt.*  
athlete very successfully spurred
- c. *Lukas hatte die Sportlerin, die einen Rekord, der seit Jahren bestand, brach, sehr*  
Lukas had the athlete who a record that for years stood broke very  
*erfolgreich angespornt.*  
successfully spurred
- d. *Lukas hatte die Sportlerin, die beim internationalen Wettbewerb einen Rekord*  
Lukas had the athlete who at-the international competition a record  
*brach, sehr erfolgreich angespornt.*  
broke very successfully spurred  
‘Luke had very successfully spurred on the athlete who broke a record that had stood for years./ Lukas had very successfully spurred on the athlete who broke a record at the international competition.’
- (12) a. *Clara kann die ein im Hauptquartier ablaufendes Telefonat abhörende Agentin*  
Clara can the a in-the headquartes taking place phone call listening agent  
*überhaupt nicht leiden.*  
at all not stand



- b. *Clara kann die im abgesperrten Nebenraum ein Telefonat abhörende Agentin überhaupt nicht leiden.*  
Clara can the in-the cordoned-off next room a phone call listening agent at all not stand
- c. *Clara kann die Agentin, die ein Telefonat, das im Hauptquartier abläuft, abhört, überhaupt nicht leiden.*  
Clara can the agent who a phone call that in-the headquarters takes place listens at all not stand
- d. *Clara kann die Agentin, die im abgesperrten Nebenraum ein Telefonat abhört, überhaupt nicht leiden.*  
Clara can the agent who in-the cordoned-off next room a phone call listens at all not stand  
'Clara does not like at all the agent who is listening to a phone call that takes place in the headquarters./ Clara doesn't like the agent at all, who is listening to a phone call in the cordoned-off next room.'
- (13) a. *Fabian will den eine über Versetzungen entscheidende Klassenarbeit korrigierenden Lehrer noch einmal sprechen.*  
Fabian wants the a on transfers deciding class assignment correcting teacher once again speak
- b. *Fabian will den zum allerersten Mal eine Klassenarbeit korrigierenden Lehrer noch einmal sprechen.*  
Fabian wants the for-the very first time a class assignment correcting teacher once again speak
- c. *Fabian will den Lehrer, der eine Klassenarbeit, die über Versetzungen entscheidet, korrigiert, noch einmal sprechen.*  
Fabian wants the teacher who a class assignment the on transfers decides corrects once again speak
- d. *Fabian will den Lehrer, der zum allerersten Mal eine Klassenarbeit korrigiert, noch einmal sprechen.*  
Fabian wants the teacher who for-the very first time a class assignment corrects once again speak  
'Fabian wants to speak again to the teacher who is correcting a class test that decides on transfers./ Fabian wants to speak again to the teacher who is correcting a class assignment for the very first time.'
- (14) a. *Diana hat den eine auf Atomphysik basierende Fächerkombination studierenden Bekannten länger nicht gesehen.*  
Diana has the a on nuclear physics basing combination of subjects studying acquaintance for some time not seen
- b. *Diana hat den an einer Privatuniversität eine Fächerkombination studierenden Bekannten länger nicht gesehen.*  
Diana has the at a private university a combination of subjects studying acquaintance for some time not seen
- c. *Diana hat den Bekannten, der eine Fächerkombination, die auf Atomphysik basiert, studiert, länger nicht gesehen.*  
Diana has the acquaintance who a combination of subjects that on nuclear physics bases studies for some time not seen

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- d. *Diana hat den Bekannten, der an einer Privatuniversität eine Fächerkombination studiert, länger nicht gesehen.*  
 Diana has the acquaintance who at a private university a combination of subjects studies for some time not seen  
 ‘Diana has not seen the acquaintance who is studying a combination of subjects that is based on nuclear physics for some time./ Diana has not seen the acquaintance who is studying a combination of subjects at a private university for some time.’
- (15) a. *Nora hatte den eine im Schaufenster posierende Modellpuppe dekorierenden Verkäufer doch nicht angesprochen.*  
 Nora had the a in-the shop window posing model doll decorating salesman after all not approached
- b. *Nora hatte den im gegenüberliegenden Laden eine Modellpuppe dekorierenden Verkäufer doch nicht angesprochen.*  
 Nora had the in-the opposite store a model doll decorating salesman after all not approached
- c. *Nora hatte den Verkäufer, der eine Modellpuppe, die im Schaufenster posiert, dekorierte, doch nicht angesprochen.*  
 Nora had the salesman who a model doll that in-the shop window posed decorated after all not approached
- d. *Nora hatte den Verkäufer, der im gegenüberliegenden Laden eine Modellpuppe dekorierte, doch nicht angesprochen.*  
 Nora had the salesman who in-the opposite store a model doll decorated after all not approached  
 ‘Nora had not approached the salesman who was decorating a model doll posing in the shop window after all./ Nora had not approached the salesman who was decorating a model doll in the store opposite after all.’
- (16) a. *Philipp konnte die ein unter Waffeneinsatz stattfindendes Verbrechen gestehende Verdächtige dann sofort festnehmen.*  
 Philipp could the a under use of weapons happening crime confessing suspect then immediately arrest
- b. *Philipp konnte die nach mühsamer Befragung ein Verbrechen gestehende Verdächtige dann sofort festnehmen.*  
 Philipp could the after laborious questioning a crime confessing suspect then immediately arrest
- c. *Philipp konnte die Verdächtige, die ein Verbrechen, das unter Waffeneinsatz stattfand, gestand, dann sofort festnehmen.*  
 Philipp could the suspect who a crime that under use of weapons happened confessed then immediately arrest
- d. *Philipp konnte die Verdächtige, die nach mühsamer Befragung ein Verbrechen gestand, dann sofort festnehmen.*  
 Philipp could the suspect who after laborious questioning a crime confessed then immediately arrest  
 ‘Philip was then able to immediately arrest the suspect who was confessing to a crime that involved the use of weapons./ Philip was then able to immediately arrest the suspect who was confessing to a crime after laborious questioning.’

- (17) a. *Gustav hatte den ein im Radio laufendes Lied pfeifenden Schaffner möglichst lange gemieden.*  
 Gustav had the a in-the radio playing song whistling conductor possibly long avoided
- b. *Gustav hatte den während der Kontrolle ein Lied pfeifenden Schaffner möglichst lange gemieden.*  
 Gustav had the during the control a song whistling conductor possibly long avoided
- c. *Gustav hatte den Schaffner, der eine Lied, das im Radio lief, pffiff, möglichst lange gemieden.*  
 Gustav had the conductor who a song that in-the radio played whistled possibly long avoided
- d. *Gustav hatte den Schaffner, der während der Kontrolle ein Lied pffiff, möglichst lange gemieden.*  
 Gustav had the conductor who during the control a song whistled possibly long avoided  
 ‘Gustav had avoided the conductor who was whistling a song that was playing on the radio for as long as possible./ Gustav had avoided the conductor who was whistling a song during the inspection for as long as possible.’
- (18) a. *Werner hatte den ein über Stunden andauerndes Pokerspiel verlierenden Freund ganz schön ausgelacht.*  
 Werner had the a for hours lasting poker game losing friend much pretty laughed-at
- b. *Werner hatte den im überfüllten Lokal ein Pokerspiel verlierenden Freund ganz schön ausgelacht.*  
 Werner had the in-the crowded pub a poker game losing friend much pretty laughed-at
- c. *Werner hatte den Freund, der ein Pokerspiel, das über Stunden andauerte, verlor, ganz schön ausgelacht.*  
 Werner had the friend who pub a poker game that for hours lasted lost much pretty laughed-at
- d. *Werner hatte den Freund, der im überfüllten Lokal ein Pokerspiel verlor, ganz schön ausgelacht.*  
 Werner had the friend who in-the crowded pub a poker game lost much pretty laughed-at  
 ‘Werner had quite a laugh at the friend who was losing a poker game that lasted for hours./ Werner had quite a laugh at the friend who was losing a poker game in the crowded pub.’
- (19) a. *Mia hatte die ein vom Flohmarkt stammendes Hemd bügelnde Oma immer wieder abgelenkt.*  
 Mia had the a from-the flea marked coming shirt ironing grandma always again distracted
- b. *Mia hatte die im unordentlichen Wohnzimmer ein Hemd bügelnde Oma immer wieder abgelenkt.*  
 Mia had the in-the messy living room a shirt ironing grandma always again distracted

- 
- c. *Mia hatte die Oma, die ein Hemd, das vom Flohmarkt stammte, bügelte,*  
 Mia had the grandma who a shirt that from-the flea market came ironed  
*immer wieder abgelenkt.*  
 always again distracted
- d. *Mia hatte die Oma, die im unordentlichen Wohnzimmer ein Hemd bügelte,*  
 Mia had the grandma who in-the messy living room a shirt ironed  
*immer wieder abgelenkt.*  
 always again distracted  
 ‘Mia had kept distracting the grandma who was ironing a shirt that came from the  
 flea market./ Mia had kept distracting the grandma who was ironing a shirt in the  
 messy living room.’
- (20) a. *Emilie hatte den ein aus Japan kommendes Gedicht lernenden Schüler wohl*  
 Emilie had the a from Japan coming poem learning student probably  
*ziemlich genervt.*  
 quite annoyed
- b. *Emilie hatte den in der Küche ein Gedicht lernenden Schüler wohl ziemlich*  
 Emilie had the in the kitchen a poem learning student probably quite  
*genervt.*  
 annoyed
- c. *Emilie hatte den Schüler, der ein Gedicht, das aus Japan kommt, lernte,*  
 Emilie had the student who a poem that from Japan came learned  
*wohl ziemlich genervt.*  
 probably quite annoyed
- d. *Emilie hatte den Schüler, der in der Küche ein Gedicht lernte, wohl ziemlich*  
 Emilie had the student who in the kitchen a poem learned probably quite  
*genervt.*  
 annoyed  
 ‘Emilie had probably been quite annoying to the student who was learning a poem  
 that came from Japan./ Emilie had probably been quite annoying to the student who  
 was learning a poem in the kitchen.’