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Length and Argument Structure in German Participle Constructions and Relative Clauses

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1 Introduction

An interesting aspect of language is that the same content can often be expressed by more than one construction. Investigating such alternative constructions can shed light on an effect of language processing on preferences in language production (cf. Hawkins, 1983, 2004), but it can also show subtle syntactic or semantic differences.

Adjectival phrases, in particular attributive participle constructions as in (1a) and (2a), as well as the the corresponding relative clauses (henceforth: RCs), (1b) and (2b), constitute such a case of syntactic choice in German: the same content can be expressed prenominally with an adjectival element (e.g. *zerstörende* 'destroying' or *adoptierte* 'adopted') and postnominally with an RC.

(1) *present participle*
   a. *die das Sofa zerstörende Katze (hat vermutlich Hunger.)*
      the the couch destroying cat (has presumably hunger)
   b. *die Katze, die das Sofa zerstört, (hat vermutlich Hunger.)*
      the cat that the couch destroys (has presumably hunger)
      'the cat (that is) destroying the couch (is presumably hungry.)'

(2) *past participle*
   a. *die gestern vom Nachbarn adoptierte Katze...*
      the yesterday by the neighbor adopted cat...
   b. *die Katze, die gestern vom Nachbarn adoptiert wurde...*
      the cat that yesterday by the neighbor adopted was...
      'the cat (that was) adopted by the neighbor yesterday...'

Having a hybrid status between adjectives and verbs (e.g. Faucher, 1994; Lübbe & Rapp, 2011), participles keep their verbal argument structure, which allows a rather complex sentential structure inside the participle phrase. Although both constructions express the same content, they differ in their position and in certain properties of their internal head. Factors that influence the alternation of prenominal attributes and RCs have been discussed in Fabricius-Hansen (2016) and Schwarz (2020). Experimental work that directly compares extended prenominal attributes and their corresponding RCs is sparse to my knowledge (see Sikos et al. 2017 for the role of information density).

Therefore, the aim of this paper is to investigate how certain factors affect the acceptability of prenominal participle phrases and RCs. The factors I am concentrating on are the length and the internal structure of the modifier.

The prenominal modifier separates the determiner and noun. Form a processing perspective, this could result in higher memory load with increasing modifier length (Gibson, 1998, 2000) and therefore a preference for an RC. Concerning internal structure, I am interested in the question whether the presence of an argument affects preferences for one construction. Such a difference could be related to the hybrid status of the participle, which has adjectival and verbal properties (e.g. Lübbe & Rapp, 2011).

Note that all adjectives in German can be extended by adjuncts and in some cases even take arguments, cf. (3).

(3) *der dem Herrchen treue Hund...*
the the owner-DAT loyal dog
'the dog that is loyal to his owner...'

For the scope of this paper, however, I will focus on participles because they can be derived productively from any VP. This allows systematic manipulations of the internal structure, i.e. the presence or absence of arguments, with a wider variety of lexemes.

The paper starts with a review of the literature about attributive participles and RCs as well as the relevant processing approaches that make predictions for both constructions. The first experiment tests the acceptability of present participles and RCs, manipulating whether an argument and/or an adjunct is present. The second experiment investigates past participles that are extended by an adjunct and/or a *by*-phrase or none and the corresponding RCs.

2 Properties of Prenominal Participle Phrases

Nominal modifiers have been of interest for linguistic research for decades. Especially the structure of RCs has been subject to debate (e.g. Chomsky, 1973; Kayne, 1994; Hulsey & Sauerland, 2006). The same holds for the syntactic status of adjectival elements inside the DP (e.g. Cinque, 2010; Leu, 2015). As this paper approaches these kinds of modifiers from an experimental perspective, it will not be possible to discuss the syntactic status of adjectives and RCs in detail. However, the question arises how similar the two constructions really are.

In German, prenominal adjectives can be extended by various material, which can result in a quite complex structure. Prenominal adjectives can take objects although accusative objects are restricted to present participles.[1] (4) shows an example of a present participle taking a dative and an accusative object.

(4) *die dem Besitzer*$_{\text{DAT}}$ *eine Maus*$_{\text{ACC}}$ *bringende Katze*
the the owner$_{\text{DAT}}$ a mouse$_{\text{ACC}}$ bringing cat
'the cat bringing the owner a mouse'

Participles keep part of their verbal properties, like the arguments they take, while being in an adjectival position and showing adjectival inflection. Due to these mixed properties, their categorical status has often been claimed to be a hybrid between verb and adjective (e.g. Lübbe & Rapp, 2011; Fuhrhop & Teuber, 2000).

One difference between present and past participle is the thematic role of the modified noun. Present participles take the head noun as the agent of the event, therefore having an active structure, whereas past participles modify the theme of the event, which corresponds to passive voice. Contrary to RCs, the modified noun always has to be the subject of the participle.

[1] Harbert (2006) identifies 18 regular adjectives that occur with accusative DPs, with part of them describing size (e.g. *groß* 'big', *lang* 'long', *dick* 'thick'). He also lists further adjectives, e.g. *müde* 'tired', *leid* 'sorry', *los* 'free'. However, in my opinion, most of the latter group are not grammatical when they are used as a prenominal attribute, in particular with an accusative object.

Participles are considered as non-finite verb forms (e.g. Bech, 1955; Lübbe & Rapp, 2011) and they do not have inherent tense. According to Lübbe & Rapp (2011), there is no inherent temporal distinction between the past and present participle: their temporal relation to the matrix clause has to be inferred pragmatically. There is, however, a distinction of aspect: present participles are imperfective, past participles are perfective. The aspect leads to a default interpretation as to simultaneous to the matrix clause for the present participle and posterior for the past participle.

3 Alternation with RCs

As participle phrases and RCs express the same content, the question arises why the two constructions alternate and when one or the other is preferred. There are two major differences between RCs and prenominal attributes: they differ in their position and in finiteness, more precisely in whether tense is overtly marked. This is related to the fact that participles serve as adjectives from an external perspective, i.e. when the whole DP is considered, whereas they behave like verbs from an internal perspective (see also Lowe, 2020).

In general, it seems like extended prenominal attributes are rarer than RCs. Weber (1994) suggests that extended attributes are a written language phenomenon. Furthermore, they do not occur in German dialects (Weiß, 2017).

3.1 Previous Research

Fabricius-Hansen (2016) discusses the distribution of prenominal attributes and RCs. She suggests a number of factors that can affect the choice for 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. These factors are based on theoretical assumptions and previous research on the translation of modifiers into German (cf. also Doherty, 2010).

As for multiple modification, the idea is that a certain balance is established by having pre- and postnominal modification, as in (5).

(5) *... eine junge, gerade flügge gewordene Krähe, die der Fuchs erbeutet hatte*
a jung just fledged become crow which the fox captured had
'a young crow just fledged that the fox had captured (Cord Riechelmann (2013: 16). *Krähen*. Berlin: Matthes & Seitz; cit. from Fabricius-Hansen 2016: 14)

Information structure and focus could also be relevant factors for the alternation of prenominal attributes and RCs. According to Fabricius-Hansen (2016), prenominal attributes are prosodically fully integrated into the DP, which might lead to a preference for one or the other construction depending on whether the focus is on the head noun or the modifier. She also acknowledges that the effect of information structure leads to a rather complex interplay of different 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). However, for the experiments presented in this paper, information structure does not play a role because the sentences are provided without context.

Sikos et al. (2017) also investigated the alternation of prenominal modifiers and RCs. Based on the *Uniform Information Density* hypothesis, they show that the comprehension of prenominal attributes and the corresponding RCs is affected by the preceding context. More precisely, if the modified noun is easier to predict from the beginning of a sentence, comprehension is easier when it appears before the modifier, hence with an RC. If the context does not make the noun predictable, a prenominal modifier might be preferred.

3.2 Effect of Different Properties of the Modifier

Simple (i.e. non-extended) adjectives are prototypically expressed as prenominal attributes, not as RCs. One explanation is the word ratio between prenominal modifier and RC (cf. Fabricius-Hansen, 2016). While the prenominal adjective in (6a) consists of one word, an additional relative pronoun and a copula are necessary to form the RC in (6b). The same holds for past participles, as the passive auxiliary is needed. For present participles, however, at least the copula is not necessarily needed, cf. (7).

(6) a. *die schwarze Katze*
the black cat
b. *die Katze, die schwarz ist*
the cat that black is
'the black cat / cat that is black'

(7) a. *die schlafende Katze*
the sleeping cat
b. *die Katze, die schläft*
the cat that sleeps

In the experiments presented in this paper, the adjectival element is either a present participle or a past participle. I would expect past participles to be more acceptable in prenominal position than present participles because an additional auxiliary is necessary to express the passive structure in an RC.

A further possibility is that the more an element resembles a "prototypical" adjective, the more acceptable it is in a prenominal position. This could apply to the length and the structure of the phrase, i.e. whether arguments are possible or not, but also to certain semantic properties. Presumably, prototypical adjectives denote properties of a noun (e.g. color, shape or size). Hence, a relation in which this noun is the agent of the adjectival element would be rather uncommon. Therefore, present participles, in particular those in which the head noun is the agent, would be the most problematic.

Present and past participles could not be compared directly in one experiment because their differences in argument structure require different lexical material. The manipulation rather concerns the internal structure of the phrase and which arguments are overtly represented. Assuming that arguments, especially direct objects, are typically not part of the structure of regular adjectives, an intransitive present participle phrase could be more acceptable in prenominal position than a transitive one. Furthermore, transitive participles have an additional argument and therefore a more complex structure. For past participles, it is possible that an overt agent emphasizes the event rather than a property of the noun, again leading to a higher acceptability for RCs than for a participle phrase.

3.3 Processing Perspective on Modifier Length

Non-local dependencies and research on relative clauses played a crucial role in work on language processing (cf. e.g. Konieczny 2000, Vasishth et al. 2013, Wu et al. 2018). Memory-based accounts like the *Dependency Locality Theory* (DLT) (Gibson, 2000) assume that certain processing effects are due to differences in memory load. More precisely, the DLT distinguishes storage costs and integration costs. Storage costs occur when open dependencies have to be stored in memory. Integration costs occur when elements have to be integrated into the structure that the parser has already built, for example when a verb has to be combined with its arguments. Integration costs are higher when the dependent elements are not close to each other, but separated by new discourse referents (usually lexical heads of DPs or VPs). Furthermore, similarity-based interference accounts (Gordon et al., 2001) and the activation-based account

of Lewis & Vasishth (2005) assume that the similarity of the intervening material, i.e. shared features with the element that has to be integrated could also play a role.

For extended prenominal modifiers, relevant dependencies are that of the determiner and the noun and that of the adjective or participle and its arguments. I will focus on the former because the latter requires assumptions about the syntactic status of adjectival attributes. Furthermore, the dependency between the adjective or participle and its arguments should be the same as for the RC verb and its arguments because both are head final. (8) shows how the DP is affected by an extended participle phrase. The modifier intervenes between determiner and noun, leading to a non-local dependency. As the beginning of the DP needs to be stored in memory, processing load becomes higher when the modifier is longer. Using the DLT metric, length can be measured in the presence of new discourse referents (e.g. here 'the couch'). For RCs, the length of the modifier does not make a difference for the distance between determiner and noun, cf. (9), because the modifier always follows the noun.

(8) ***die*** *das Sofa zerstörende* ***Katze***
the the couch destroying cat
'the cat destroying the couch'

(9) ***die Katze****, die das Sofa zerstört*
the cat that the couch destroys
'the cat that is destroying the couch'

The tendency for determiner (if present) and noun to be as close to each other as possible leads to a preference for an RC if the modifier is extended. For production, this would mean that the longer the modifier, the more likely it is to be expressed as an RC (cf. Fabricius-Hansen, 2016).

4 Experiment 1

The first experiment compares the acceptability of present participles and RCs, in order to investigate the effect of length and of the internal structure of a nominal modifier on the acceptability of the two constructions. The main difference between the two constructions is their position, but the fact that only RCs are finite could also play a role. Experimental stimuli have the advantage that it is possible to compare both constructions directly while controlling for other factors like register or contextual effects. In general, prenominal participle phrases are grammatical; therefore, the acceptability judgments are employed to detect smaller differences in acceptability or potential processing difficulties.

Based on the assumptions about processing described in 3.3, the general prediction is that the length of the modifier only matters for prenominal attributes, not for RCs. Prenominal participles will receive lower acceptability ratings the more material the modifier contains. Note that it is also possible that a longer modifier is in general less acceptable for both participle phrases and RCs as it still interrupts the main clause. However, I assume that the effect is stronger when determiner and noun are separated because here not only the main clause but also the DP is interrupted. In the experiment, modifier length is manipulated by the insertion or absence of an adjunct and/or an object of the participle or RC verb, respectively.

A further aim of the experiment is to test an effect of transitivity of the participle and RC verb. The idea is that more verbal properties of the modifier lead to a preference for expressing it as an RC rather than as a participle phrase, presumably because of the hybrid status of the participle. This holds in particular in the presence of a direct object which usually only occurs with present participles and not with other adjectival elements. Therefore, the experiment investigates the effect of the presence of an accusative object in optionally transitive verbs on the acceptability of participle phrases and corresponding RCs.

4.1 Method

4.1.1 Material

The experiment consisted of 40 experimental items and had a 2×2×2-design: modification (prenominal attribute or relative clause) × PP adjunct (present or not) × accusative object (present or not), resulting in 8 conditions. The experimental items always consisted of a main clause with a transitive verb. The accusative object was modified by either a participle or an RC. The verbs that were used as participles or RC verbs could all be used transitively or intransitively. 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. (10) shows an example of the material (the modified DP is highlighted): in a–d, the noun is modified by a prenominal participle, in e–h, it is modified by an RC. The modifier either consisted only of the participle or RC verb respectively (a, e), or it was extended by an adjunct (*bei der Hochzeit* 'during the wedding', b,f), an accusative object (*einen Walzer* 'a waltz', c, g) or both (d, h). 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 material was divided into eight lists. Each participant rated each experimental item only in one condition.

(10)

a. participle, – PP adjunct, – acc. object

Lisa hatte ***die tanzende Cousine*** *irgendwie kaum beachtet.*
Lisa had the dancing cousin somehow little paid.attention

b. participle, + PP adjunct, – acc. object

Lisa hatte ***die bei der Hochzeit tanzende Cousine*** *irgendwie kaum beachtet.*
Lisa had the at the wedding dancing cousin somehow little paid.attention

c. participle, – PP adjunct, + acc. object

Lisa hatte ***die einen Walzer tanzende Cousine*** *irgendwie kaum beachtet.*
Lisa had the a waltz dancing cousin somehow little paid.attention

d. participle, + PP adjunct, + acc. object

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

e. RC, – PP adjunct, – acc. object

Lisa hatte ***die Cousine, die tanzte,*** *irgendwie kaum beachtet.*
Lisa had the cousin who danced somehow little paid.attention

f. RC, + PP adjunct, – acc. object

Lisa hatte ***die Cousine, die bei der Hochzeit tanzte,*** *irgendwie kaum beachtet.*
Lisa had the cousin who at the wedding danced somehow little paid.attention

g. RC, – PP adjunct, + acc. object

Lisa hatte ***die Cousine, die einen Walzer tanzte,*** *irgendwie kaum beachtet.*
Lisa had the cousin who a waltz danced somehow little paid.attention

h. RC, + PP adjunct, + acc. object

Lisa hatte ***die Cousine, die bei der Hochzeit einen Walzer tanzte,*** *irgendwie kaum*
Lisa had the cousin who at the wedding a waltz danced somehow little
beachtet.
paid.attention

'Lisa had somehow paid little attention to the cousin (who was) dancing (a waltz) (at the wedding).'

There were further restrictions for the material. 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. The adjuncts inside the modifiers were PPs consisting of 2–3 words. The direct objects of the participle / RC verb were indefinite, inanimate NPs. The gender of the accusative object and the head noun was always different to avoid an influence of similarity. In half of the items, the matrix clause was in present tense, the other half was in past tense.

4.1.2 Participants

Overall, 57 native speakers of German participated, 10 of them 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.[2] On average, the experiment took about 10–20 minutes.

4.1.3 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 Ibex Farm (http://spellout.net /ibexfarm/). Prolific directed the participants to a website with the instructions, including a consent form. They were also asked whether they were a native speaker of German. 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" was defined as "there is nothing wrong with the sentence", whereas "totally unacceptable" would mean that the participant would never encounter a sentence in this form.

4.1.4 Analysis

The judgment data was analyzed in R (R Core Team, 2017). Due to a technical error, one version of sentence 21 was not displayed correctly. Therefore this item had to be excluded from the analysis, leaving 39 experimental items.

The data was analyzed with a *Cumulative Link Mixed Model*, which is part of the "ordinal" package (Christensen, 2019). Two-way contrasts (-1:1) were created for the predictors modification (participle or RC), accusative object (present or not) and PP adjunct (present or not). If interactions occurred, I used post-hoc tukey tests (part of the "lsmeans" package, Lenth 2016) to determine which conditions caused the interaction.

[2] A disadvantage of participant recruitment with web-based platforms is the lack of a controlled setting during the experiment. Therefore, part of the fillers in the questionnaire were from a different experiment, which was tested as a pen and paper version before. A comparison of this data ensured that participants payed attention.

4.2 Results

Table 1 and Figure 4.2 show the mean acceptability ratings. The statistical analysis (cf. Table 2) reveals a main effect of the kind of modification and of the presence of an accusative object. There is a significant interaction of the kind of modification and the presence or absence of an accusative object. The interaction of the kind of modification and the presence or absence of an adjunct is also significant. The three-way interaction of the kind of modification, and presence or absence of an accusative object and adjunct is not significant.

Table 1. Mean response for acceptability judgments in Experiment 1; scale from 1 (totally unacceptable) to 7 (totally acceptable).

adjunct *(bei der Hochzeit)* ('at the wedding')	argument *(einen Walzer)* ('a waltz')	modification participle	 RC
+	+	5.03	6.28
–	+	5.23	6.10
+	–	5.89	5.98
–	–	6.08	5.90

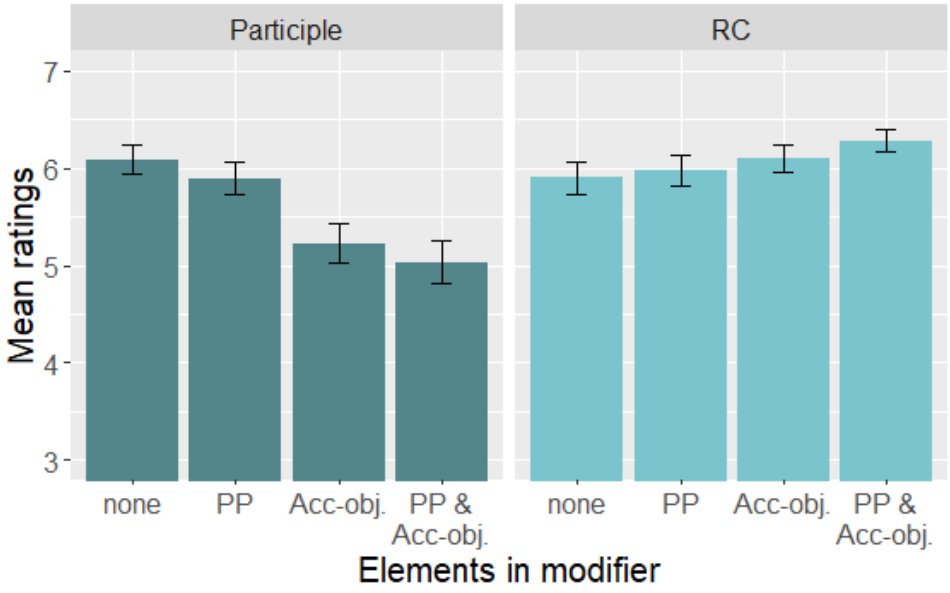

Figure 1. Mean acceptability ratings by condition for Experiment 1

When only the presence or absence of an accusative object is considered, participles with an object received mean ratings of 5.13, compared to 5.99 for participles without an accusative object. For RCs, it is 6.19 with an accusative object and 5.94 without it. A pairwise test (tukey method) for the two-way interaction of modification and presence of an accusative object revealed a significant difference between participles with an accusative object and RCs with an accusative object ($z = -8.195$; $p < .0001$), as well as participles without an accusative object ($z = -8.037$; $p < .0001$) and RCs without an accusative object ($z = -5.106$; $p < .0001$). Hence, the participles extended with an accusative object were rated significantly worse than participles without an accusative object or any RC.

Overall, participles received a mean rating of 5.46, when there was an adjunct inside the modifier, and 5.66 without an adjunct. For RCs, it was 6.13 with an adjunct and 6.00 without. For the interaction of adjunct and modification, the tukey test showed a significant difference between participles with an adjunct and RCs with an adjunct ($z = -5.184$; $p < .0001$), and RCs without an adjunct ($z = -3.806$; $p < 0.001$), but also between RCs with an adjunct and participles

without an adjunct ($z = 3.688$; $p < .01$) and a significant difference between participles without an adjunct and RCs without an adjunct ($z = –2.862$; $p < .05$). Hence, there is no significant difference when participles with or without an adjunct are compared directly and the same holds for RCs.

Table 2. Cumulative Link Mixed Model (fitted with the Laplace approximation) for Experiment 1
formula: response ∼ modification * acc. object * adjunct + (1 + modification + acc. object + adjunct | participant) + (1 + modification + acc. object + adjunct | sentence)

Coefficients:				
	Estimate	Std. Error	z value	Pr(> |z|)
modification	0.82295	0.18452	4.460	8.2e-06 ***
acc. object	0.54991	0.15054	3.653	0.000259 ***
adjunct	0.06724	0.11955	0.562	0.573804
modification:acc. object	-1.69799	0.17943	-9.463	< 2e-16 ***
modification:adjunct	-0.47300	0.17699	-2.672	0.007530 **
acc. object:adjunct	0.12755	0.17488	0.729	0.465787
modification:acc. object:adjunct	0.09768	0.35063	0.279	0.780557

4.3 Discussion

All sentences received ratings higher than 5. This was expected because the constructions occur frequently and productively in written language. However, there are still systematic differences, which will now be discussed.

The results do not show a clear effect of length: As shown in Figure 4.2, 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. The significant interaction of the presence of an adjunct and the kind of modification hints to this opposite tendency. 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. Furthermore, if only the memory load due to the modifier length is considered, the expected pattern would be that participles with only an adjunct and those with only the accusative object receive the same mean ratings because they have approximately the same length.[3] However, there is a difference between these conditions, with lower ratings for the accusative object.

Overall, 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. No such effect holds for RCs. This is important because it excludes the possibility that there is a general preference for intransitive use for the specific verbs in the experiment. If the effect is due to higher complexity of the transitive structure, it applies only for the participle. A possible explanation is the hybrid nature of the participle: The adjectival properties with respect to the DP, but also the verbal properties with respect to its own phrase might affect processing (Fuhrhop & Teuber, 2000; Lowe, 2020). An additional argument adds more complexity to the verbal part which might then lead to higher processing load due to the additional function as an adjective. This would not apply for the RC verbs, as they only have verbal properties. A second explanation could be that prenominal attributes in general do not frequently take accusative objects. Hence, they are unexpected in this position.

[3] The adjuncts consisted of two to three words, the accusative objects of two words. If new discourse referents (according to the DLT) are considered, there should be no difference between adjuncts and accusative objects, as they both introduce one new discourse referent.

5 Experiment 2

After examining effects on present participles, it is also interesting to see how past participles are affected by similar manipulations. The main differences between those two adjectival elements are the argument structure, the inherent aspect of the participle and the word ratio between prenominal modifier and RC (at least in the way the RCs are constructed here). Past participles correspond to a passive structure, as the modified noun is the direct object or theme. Therefore the subject, or agent, can optionally be realized as a *by*-phrase. One possibility is that the insertion of an overt agent emphasizes the verbal character of the modifier, leading to a preference for an RC as a more independent syntactic unit. This would correspond to the effect of the accusative object in Experiment 1.

Another difference is the word ratio: whereas the RC contained only one more word than the participle phrase in the previous experiment, namely the relative pronoun, an additional auxiliary is necessary to form the passive (11). It is possible that a difference in word ratio leads to a preference for short modifiers in particular to be realized prenominally (cf. Fabricius-Hansen, 2016).

(11) a. *die vom Nachbarn adoptierte Katze...*
the by the neighbor adopted cat...
b. *die Katze, die vom Nachbarn adoptiert wurde...*
the cat that by the neighbor adopted was...
'the cat (that was) adopted by the neighbor...'

5.1 Method

5.1.1 Material

40 sentences were constructed in which the accusative object of a transitive main clause is modified by a prenominal participle construction or an RC. The difference to Experiment 1 is that past participles and the corresponding passive RCs were used. The presence or absence of a PP adjunct and/or a *by*-phrase leads to a manipulation of length and internal structure of the modifier. Overall, this results in a 2×2×2-design: attribute or relative clause × ±adjunct × ±*by*-phrase. (12) shows an example of the material.

(12)

a. participle, – PP adjunct, – *by*-phrase
Susi hat ***die gestrickte Mütze*** *heimlich wieder verschenkt.*
Susi has the knitted hat secretly again given away

b. participle, – PP adjunct, + *by*-phrase
Susi hat ***die von der Tante gestrickte Mütze*** *heimlich wieder verschenkt.*
Susi has the by the aunt knitted hat secretly again given away

c. participle, + PP adjunct, – *by*-phrase
Susi hat ***die für Weihnachten gestrickte Mütze*** *heimlich wieder verschenkt.*
Susi has the for Christmas knitted hat secretly again given away

d. participle, + PP adjunct, + *by*-phrase
Susi hat ***die von der Tante für Weihnachten gestrickte Mütze*** *heimlich wieder*
Susi has the by the aunt for Christmas knitted hat secretly again
verschenkt.
given away

e. RC, – PP adjunct, – *by*-phrase

Susi hat die Mütze, ***die gestrickt wurde****, heimlich wieder verschenkt.*
Susi has the hat that knitted was secretly again given away

f. RC, – PP adjunct, + *by*-phrase

Susi hat die Mütze, ***die von der Tante gestrickt wurde****, heimlich wieder verschenkt.*
Susi has the hat that by the aunt knitted was secretly again given away

g. RC, + PP adjunct, – *by*-phrase

Susi hat die Mütze, ***die für Weihnachten gestrickt wurde****, heimlich wieder verschenkt.*
Susi has the hat that for Christmas knitted was secretly again given away

h. RC, + PP adjunct, + *by*-phrase

Susi hat die Mütze, ***die von der Tante für Weihnachten gestrickt wurde****, heimlich*
Susi has the hat that by the aunt for Christmas knitted was secretly
wieder verschenkt.
again given away

'Susi has secretly given away again the hat (that was) knitted (by the aunt) (for Christmas)'

In order to keep other potential effects constant, the material was further restricted. The gender of the modified noun is evenly distributed, the nouns are feminine, masculine or neuter. The *by*-phrase is always definite and the modified noun and the head noun do not have the same gender. The PP adjunct consists of 2–3 words, like in Experiment 1. In addition to the experimental items, the questionnaire contained 60 filler sentences. Those are the same as in Experiment 1.

5.1.2 Participants

As in Experiment 1, I used Ibex Farm to create an online questionnaire. 49 participants were recruited with Prolific. Additionally, 8 people participated voluntarily.

5.1.3 Procedure

The procedure was the same as in Experiment 1.

5.2 Results

Table 3. Mean response for acceptability judgments in Experiment 2; scale from 1 (totally unacceptable) to 7 (totally acceptable)

by-phrase *(von der Tante)* ('by the aunt')	PP adjunct *(für Weihnachten)* ('for Christmas')	modification participle	RC
+	+	5.52	6.11
–	+	6.09	6.18
+	–	6.17	6.18
–	–	6.38	6.01

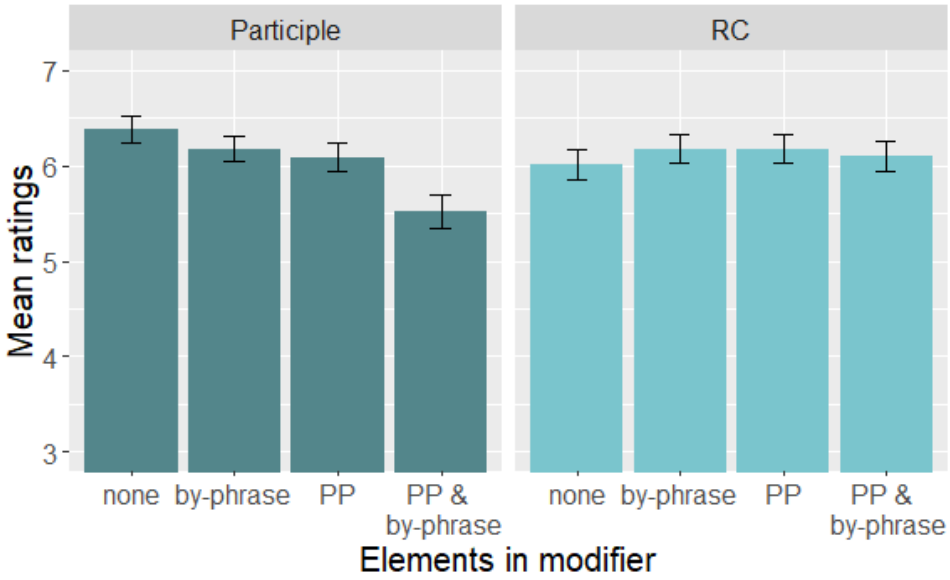

Figure 2. Mean acceptability ratings by condition for Experiment 2

Table 4. Cumulative Link Mixed Model (fitted with the Laplace approximation) for Experiment 2
formula: response ∼ modification * *by*-phrase * adjunct + (1 + modification + *by*-phrase + adjunct | participant) + (1 + modification + *by*-phrase + adjunct | sentence)

Coefficients:				
	Estimate	Std. Error	*z* value	Pr(> |*z*|)
modification	0.2214	0.1500	1.475	0.14012
by-phrase	0.4999	0.1201	4.163	3.15e-05 ***
adjunct	0.4024	0.1326	3.034	0.00241 **
modification:*by*-phrase	-1.1565	0.1844	-6.273	3.55e-10 ***
modification:adjunct	-1.1692	0.1843	-6.344	2.24e-10 ***
by-phrase:adjunct	-0.3888	0.1822	-2.133	0.03290 *
modification:*by*-phrase:adjunct	-0.3639	0.3597	-1.012	0.31172

The statistical analysis (cf. Table 4) reveals a significant main effect of the presence of an adjunct and of a *by*-phrase. Furthermore, there is a significant interaction of modification and adjunct, modification and *by*-phrase and adjunct and *by*-phrase. However, a closer look at the results (cf. Table 3 and Figure 5.2) suggests that these effects are mainly driven by the condition, in which both, a *by*-phrase and a PP adjunct are present and the modifier is a prenominal participle phrase.

This is supported by pairwise comparisons (Tukey's test) for the significant interactions: When only modification and the presence or absence of an adjunct is considered, the mean ratings are 5.81 for participles with an adjunct, 6.28 for participles without an adjunct, 6.14 for RCs with an adjunct and 6.10 for RCs without an adjunct. There is a significant difference between participles with an adjunct and RCs with an adjunct ($z = –4.626$; $p < .0001$), participles with an adjunct and participles without an adjunct ($z = –6.174$; $p < .0001$) and a mildly significant difference between participles with an adjunct and RCs without an adjunct ($z = –2.943$; $p < .05$).

For the interaction of modification and *by*-phrase, the difference between participles with a *by*-phrase and RCs with a *by*-phrase was significant ($z = – 4.656$; $p < .0001$), as well as the difference between participles with a *by*-phrase and RCs without a *by*-phrase ($z = –3.734$; $p < .005$) and the difference between participles with a *by*-phrase and without a *by*-phrase was significant ($z = –7.176$; $p < .0001$). The mean rating for all participles with a *by*-phrase were 5.85, compared to 6.24 without. For RCs the mean ratings were 6.14 with a *by*-phrase and 6.09 without it.

Overall, the mean ratings were 5.81 for +adjunct +*by*-phrase conditions, 6.18 for –adjunct +*by*-phrase, 6.13 for +adjunct –*by*-phrase and 6.20 for –adjunct –*by*-phrase. The pairwise comparison for the interaction of adjunct and *by*-phrase revealed a significant difference between the conditions with an argument and a *by*-phrase, compared to the conditions without both (z = –5.295; $p < .0001$) or with only an adjunct (z = –4.673; $p < .0001$) or a *by*-phrase (z = –3.833; $p < .001$).

5.3 Discussion

For past participles there seems to be no effect of a richer verbal structure. The presence of a *by*-phrase did not reduce the ratings more than the presence of any other adjunct. This either suggests that there is no difference between the by-phrase and other PP-adjuncts or that past participles differ from present participles. The initial idea was that the by-phrase emphasizes the verbal properties of the past participle by overtly expressing the agent. However, they both are adjuncts from a syntactic perspective (Baker et al., 1989) and therefore might affect the acceptability in the same way.

Compared to present participles, past participles seem to be more adjectival. For example, *un*-prefixes are less restricted than for present participles, e.g. *das ungesungene Lied* 'the unsung song' vs. **die unsingende Frau* (Fuhrhop & Teuber, 2000). It is possible that the conflict between adjectival and verbal properties is less problematic. However, this would only be the case if dative objects as in (13) would also not affect the acceptability.

(13) *das einem Freund geschenkte Buch*
the a friend-DAT given book
'the book given to a friend (as a gift)'

There is only one condition that differs significantly from the others, namely when a participle phrase is extended by an argument and an adjunct. This clearly indicates an effect of modifier length, which could be caused by higher memory load. It also seems that the ratings gradually decrease with increasing modifier length and the conditions with either by-phrase or PP adjunct are at the same level. However, the difference between no extension and only one element is also quite small. For RCs, the ratings do not differ with an increased number of words inside the modifier. The results indicate that modifier length affects participle phrases but not RCs, as suggested by Fabricius-Hansen (2016).

6 General Discussion

Overall, the experiments provided mixed results with respect to modifier length and the internal structure of the modifier. It is not in general the case that attributive participles are less acceptable than RCs. Even when they were extended, they received relatively high ratings. Interestingly, present and past participles behaved differently: increasing the modifier length affected the ratings for past participles. The presence of a *by*-phrase did not lead to lower ratings compared to the presence of a PP adjunct. For present participles, the ratings were affected by the presence of an argument, i.e. an accusative object, but there was no significant effect attributable to modifier length. In the following, I will discuss these findings in more detail.

6.1 Effect of Memory Load

As far as the length of the modifier is concerned, the experiments yielded mixed results. In both experiments, the longest modifier in the prenominal position received the lowest ratings, whereas no difference or an opposite tendency could be observed for RCs. An effect of modifier length has been predicted for the alternation of prenominal attributes and RCs in previous literature (Fabricius-Hansen, 2016; Doherty, 2010) and would be in line with processing accounts that

predict higher memory load for greater distances between the determiner and noun (Gibson, 2000).

The results of Experiment 2 provide evidence for an effect of modifier length on acceptability. The ratings were highest for participles without any extensions, slightly lower for one PP and lowest with two PPs. It would be interesting to test whether the ratings decrease even more when the modifier contains more than two PPs. For the first experiment, however, the corresponding effect was not statistically significant and it is not clear how much of the decrease in acceptability with length is caused by the presence of the accusative object. As the modifier length seems to matter for past participles and as the determiner and the noun are separated in both cases, it seems more plausible that a longer modifier with a present participle also causes higher memory load, but that this effect is not visible in Experiment 1 due to manipulation of the internal structure. Therefore, a study focusing only on modifier length might show a clearer picture for present participles.

With the assumption that the non-local dependency of determiner and noun causes higher processing load, especially with increasing modifier length, the question arises whether this affects production (e.g. Hawkins, 2004), comprehension (e.g. Gibson, 2000) or both (for a possible connection between language production and comprehension, cf. MacDonald, 2013). Contrary to online data, acceptability judgments measure sentence comprehension less directly: participants can take their time when they judge the acceptability of sentences, and it is possible that they make judgments based on their own likelihood to utter the sentence or that they silently produce the sentence, which would rather hint at production data (cf. e.g. Schütze & Sprouse, 2014; Konieczny, 2000).

Note that a longer modifier could also increase memory load for the RCs in the material because it increases the distance between the noun and the verb of the matrix clause. However, a longer modifier did not lead to a decrease of the ratings for RCs. If only the prenominal modifier is affected by the length manipulation, it could mean that it is more problematic to have open dependencies inside the DP.

Another interesting point is that RCs can be extraposed whereas this is not possible for prenominal phrases. It is likely that a very long modifier is expressed as an extraposed RC, as in (14). The extraposition of material to the right edge of the clause is considered as a way to reduce memory load, at least for production (Hawkins 2004, cf. Konieczny 2000), if there is not too much material between the DP and the relative pronoun.

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

Hence, there are actually three possible positions for the modifier: The prenominal modifier can be considered as the most costly in terms of memory load, as it is center embedded inside the DP. An RC that directly follows the DP is center embedded in the matrix clause, if it modifies the noun phrase or if the sentence final position is filled e. g. by part of the VP. When an extraposed RC is processed, there are no open dependencies left from the matrix clause. I assume that the acceptability of these three constructions correlate with the modifier length.

6.2 Effect of a Richer Verbal Structure

The diminishing effect of an accusative object inside a present participle phrase on the ratings in Experiment 1 is a very interesting finding, as to my knowledge it has not been mentioned in previous literature. An explanation could be that a sentential structure of a prenominal participle phrase, i.e. arguments in general, results in a decrease in acceptability. I assume that this is due to the double role of the participle as adjective and verb. A higher verbal complexity like a richer argument structure potentially leads to higher processing load. Further evidence for this

hypothesis comes from deverbal nominals and adjectives: For Greek, Manouilidou (2006) found that nouns and adjectives which are derived from verbs are processed slower, when thematic features are present. Hence, it would not be surprising if the presence of arguments affect the acceptability of participles. For the RC verbs, there is no such conflict, as they do not have adjectival properties. To my knowledge there is no evidence that transitivity should lower the acceptability of verbs in general. On the contrary, previous research showed that arguments even facilitated the processing of verbs in verb final clauses in German (e.g. Konieczny & Döring, 2003; Levy & Keller, 2013).

While difficulties due to a richer verbal structure explain the results of Experiment 1, the *by*-phrase did not differ from other PP adjuncts in Experiment 2. Syntactically, the *by*-phrase is an adjunct (Baker et al., 1989) and therefore has the same status than the PP adjunct. However, it overtly expresses the agent of the event, which also emphasizes the verbal role of the past participle. It is possible the agent is always present in the event structure, even when it is not overtly mentioned. This would explain why the by-phrase did not differ from an adjunct. In theory, however, this could also hold for the object of the present participle in Experiment 1. Contrary to the *by*-phrase in Experiment 2, here the results suggest that the presence of the object leads to a higher complexity.

If a richer verbal structure leads to higher processing load, the same decrease of the ratings should be observed for dative or PP objects. If this is the case, participles of intransitive verbs should be preferred to those with more arguments and the presence of optional arguments should be less acceptable. Under the assumption that the implicit presence of the *by*-phrase is the only reason why it did not affect the ratings for past participles, other arguments like dative objects would then have an effect for past participles as well. However, accusative objects might have a special status as they do not occur with any other adjectival element. Hence, it is also possible that a modifier including an accusative object differs more from protoypical adjectival phrases.

Both experiments focused on participles, which are considered to be verbal, but with an adjectival position and agreement. However, some adjectives in German also take arguments, as shown in (3).

(3) *der dem Herrchen treue Hund...*
the the owner-DAT loyal dog
'the dog that is loyal to his owner...'

It is an open question whether arguments will lead to lower acceptability ratings in this case. On the one hand, it is possible that they do not because the adjective is not a hybrid category like the participle. On the other hand, the modifier is more sentential and therefore an RC might still be preferred in this case.

Note that some adjectives can take objects that express a degree, like *zwei Meter* 'two meters' in (15).

(15) *der zwei Meter große Mann*
the two meters tall man

In this case, it can be assumed that the adjective projects a degree phrase in which the DP inside the modifier is realized (e.g. Heim, 2000). As this structure is different from verbal arguments, I would not assume that the presence of the object in an attributive use affects the acceptability apart from a potential effect of modifier length.

6.3 Further Influences

Instead of considering the syntactic structure of the modifier, the effect of the accusative object in Experiment 1 could also be due to a change in the event structure. As imperfective aspect is one of the properties of present participles (Rapp, 1997; Lübbe & Rapp, 2011), an event expressed in

the modifier usually takes place during the complete time span of the event in the main clause. The insertion of an incremental theme (Dowty, 1991), i.e. a theme that undergoes a change of state during the event, could change the event expressed by the participle from an activity to an accomplishment. If this was the case, the clash of the imperfective aspect of the participle with a theme that actually changes during the event could lead to a (mild) coercion effect, which makes this structure a bit more odd than participle phrases which express only the activity. Intuitively, however, it is not clear whether such a change actually is caused by the object in the material of Experiment 1. In order to test whether there is a clash with the inherent aspect of 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).

The effect in Experiment 1 could also be due to the rare occurrence of accusative objects in prenominal attributes. Low frequency in the input could cause a surprisal effect when the reader encounters the object because it is highly unexpected (e.g. Hale, 2001; Levy, 2008). While frequency should definitely be taken into account for the acceptability of different modifiers, an approach that focuses on verbal complexity or memory effects could also explain preferences in production.

7 Conclusion

Two experiments tested the acceptability of modifiers realized either as a prenominal participle phrase or a postnominal RC. This was based on two hypotheses: A longer modifier is more acceptable as an RC than as a participle phrase and the modifier is more acceptable in prenominal position when it is more similar to prototypical adjectives. The results for present participles and past participles show different patterns. Whereas the past participle phrases in Experiment 2 provide evidence for an effect of length on the preferred kind of modification, a potential effect of modifier length is hidden by a different effect for present participle phrases, namely that of an accusative object. A potential explanation could be that a richer verbal structure is more problematic for the participle because it has an adjectival function as well. However, the effect of modifier length is present at least in one experiment and it is well supported by theories of language processing that take dependency length into account (Gibson, 2000). Therefore, further research concentrating on only this factor could be very insightful.

References

Baker, M., Johnson, K., & Roberts, I. (1989). Passive arguments raised. *Linguistic Inquiry*, *20*(2), 219–251.

Bech, G. (1955). *Studien ueber das deutsche Verbum Infinitum. Band 1*. Kopenhagen: Munksgaard.

Chomsky, N. (1973). Conditions on transformations. In S. R. Anderson & P. Kiparsky (Eds.), *A Festschrift for Morris Halle* (pp. 232–286). New York: Holt Rinehart and Winston.

Christensen, R. H. B. (2019). Ordinal–Regression Models for Ordinal Data. R package version 2019.4-25. http://www.cran.r-project.org/package=ordinal/.

Cinque, G. (2010). *The Syntax of Adjectives: A Comparative Study*. Cambridge, MA: MIT Press.

Doherty, M. (2010). *Structural propensities: Translating nominal word groups from English into German*, volume 65 of *Benjamins translations library 0929-7316*. Amsterdam and Philadelphia: John Benjamins.

Dowty, D. (1991). Thematic proto-roles and argument selection. *Language*, *67*(3), 547–619.

Dowty, D. R. (1979). *Word Meaning and Montague Grammar*. Dordrecht: Reidel.

Fabricius-Hansen, C. (2016). Vorangestellte Attribute und Relativsätze im Deutschen: Wettbewerb und Zusammenspiel. In M. Hennig (Ed.), *Komplexe Attribution* (pp. 135–168). Berlin / Boston: De Gruyter Mouton.

Faucher, E. (1994). Partizip oder Adjektiv? Partizip oder Infinitiv? Bennenung- und Abgrenzungsfragen. In D. Bresson & M. Dalmas (Eds.), *Partizip und Partizipialgruppen im Deutschen* (pp. 1–18). Tübingen: Narr.

Fuhrhop, N., & Teuber, O. (2000). Das Partizip 1 im Deutschen. *ZAS Papers in Linguistcs*, *16*, 100–114.

Gibson, E. (1998). Linguistic complexity: Locality of syntactic dependencies. *Cognition*, *68*(1), 1–76.

Gibson, E. (2000). The dependency locality theory: A distance-based theory of linguistic complexity. In A. Marantz, Y. Miyashita & W. O'Neil (Eds.), *Image, Language, Brain* (pp. 95–126). Cambridge, MA: MIT Press.

Gordon, P. C., Hendrick, R., & Johnson, M. (2001). Memory interference during language processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*(6), 1411–1423.

Hale, J. (2001). A probabilistic earley parser as a psycholinguistic model. In *Proceedings of the second meeting of the North American Chapter of the Association for Computational Linguistics on Language technologies*, (pp. 1–8). Association for Computational Linguistics.

Harbert, W. (2006). *The Germanic Languages*. Cambridge, UK: Cambridge University Press.

Hawkins, J. A. (1983). *Word Order Universals: Quantitative Analyses of Linguistic Structure.* New York: Academic Press.

Hawkins, J. A. (2004). *Efficiency and Complexity in Grammars*. Oxford University Press on Demand.

Heim, I. (2000). Degree operators and scope. In Jackson, B., & Matthews, T. (Eds.), *Proceedings of SALT 10*, (pp. 40–64)., Ithaka, NY. Cornell Linguistics Club.

Hulsey, S., & Sauerland, U. (2006). Sorting out relative clauses. *Natural Language Semantics*, *14*(2), 111–137.

Kayne, R. S. (1994). *The Antisymmetry of Syntax*. Cambridge, MA: MIT press.

Konieczny, L. (2000). Locality and parsing complexity. *Journal of Psycholinguistic Research*, *29*(6), 627–645.

Konieczny, L., & Döring, P. (2003). Anticipation of clause-final heads: Evidence from eye-tracking and SRNs. In Slezak, P. P. (Ed.), *Proceedings of the 4th International Conference on Cognitive Science, July 13-17, 2003*, (pp. 13–17)., Sydney. University of New South Wales.

Lenth, R. V. (2016). Least-squares means: The R package lsmeans. *Journal of Statistical Software*, *69*(1), 1–33.

Leu, T. (2015). *The Architecture of Determiners*. Oxford / New York: Oxford University Press.

Levy, R. (2008). Expectation-based syntactic comprehension. *Cognition*, *106*(3), 1126–1177.

Levy, R. P., & Keller, F. (2013). Expectation and locality effects in German verb-final structures. *Journal of Memory and Language*, *68*(2), 199–222.

Lewis, R. L., & Vasishth, S. (2005). An activation-based model of sentence processing as skilled memory retrieval. *Cognitive Science*, *29*(3), 375–419.

Lowe, J. (2020). Mixed projections and syntactic categories. *Journal of Linguistics*, *56*, 315—357.

Lübbe, A., & Rapp, I. (2011). Aspekt, Temporalität und Argumentstruktur bei attributiven Partizipien des Deutschen. *Zeitschrift für Sprachwissenschaft*, *30*(2), 259–299.

MacDonald, M. C. (2013). How language production shapes language form and comprehension. *Frontiers in Psychology*, *4*, 226.

Manouilidou, C. (2006). *On the Processing of Thematic Features in Deverbal Nominals*. PhD thesis, University of Ottawa (Canada).

Potts, C. (2005). *The Logic of Conventional Implicatures*. Oxford University Press on Demand.

R Core Team (2017). *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing.

Rapp, I. (1997). *Partizipien und semantische Struktur: Zu passivischen Konstruktionen mit dem 3. Status*. Tübingen: Stauffenburg-Verlag.

Schütze, C. T., & Sprouse, J. (2014). Judgment data. In R. J. Podesva & D. Sharma (Eds.), *Research Methods in Linguistics* (pp. 27–50). Cambridge, UK: University Press Cambridge.

Schwarz, I. (2020). *Attribute an der Schnittstelle*. Tübingen: Tübingen University Press.

Sikos, L., Greenberg, C., Drenhaus, H., & Crocker, M. W. (2017). Information density of encodings: The role of syntactic variation in comprehension. In Gunzelmann, G., Howes, A., Tenbrink, T., & Davelaar, E. (Eds.), *Proceedings of the 39th Annual Conference of the Cognitive Science Society*, (pp. 3168–3173)., Austin, TX. Cognitive Science Society.

Vasishth, S., Chen, Z., Li, Q., & Guo, G. (2013). Processing chinese relative clauses: Evidence for the subject-relative advantage. *PloS one*, *8*(10), e77006.

Weber, H. (1994). Erweiterte Partizipialattribute: Nur eine schriftsprachliche Konstruktion? In D. Bresson & M. Dalmas (Eds.), *Partizip und Partizipialgruppen im Deutschen* (pp. 149–162). Tübingen: Narr.

Weiß, H. (2017). Warum gibt es (im Bairischen) keine kochenden Hausfrauen, sondern nur kochendes Wasser? Über seltsame sprachliche Lücken und Beschränkungen. In S. Zeman, M. Werner & B. Meisnitzer (Eds.), *Im Spiegel der Grammatik: Beiträge zur Theorie sprachlicher Kategorisierung* (pp. 53–68). Tübingen: Stauffenburg Verlag.

Wu, F., Kaiser, E., & Vasishth, S. (2018). Effects of early cues on the processing of Chinese relative clauses: Evidence for experience-based theories. *Cognitive Science*, *42*, 1101–1133.