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Revisiting German two-way prepositions

Towards a usage-based account of case

https://doi.org/10.1515/zfs-2021-2029
Received June 15, 2020; accepted April 20, 2021; published online September 9, 2021

Abstract: German two-way prepositions have long troubled grammar writing. Unlike most other German prepositions, they occur with both accusative and dative case. Their case is difficult to predict and has been attributed to different underlying meaning construals. Recent exploratory corpus studies propose that, in addition, their case depends on multiple co-occurring contextual variables. Following this approach, this study uses multivariate regression and collostructional analysis to investigate what determines the case of two-way prepositions in a large sample of authentic language use. Based on the results, this study then attempts to provide a usage-based description of the case of two-way prepositions. Contrary to expectations, none of the proposed variables had much influence on case, suggesting that the effects observed in the literature only hold for specific contexts. Instead, the results indicated associations of accusative and dative with individual prepositions and specific lexical items in the context. Framed in terms of usage-based construction grammar, this is interpreted as item-specific constructional prototypes that emerge from typical usage patterns and, once established, determine case based on form-meaning overlap with the current context of use. In line with recent usage-based research on grammar, a first attempt is made to describe case as part of a network of associative links between constructions and lexical items.

Keywords: German, two-way prepositions, case, usage-based linguistics, corpus linguistics, grammar network

1 Introduction

Recent years have seen the arrival of quantitative data-based methods in all domains of linguistic research, including grammar. Under the name of usage-based construction grammar, a family of novel theories has emerged that approaches

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grammar “bottom up,” that is, from language use to linguistic structure (Bybee 2013; Diessel 2015). The current study applies quantitative methods from usage-based linguistics to a topic that has posed difficulties to introspective, “top-down” grammar writing: case in the context of German two-way prepositions.

Most German prepositions assign fixed cases to their nominal complements. The situation is different with the nine so-called two-way prepositions auf ‘on’, in ‘in’, hinter ‘behind’, neben ‘beside’, an ‘at’, unter ‘under’, vor ‘before’, über ‘above’, and zwischen ‘between.’ They occur with both accusative and dative, as illustrated in example (1). German marks case at articles and nouns (and sometimes adjectives). Here, the article die indicates accusative (1-a), while den and the noun suffix -n mark dative (1-b). The exact form of the case markers depends on gender and number of the noun. In the context of two-way prepositions, the two cases often occur with different meanings that correspond to the difference between into and in in English, as seen in (1).

(1)  

a. Das Holznilpferd Susi reist in die Heimatländer der Schulkinder.  
the wodden hippo Susi travels in the-ACC homelands of the school children  
‘The wodden hippo named Susi travels into the school children’s homelands.’

b. Das Holznilpferd Susi reist in den Heimatländern der Schulkinder.  
the wodden hippo Susi travels in the-DAT homelands-DAT of the school children  
‘The wodden hippo named Susi travels in the school children’s homelands.’

This study addresses the question of what determines the case of two-way prepositions. Researchers have approached this issue from different perspectives and with different methods. Exceptions notwithstanding, they have proposed several meaning- and context-related influencing factors. The objective of the study is to assess the extent to which these factors predict case in actual language use. Using quantitative methods from usage-based linguistics, the current study investigates the influence of the different variables based on a large sample of authentic language use. Based on the outcome of the analysis the study aims to provide a comprehensive description of case with two-way prepositions. Surprisingly, the results indicate that the discussed variables are of minor importance. Instead, case heavily depends on specific lexical items in its context. Adopting usage-based
construction grammar as framework, this is described in terms of item-specific constructional prototypes that determine the use of accusative and dative with two-way prepositions in different contexts. This lays the groundwork for a usage-based network account of case in general.

The paper is structured as follows. In Section 2, relevant literature on two-way prepositions is reviewed and several factors that presumably influence case are introduced. In Section 3, methods and results of the corpus study are described. Section 4 discusses the results of the corpus study and on this basis develops a usage-based construction grammar approach to two-way prepositions and case. Finally, Section 5 summarizes the most important results and makes brief proposals for future research.

2 Background

German prepositions normally require particular cases independent of their meaning or use. For instance, despite their similar meanings, the preposition entgegen only occurs with dative (e.g., entgegen dem dat Wunsch meiner Eltern) whereas the preposition gegen requires accusative (e.g., gegen den acc Wunsch meiner Eltern ‘against my parents’ wish’) (Helbig and Buscha 2001: 357). In contrast, two-way prepositions occur with both accusative and dative. Most research assumes that the case variation depends on meaning. Sprachgefühl and introspective analysis of examples such as the ones in (1) suggest that the sentence acquires “directional” meaning with accusative but non-directional, “locational” meaning with dative. More precisely, the accusative phrase in die Heimatländer (1-a) refers to the destination or endpoint of the journey whereas the dative phrase in den Heimatländern (1-b) profiles the homelands as locations where the journey takes place.

The exact difference in meaning is difficult to describe. Several attempts have been made in the literature. For instance, the German Duden grammar states that accusative designates dynamic change of place or directed movement. In contrast, dative is supposed to be used to describe static posture and unchanged locations (Duden 2009: 608). As is evident from example (1-b), there are exceptions to this rule of thumb. To give another example, Hermann (1920: 5) proposes that accusative is used when the relationship that is profiled by the preposition is in the process of being established. In contrast, dative is used when the relationship is conceived of as already established. However, none of these apply straightforwardly to the examples in (1). Following Paul, the accusative sentence in (1-a) should probably mean that the toy is going to go on the journey to the children’s
homelands soon. This does not rule out the contrasting reading that the toy has been on the journey all along. Moreover, observe that the semantic difference does not generalize to case with other prepositions that occur with only one particular case (Zwarts 2006). For instance, um ‘around’ occurs only with accusative despite its non-directional meaning (e. g., Der Wind rauschte um das Haus ‘The wind rushed around the house’), whereas zu ‘to’ profiles the goal of a movement but requires dative (e. g., Der kommt immer zu mir ‘That one always comes to me’).

More recently, researchers in cognitive linguistics have suggested that the meaning difference is best described in terms of image schemas defined as mental representations of bodily experience such as movement through space or up-down orientation which form the basis for linguistic meaning and motivate many other formal distinctions. For example, Langacker (1999) describes the meaning of prepositions as defining search domains to which they confine their trajector. For instance, in example (1), the preposition in places the trajector (here, the toy) in a region or space within certain boundaries (search domain). Like all two-way prepositions (but unlike all other prepositions), in then uses case to explicitly encode whether the trajector enters the search domain (accusative) or is already within the search domain (dative). By analogy, in example (1-a), the traveler crosses the homeland borders and therefore accusative is used, while in (1-b) the use of dative indicates that its movement is confined to the region within the borders. Subsequent studies have proposed variations and developed more fine-grained image schemas (Leys 1989; Serra-Borneto 1997; Smith 1993; 1995). For instance, Smith (1993; 1995) suggests that accusative profiles any change of location or state.

These approaches have been criticized by researchers in applied linguistics for being too general, unintuitive, and impractical. For instance, Baten (2008; 2009) surveys the teaching practices of foreign language teachers and relates them to the linguistic literature on two-way prepositions. He comes to the conclusion that the linguistic research is of only limited use to the teachers. Both teachers and applied linguists point out many contexts which are challenging to foreign language learners but which are not covered in most linguistic research. In particular, the nonliteral use of two-way prepositions in multiword units with fixed case such as warten auf ‘wait for’, freuen über ‘be glad about’, and Angst vor ‘fear of’ do not comply with the literature (Baten 2009; De Knop 2008; Helbig and Buscha 2001: 359).

More precisely, in prepositional verbs such as warten auf ‘wait for’, in fixed strings like Angst vor ‘fear of’ or in der Regel ‘normally’, and in nonliteral expressions such as auf ein Problem eingehen ‘target a problem’ or in eine andere Sprache übersetzen ‘translate into another language’, the prepositions are not used with
their literal meaning. They do not profile spatial or temporal relations. Instead, they are part of larger multiword units which have acquired meanings on their own. Most of the time, the case of the two-way preposition does not follow from different meanings (and not from individual prepositions either) but is often arbitrary and bound to the expression as a whole. Some researchers suggest that nonliteral usage contexts favor accusative (2-a) whereas dative is used with literal meaning of the preposition (2-b), as example (2) illustrates (Rys, Willems, and De Cuypere 2014).

(2) a. Sein Zorn wird sich über mich entladen.
   his wrath will REFLECT over me-ACC unload
   ‘His wrath will hit me.’

   b. Das Gewitter entlud sich über dem See.
      the storm unloaded REFLECT over the-DAT lake
      ‘The storm occurred over the lake.’
      (Rys, Willems, and De Cuypere 2014: 215)

In addition, case is often influenced by other lexical items in the context of the preposition. For example, De Knop (2008) notes that accusative is often used with verbs that express directional motion through space such as stellen ‘put’, legen ‘lay’, and setzen ‘sit down’, whereas dative often occurs with posture verbs that profile static scenes, for example, stehen ‘stand’, liegen ‘lie’, and sitzen ‘sit.’ Other researchers have developed more general meaning-based verb classes which are assumed to interact with underlying image schemas and as a consequence attract accusative or dative (Smith 1993; 1995). For example, Smith (1995) suggests that so-called profile restriction verbs (e. g., landen auf ‘land on’, abstellen in ‘put aside in’) require dative because they highlight local parts of the image schema path. In contrast, so-called endpoint focus verbs (e. g., anlehnen an ‘lean on’, versinken in ‘sink into’) occur with either accusative or dative depending on subtle conceptual differences.

Last, research has focused mostly on contexts like in example (1) where two-way prepositions (here, in) depend on verbal heads (here, reisen). Actual usage is more diverse and includes nominal heads, as illustrated in example (3). Here, the preposition auf structurally depends on the nouns Recht (3-a) and Stimmung (3-b), respectively. Moreover, as is evident from the examples, prepositions with nominal heads in principle occur with both accusative (3-a) and dative (3-b). Most of the meaning correlations proposed in the literature apply only indirectly to these contexts. In example (3-a), the preposition auf is not used with its literal meaning but as part of a collocational string, which is common with nominal heads. In example (3-b), too, the preposition is headed by the noun Stimmung and
Dative is used despite the border-crossing movement implied by the verb. Moreover, unlike in example (1), changing the case to dative and accusative in (3-a) and (3-b) respectively does not produce grammatical sentences, suggesting that case is more constrained in these contexts.

(3) a. *Jeder DDR-Bürger hatte das Recht auf einen Arbeitsplatz.*
    each GDR citizen had the right on a-aCC workplace
    ‘Each GDR citizen had a right to employment.’

b. *Die Stimmung auf dem Balkon schwappete über.*
    the atmosphere on the-DAT balcony spilled over
    ‘The atmosphere on the balcony spilled over.’

In line with this, many studies have pointed out that the case of two-way prepositions is sensitive to the context of use. In addition to the lexical head, the literature suggests that case is influenced by the meaning of the nominal complement of the preposition, particle verbs, verb tense and voice, the syntactic role of the prepositional phrase, and additional adjuncts (Rehbein and van Genabith 2006; Rys, Willems, and De Cuypere 2014; Serra-Borneto 1997; Smith 1995; Willems, De Cuypere, and Rys 2018). Moreover, acquisitional studies with focus on case in general suggest that case errors of (foreign) language learners are related to the form of the nominal complement, word order, contracted preposition-article forms, and the influence of the native language (Baten 2011; De Knop 2008). For instance, the analysis of nonnative corpus data indicates that error rates are higher with noncanonical compared to canonical word orders and with nominal compared to pronominal complements (Baten 2011). The current study is not concerned with language acquisition but some of the discussed variables might still influence the use of case with two-way prepositions.

The relationship of case to any of these variables is often unclear or difficult to grasp. For example, Serra-Borneto (1997: 199) describes dative in terms of image schemas as the “case of container” and states that dative is only used when the meanings of co-occurring verbs and nominals are compatible with the container image and its many implications (e.g., protection and resistance, limitation and restriction of force, and so on). As a consequence, only dative is supposed to be acceptable in example (4) because the noun *Ufer* is conceived of as a container rather than the endpoint of a path. At the same time, Serra-Borneto (1997: 198–199) assumes that verb particles profile end points and therefore also favor dative. Yet, this seems difficult to reconcile with the container image. Others argue that particles introduce some sense of directionality into the context which renders accusative redundant (Rehbein and van Genabith 2006). In contrast, the Duden grammar notes that in the context of particle verbs accusative and dative are ex-
changeable and that dative carries semantically more concrete connotations than accusative (Duden 2009: 609).

(4) Sie haben das Boot am / * ans Ufer angebunden.  
they have the boat at-the-DAT / at-the-ACC riverside tied  
‘They tied the boat at the or to the riverside.’  
(Serra-Borneto 1997: 199)

Concerning voice and tense, some researchers suggest that the occurrence of past participles in passive voice or perfect tense improves the odds of dative, for instance, in (stative) passives such as in example (5-a) (Smith 1995). Past participles “highlight the end of the verbal process” (Langacker 2008: 121–122), which makes them semantically similar to profile restriction verbs. In contrast, dative sounds odd in active sentences (5-b).

(5) a. Der Text ist auf dünnem Papier gedruckt.  
the text is on thin-DAT paper printed  
‘The text is printed on thin paper.’

b. Er druckte den Text auf dünnem Papier.  
he printed the text on thin-DAT paper  
‘He printed the text on thin paper.’  
(Smith 1995: 307)

Some might object that accusative would be acceptable in (5-a), too, and that (5-b) does not sound odd at all. Accordingly, studies based solely on introspective analysis of single selected examples have been criticized for lack of methodological rigor (Willems 2011). In addition, the exact influence of different variables is difficult to determine because they co-occur in the examples. In response to this, most recent studies have adopted multivariate quantitative methods.

For instance, Rys, Willems, and De Cuypere (2014) analyze case in the context of the particle verbs versenken ‘plunge’, versinken, einsinken, and eisenken (all three roughly ‘sink into’) followed by in based on authentic usage data from the German Reference Corpus¹. Using multivariate statistical procedures, they find that case is influenced by different senses of the verbs, verb valency, specific particles, and the co-occurrence of degree adjuncts. Accusative tends to occur with the particle ein- and in the context of adjuncts of degree. In contrast, dative is associated with the particle ver- and specific verb senses. In a similar study based on two samples of the prepositional verbs aufsetzen auf ‘put on’ and aufnehmen

¹ Deutsches Referenzkorpus DeReKo, https://www1.ids-mannheim.de/kl/projekte/korpora/, accessed June 8 2020.
in ‘take in’, Willems, De Cuypere, and Rys (2018) find that accusative is associated with transitive, dative with intransitive usage of the verbs, and that the cases are attracted to different verb senses.

The use of corpus data and multivariate research designs is promising for both linguistic research and grammar writing. Corpus linguistic approaches are able to provide more accurate descriptions of the actual use of two-way prepositions and often discover patterns which have been overlooked by more subjective, introspective approaches. To my knowledge, corpus-linguistic studies on two-way prepositions have so far focused on only a handful of lexically specific contexts and have relied on samples which are large compared to other research on two-way prepositions but small compared to corpus-linguistic studies in general. Moreover, even though they used lexically specific samples, these studies tend to draw general conclusions. From a usage-based perspective, the results of Rys, Willems, and De Cuypere (2014) suggest that the linguistic knowledge of case might be much more lexically specific than previously thought.

To address these issues, the current study searches for usage patterns of two-way prepositions at different levels of analysis, based on a much larger sample. Surprisingly, the results indicate that none of the proposed variables have much influence on case. Instead, different cases are strongly associated with lexically specific contexts, suggesting that accusative and dative are used as parts of lexical item-specific constructional patterns.

3 The current study

3.1 Method

CORPUS AND SAMPLE. A corpus from the Leipzig Corpora Collection (Goldhahn, Eckart, and Quasthoff 2012) was used. The collection provides open-for-research corpora of different languages, sizes, and from different years. The corpora were collected to create usage-based dictionaries for different languages. The sources are newspaper texts and texts automatically collected from the web by a web crawler. The material has already been stripped of foreign language material, HTML- and other code, and has been segmented into sentences. The current study is based on the most recent and largest so-called “mixed-typical” German-language corpus. The corpus contains 999,926 randomly selected sentences from the year 2011, 6,593,439 word tokens and 413,551 word types (lemmas), excluding punctuation. All examples are from this corpus if no other source is specified. The corpus was tokenized, lemmatized, part-of-speech (POS)-tagged, and parsed
for morphosyntactic relations with the Zurich Dependency Parser for German (Sennrich, Schneider, et al. 2009; Sennrich, Volk, and Schneider 2013). Non-verbal sentence fragments were excluded. All sentences containing at least one of the nine German two-way prepositions *an*, *auf*, *hinter*, *in*, *neben*, *über*, *unter*, *vor* and *zwischen*, including their contracted forms (e.g., *ans*, *am*, *aufs*, *ins*, *vors* etc., Helbig and Buscha 2001: 348–358), were extracted from the corpus. Around 25.35% of the two-way prepositions in the corpus occurred with neither dative nor accusative but with no overt case marker, for instance, *in* in example (6).

(6) 1908 geht die erste Strangpresse in Betrieb.
   ‘In 1908, the first extrusion press went into operation.’

Since the current paper is concerned with case, sentences with no overt case markers were excluded. The distribution of two-way prepositions in the corpus was heavily skewed, with *in* accounting for almost half of the occurrences (47.4%), followed by *auf* (20.96%), *an* (16.28%), *über* (6.32%), *vor* (3.87%), *unter* (2.74%), *zwischen* (1.32%), *hinter* (0.56%), and *neben* (0.54%). To obtain a balanced sample, 1,000 sentences for each preposition were randomly selected. Duplicated sentences with two or more overt case-assigning prepositions such as *an* and *in* in example (7) were included in the sample multiple times, while duplicates without overt case were removed.

(7) Wir gehen am Sonnabend in den Baumarkt.
   ‘On Saturday, we will go to the DIY market.’

**VARIABLES.** Following the literature the sample was analyzed for case (dative vs. accusative) and the following variables. First, based on the parser’s annotations, the lemma and the POS of the lexical head and the lexical complement of the preposition, the syntactic role of the prepositional phrase, and whether the preposition was contracted with the following article or not (contraction) were recorded. By way of illustration, in example (8), the lexical head of the preposition *in* is the verb *angelegt* and its lexical complement is the noun *Gesellschaft*. The parser identified the prepositional phrase *in der bürgerlichen Gesellschaft* as adjunct. Preposition and article are not contracted. By comparison, in example (9), the prepositional phrase *ins Wasser* is classified as prepositional object and the preposition *in* is coalesced with the article *das*, forming *ins*.

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2 For a general evaluation of the performance of the parser and information on its precision and recall, see Sennrich, Volk, and Schneider (2013).
(8) *Der moderne Antisemitismus ist in der bürgerlichen Gesellschaft*  
the modern antisemitism is in-the-DAT bourgeois-DAT society  
angelegt.  
located  
‘Modern antisemitism is an inherent part of bourgeois society.’

(9) *Dort führt eine Treppe ins Wasser.*  
there leads a stairway in-the-ACC water  
‘There, a stairway leads into the water.’

In addition, I recorded whether or not the sentence included particle verbs with particles that are form-identical to two-way prepositions or *ein* (like *an* in *angelegt* in example (8), Duden 2009: 697), whether or not the sentence included past participle verbs (again like *angelegt* in (8)), and the transitivity of the verb usage. Following Willems, De Cuypere, and Rys (2018), transitivity was defined as the number of subject and object noun phrases in the sentence, excluding prepositional objects. For example, in examples (8) and (9) there is only one nominal phrase in addition to the prepositional phrase, *der moderne Antisemitismus* and *eine Treppe* respectively. Both examples were therefore annotated as *intransitive*.

Some acquisitional studies mention that word order affects the use of case by learners and suggest that error rates increase with non-canonical locations of case-marked phrases, for example, with preverbal objects (Baten 2011). This implies that case-marked phrases are attracted to specific locations in the sentence. To determine the prototypical locations of dative and accusative prepositional phrases, the location of each preposition was defined as the linear distance to the center of the sentence and computed as standard deviations from the mean. Linear distance is a common measure in psycholinguistic studies (Gibson 2000) and much easier to conceptualize and to operationalize than, say, hierarchical distance. For example, the sentence in example (9) contains six words. The center of the sentence is at the mean 3.5, the standard deviation is 1.87, and the preposition *ins* is at the fifth position, that is, the preposition is located 0.8 standard deviations away from the mean or the center of the sentence. The higher the value, the larger the distance of the preposition to the center of the sentence. Values higher than zero indicate locations right and values lower than zero left of the center. By way of illustration, consider the sentences in Examples (10). From examples a. to d., the bold-printed prepositions gradually “move” from locations left of the center at the beginning of the sentence to the right towards the end of the sentence.

(10) a. *Über die Paarungszeit der Füchse ist bislang nichts bekannt.*  
‘Nothing is known about the mating season of foxes.’
b. *Das Herzogtum war auf einen Einfall nicht vorbereitet.*
   ‘The dukedom was not prepared for an attack.’

c. *Dann sei sie ins Koma gefallen.*
   ‘Then she fell into a coma.’

d. *Das hat natürlich wiederum Auswirkungen auf das Diesseits.*
   ‘Of course, this has in turn effects on the mortal world.’

The literature suggests that dative is associated with literal usage of prepositions, whereas accusative correlates with nonliteral or metaphorical usage (Baten 2009; De Knop 2008; Rys, Willems, and De Cuypere 2014). In particular, as part of multiword units such as *auf jeden Fall* ‘in any case’, *warten auf* ‘wait for’, and *vor allem* ‘especially’ prepositions are semantically empty and not used literally. Therefore, the collocational strength of preposition and lexical head (e.g., *auf* and *warten*) and of preposition and lexical complement (e.g., *auf* and *Fall*) was computed. As the measure of collocational strength, cue validity was used. Cue validity is widely used in psychological and psycholinguistic research on language learning and processing (Bates and MacWhinney 1989; MacWhinney 2012) and here refers to the information value of the lexical head or complement as cue to the preposition. More predictable prepositions tend to be semantically empty. For example, *warten* strongly predicts *auf* because they are often used together and thus become associated in memory (chunking). The component parts of chunks are mentally backgrounded and instead the chunk is stored and used en bloc. Here, the preposition *auf* lost its literal (local, temporal) meaning and is used as part of the multiword unit *warten auf* which does not profile any specific local or temporal relationship.

Last, research indicates that in addition to varying collocational strength and correlated meaning effects, dative and accusative are tied to specific lexical items and strings (Baten 2008; De Knop 2008; Willems, De Cuypere, and Rys 2018; Wilmots and Moonen 1997). For example, *Angst vor* ‘fear of’ is only used with dative. In general, usage-based research draws attention to item-specific linguistic knowledge (Diessel 2016; Stefanowitsch and Gries 2003). Therefore, effects of specific prepositions and lexical items in their context were investigated to assess their individual preference for dative or accusative.

**Statistical modeling.** For statistical analysis, a multivariate binomial logistic regression was used. This type of statistical procedure models the relationship between a dependent variable (here, case) and multiple explanatory variables (here, the many parameters of the context of use) by estimating the influence of each explanatory variable on the dependent variable. Roughly speaking, the model attempts to predict the outcome (dative or accusative) from the different explanatory variables and adjusts its estimations of their influence until the
actual outcome is best approximated. Multivariate regression is able to assess the import of multiple variables jointly and to compute effect direction and size for each variable across individual contexts. Conventional regression analysis deals with the effects of categorical and continuous variables only. To account for the effects of individual prepositions, an additional component for item-based effects was included in the model (for details on this type of mixed-effects regression, see Johnson 2008: 216–258). For model evaluation, I followed the procedures described by Levshina (2015: 253–276). For the detailed analysis of the import of individual prepositions, lexical heads, and complements, collostructional analysis was used. Collostructional analysis estimates the association strength of specific lexical items with certain constructions (and the other way around), by comparing observed and expected co-occurrence frequencies in contingency tables (Gries and Stefanowitsch 2004; Stefanowitsch and Gries 2003). Significant differences between observed and expected frequencies indicate that construction and item occur together more often than expected by chance. That suggests that they for one reason or another attract each other. In addition, all variables, including item-specific ones, were described one at a time based on contingency tables. The statistical analysis was carried out in R (R Core Team 2020). Mixed effects models were fitted with the lme4 package (Bates et al. 2015).

3.2 Results

3.2.1 Individual prepositions and verbs attract different cases

Of the 9,704 sentences in the sample, 372 (3.83%) were excluded from the analysis because of parser errors or because they represented marginal and infrequent contexts. Because of this and 685 duplicated sentences that were kept in the sample, the frequency distribution of the prepositions in the final sample was as in Table 1.

Concerning case, dative was much more frequent than accusative (76.61% vs. 23.39%) but there was considerable item-specific variation, as seen in Figure 1. The cases were not equally distributed across all prepositions. Instead, accusative was mostly used with only two prepositions, *auf* and *über*. With the other prepositions, accusative was only marginal (*an, hinter, in, unter, zwischen*) or almost nonexistent (*neben, vor*). Collostructional analysis confirmed that *auf* and *über* occurred with accusative more often than expected by chance, while all other prepositions were preferentially used with dative. The results are summarized in Table 2. The $p$-value indicates the statistical significance of each preposition-case combination and is commonly logged for more intuitive interpretation. – log 10($p$)
Table 1: Distribution of prepositions in the sample.

|       | an  | auf | hinter | in  | neben | über  | unter | vor  | zwischen |
|-------|-----|-----|--------|-----|-------|-------|-------|------|----------|
| n     | 1186| 1083| 970    | 1396| 966   | 956   | 931   | 975  | 869      |
| p     | 12.71| 11.61| 10.39  | 14.96| 10.35 | 10.24 | 9.98  | 10.45| 9.31     |

Note n = number, p = proportion in %

Figure 1: Distribution of prepositions across accusative and dative.

Table 2: Results of collostructional analysis of case and individual prepositions.

| Preposition | Preferred case | – log 10(p) | ΔP  |
|-------------|----------------|-------------|-----|
| über        | Accusative     | Inf         | 0.76|
| auf         | Accusative     | 139.14      | 0.37|
| an          | Dative         | 15.13       | –0.10|
| in          | Dative         | 17.64       | –0.10|
| unter       | Dative         | 18.47       | –0.12|
| zwischen    | Dative         | 37.57       | –0.18|
| hinter      | Dative         | 41.93       | –0.18|
| vor         | Dative         | 71.76       | –0.22|
| neben       | Dative         | 72.69       | –0.22|

Values higher or equal to 1.3 indicate statistical significance. In addition ΔP values were computed for each preposition. Higher and lower ΔP values indicate stronger connections of prepositions to accusative and dative, respectively.

Following this line of investigation, the association of accusative and dative with specific lexical heads and complements of the prepositions was analyzed. Collostructional analyses indicated that, as expected, accusative and dative were used with particular lexical items more often than chance would predict. The twenty items with the highest significance values are tabulated in Tables 3 and 4.
Table 3: Results of collostructional analysis of case and lexical heads.

| Item       | – log 10(p) | ΔP | Item       | – log 10(p) | ΔP |
|------------|-------------|----|------------|-------------|----|
| verfügen   | 34.73       | 0.68 | stehen     | 68.57       | −0.25 |
| freuen     | 23.26       | 0.72 | liegen     | 34.90       | −0.23 |
| gehen      | 18.88       | 0.40 | befinden   | 14.35       | −0.23 |
| informieren| 18.33       | 0.62 | stecken    | 11.27       | −0.23 |
| stellen    | 14.31       | 0.54 | leiden     | 11.18       | −0.24 |
| setzen     | 13.78       | 0.53 | bleiben    | 10.59       | −0.24 |
| verzichten | 12.66       | 0.72 | finden     | 10.30       | −0.21 |
| legen      | 11.68       | 0.52 | sein       | 10.13       | −0.11 |
| fallen     | 11.17       | 0.40 | sitzen     | 9.65        | −0.24 |
| kommen     | 10.99       | 0.28 | warnen     | 9.30        | −0.24 |
| denken     | 8.99        | 0.71 | werden     | 9.05        | −0.12 |
| weiterleiten| 8.21       | 0.77 | beginnen   | 7.67        | −0.24 |
| schauen    | 7.17        | 0.70 | haben      | 5.77        | −0.16 |
| bringen    | 7.02        | 0.48 | sterben    | 4.48        | −0.21 |
| ziehen     | 6.98        | 0.64 | verbergen  | 4.29        | −0.23 |
| erinnern   | 6.89        | 0.60 | hängen     | 4.06        | −0.23 |
| hoffen     | 6.86        | 0.57 | verstecken | 4.06        | −0.23 |
| reagieren  | 6.57        | 0.69 | Angst      | 3.83        | −0.23 |
| erfolgen   | 6.48        | 0.30 | verschwinden| 3.48        | −0.23 |
| Überblick  | 6.32        | 0.77 | Unterschied| 3.25        | −0.23 |

Considering the items occurring as heads of the preposition (Table 3), dative apparently attracted many verbs which in one way or another describe static situations, such as posture verbs like stehen ‘stand’, liegen ‘lie’, and sitzen ‘sit’, stative verbs such as befinden ‘be located’, leiden ‘suffer’, bleiben ‘stay’, and haben ‘have’, and verbs that are used to describe static scenes, for example, stecken ‘stick’, verbergen ‘conceal’, verstecken ‘hide’, and hängen ‘hang.’ Moreover, there were parts of multiword units with fixed prepositions and cases, e.g., warnen vor ‘warn against’ and Angst vor ‘fear of.’ In contrast, accusative occurred with verbs profiling movement through space, for instance, gehen ‘walk’, stellen ‘put’, setzen ‘sit down’, legen ‘lie down’, fallen ‘fall’, kommen ‘come’, bringen ‘bring’, and ziehen ‘pull.’ In addition, there were many components of multiword units, in particular, prepositional verbs which require specific prepositions and accusative, for example, verfügen über ‘have available’, freuen über ‘be happy about’, freuen auf ‘look forward to’, informieren über ‘inform about’, verzichten auf ‘relinquish’, and hoffen auf ‘hope for.’
As for the items occurring as complements of the preposition (Table 4), dative was strongly associated with time nouns which refer to the day of the week (e.g., *am Montag* ‘on Monday’) or the month (e.g., *im Oktober* ‘in October’). Many of the remaining items were parts of multiword units with no case variation, for example, *vor allem* ‘especially’, *unter anderem* ‘among other things’, *in der Regel* ‘normally’, *hinter Gittern* ‘behind bars’, and *unterm (unter dem) Strich* ‘on balance.’ By comparison, the items that occurred with accusative were more diverse. There was no salient pattern, except the lack of time nouns and some components of fixed multiword units with idiomatic meanings such as *hinter die Kulissen* ‘behind the scenes’, *unter die Räder* (literal translation *under the wheels* ‘to go to the dogs’), *unter die Haut* ‘under the skin’, and *hinters Licht führen* (literal translation *to lead behind the light* ‘to lead down the garden path’). Some of the entries seem to be artifacts of the corpus, for instance, *Zähler* ‘counts’ and *Punkt* ‘point’, which mostly came from business sections of newspapers talking about the stock market (e.g., *Im Dax-Gefolge stieg der MDax um 1,0 Prozent auf 8226 Zähler* ‘Following the DAX the MDAX increased by 1,0 percent to 8226 counts’, *Der Dax rückte um 0,2% auf*
The DAX increased by 0.2% to 5490 points). Apparently, then, both accusative and dative were strongly associated with specific lexical items in the context of the two-way prepositions.

### 3.2.2 Little influence of other contextual factors

Next, consider the interaction of case with the POS of the lexical head and lexical complement, the syntactic role of the prepositional phrase, and the contraction of the preposition with the following article, summarized in Tables 5 to 8.

**Table 5: Distribution of case across different POS of lexical heads.**

|       | Noun | Verb | Sum  |
|-------|------|------|------|
| Accusative | 291  | 1892 | 2183 |
| Dative   | 969  | 6180 | 7149 |
| Sum      | 1260 | 8072 | 9332 |

First, the POS of the lexical heads of the preposition. The lexical heads were either verbs (such as *verstecken* in example (11-a)) or nouns (for example, *Herr* in (11-b)). As seen in Table 5, verbal heads were much more common than nominal heads in the sample. Differences between expected and observed frequencies indicate that accusative was used more often than chance would predict with nominal heads (11-b). In contrast, dative was more frequent than expected with verbal heads (11-a). In spite of that, a chi-squared test indicated that the observed distribution was not significantly different from the expected one, and Cramer’s V indicated small effect size magnitude suggesting that the variable had little influence on the distribution of case, $X^2(1) = 0.05, p \geq .05, V = 0$.

(11) a. *Ein besonders findiger Zombie versteckt sich hinter einem*,
    *particularly clever zombie hides behind an*-
    *REFL behind an-DAT*  *Gegenstand*.
    ‘A particularly clever zombie hides behind an object.’

b. *Herr über das Geld bleibt allerdings der Westen*.
   *Lord over the money remains however the West*.
   ‘Lord over the money remains, however, the West.’
Similarly, case was apparently influenced by the POS of the lexical complement of the preposition. In the sample the prepositions were used with either nouns (for instance, Tür in (12-a)) or pronouns (such as ihm in (12-b)). As seen in Table 6, noun complements were much more frequent than pronoun complements. Dative was more frequent than accusative with both POS categories but occurred more often than expected with pronoun complements (12-b), whereas accusative was unexpectedly frequent with noun complements (12-a). While the difference was significant in a chi-squared test, the effect size was again negligible, $X^2(1) = 64.43$, $p \leq .001$, $V = 0.08$.

(12)  

a. *Das Erntedankfest steht vor der Tür.*  
the thanksgiving stands before the-DAT door  
‘Thanksgiving is just around the corner.’  

b. *Zwischen ihm liegt ein Asteroidengürtel.*  
between him-DAT lies an asteroid belt  
‘Between him lies an asteroid belt.’

Next, the syntactic role of the prepositional phrase was analyzed. As illustrated in example (13), the prepositional phrases were either adjuncts (13-a) or prepositional objects (13-b). Table 7 indicates that prepositional adjuncts were more frequent than prepositional objects. With respect to case, accusative occurred more often than expected with objects (13-b), whereas dative was attracted to adjuncts (13-a). A chi-squared test indicated statistical significance but the effect size was small, $X^2(1) = 238.4$, $p \leq .001$, $V = 0.16$.

(13)  

a. *Er streckt sich in der Sonne.*  
he stretches REFt in the-DAT sun  
‘He relaxes lying in the sun.’  

b. *Sie stürzte und geriet unter das Fahrzeug.*  
she fell and got under the-ACC vehicle  
‘She fell and got under the vehicle.’
Table 7: Distribution of case across syntactic roles of the prepositional phrase.

|        | Object | Adjunct | Sum  |
|--------|--------|---------|------|
| Accusative | 677    | 1506    | 2183 |
| Dative  | 1145   | 6004    | 7149 |
| Sum     | 1822   | 7510    | 9332 |

Table 8: Distribution of case across the different forms of the preposition.

|        | Stand-alone | Contracted | Sum  |
|--------|-------------|------------|------|
| Accusative | 2109        | 74         | 2183 |
| Dative  | 5859        | 1290       | 7149 |
| Sum     | 7968        | 1364       | 9332 |

The syntactic role was linked to the POS of the lexical head such that nominal heads always occurred with prepositional adjuncts but never with prepositional objects. In other words, the automatic parser classified all prepositional phrases with nominal heads as adjuncts. This is not surprising. Objects are by definition part of verb frames and structurally dependent on verbs, whereas adjuncts occur with both verbal and nominal heads. With nominal heads they are also called attributes or modifiers of their head.\(^3\) This kind of “correlation” is problematic when fitting multivariate regression models to the data and will concern us again below.

Fourth, consider the variable contraction. Table 8 summarizes the distribution of case across stand-alone prepositions (e.g., *auf die* in (14-a)) and prepositions which were contracted with the following article (*im* in (14-b)). As is evident, stand-alone usage was much more frequent than contracted usage, which might in part be due to the written-language source of the sample. Moreover, recall that the focus was on whether or not the preposition was contracted with the following article (which is supposed to attract dative). Therefore, prepositions with no articles following were classified as stand-alone, too (for example, *hinter* in (14-c)). Comparison of observed to expected frequencies indicates that accusative oc-

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\(^3\) One might object that at least in some contexts prepositional modifiers are better analyzed as objects. For example, in the sentence *Auch gebe es noch keine Hinweise auf ein Massaker* ‘Moreover there was no evidence for a massacre yet’ the prepositional phrase *auf ein Massaker* ‘for a massacre’ refers to the proposition which is arguably core part of the meaning frame evoked by the nominal head *Hinweise* ‘evidence’ and should therefore probably be classified as complement to the head. In many contexts the relationship is more ambiguous and would involve more subjective judgement. Therefore the current study relied on the decisions of the parser only.
Table 9: Distribution of case across contexts with and without particle verbs.

| Case          | No part. | Part. | Sum  |
|---------------|----------|-------|------|
| Accusative    | 2061     | 122   | 2183 |
| Dative        | 6773     | 376   | 7149 |
| **Sum**       | **8834** | **498** | **9332** |

*Note* Part. = Particle verb.

Table 10: Distribution of case across contexts with and without past participles.

| Case          | No p. p. | P. p. | Sum  |
|---------------|----------|-------|------|
| Accusative    | 1686     | 497   | 2183 |
| Dative        | 5453     | 1696  | 7149 |
| **Sum**       | **7139** | **2193** | **9332** |

*Note* P. p. = Past participle.

curred more often than expected with stand-alone forms (14-a), whereas dative was attracted to contracted forms (14-b). Like above, the difference was significant but the effect size was not large, $X^2(1) = 286.61, p \leq .001, V = 0.18$.

(14)  

a. *Der Nikolaus macht sich auf die Reise.*  
The Santa Claus makes REFLEXIVE the-ACC journey  
‘Santa Clause take to the road.’

b. *Ein Mann geht im Wald spazieren.*  
a man walks in-the-DAT wood stroll  
‘A man takes a stroll in the woods.’

c. *Kozlowski sitzt derzeit hinter Gittern.*  
Kozlowski sits currently behind bars-DAT  
‘Kozlowski is currently imprisoned.’

Next, consider form and transitivity of the verb of the sentence. Tables 9 to 11 summarize the results for the interactions of case with the presence or absence of particle verbs, of past participle verbs, and the transitivity of the verb.

As seen in Table 9, sentences with particle verbs (15-a) were the exception rather than the rule in the sample. Even though particle verbs are highly productive and frequent in German, this was expected, as only particle verbs with particles that are form-identical to two-way prepositions were included in the category and as the other category contains all non-particle verbs, for example, simplex verbs (15-b), composite verbs, and derivational verbs with particles or prefixes of different forms. Regarding case, dative was more frequent than expected in con-
texts without particle verb (15-b). In contrast, accusative occurred more often than expected in the context of particle verbs (15-a). The distribution was not significant and the effect size was vanishingly small, $X^2(1) = 0.3, p \geq .05, V = 0.01$.

(15) a. *Diese Harmonie übertrug sich auch aufs Publikum.*
   'This harmony spread to the audience.'

   b. *Der Vater litt sehr unter diesem Verlust.*
   'The father suffered very much from this loss.'

Moreover, concerning the inflectional form of the verbs, as is evident from Table 10, past participles (16-b) were rather rare compared to other verb forms (16-a). Again, this is due to different ranges of the categories. Dative occurred more often than expected with past participles (16-b), whereas other verb forms were used with accusative more often than expected (16-a). The difference was not significant and the effect size was negligible, $X^2(1) = 0.8, p \geq .05, V = 0.01$.

(16) a. *Mit einer Lupe kam ich hinter das Geheimnis.*
   'Using a magnifier I discovered the secret.'

   b. *Die Literatur wird in der Vorlesung bekanntgegeben.*
   'The literature will be announced in the lecture.'

Concerning the transitivity of the sentence verb, the results in Table 11 indicate that by far most verbs were intransitive, that is, the sentences contained only subject and prepositional adjunct or object but no other objects (17-a). More complex transitive sentences, which contained one object in addition to subject and prepositional phrase, were less frequent (17-b). Even more complex ditransitive sentences with two objects (e.g., *Der Fahrer hielt mir eine Eisenstange unter die Nase* 'The driver held an iron bar under my nose') and most simple sentences with only verb and prepositional phrase (e.g., *Auf diese Propagandisten sei gepfiffen* 'Let’s forget about those propagandists') occurred only rarely and had therefore been excluded from the analysis. Dative was favored in intransitive sentences (17-a), whereas accusative occurred more often than expected in transitive sentences (17-b). While the difference was statistically significant, the effect size was negligible, $X^2(1) = 5.8, p \leq .05, V = 0.03$.

(17) a. *Hinter allen Dingen droht der Abgrund.*
   'Behind all things, there is a threatening abyss.'
Revisiting German two-way prepositions

Table 11: Distribution of case across transitive and intransitive sentences.

|               | Intr.  | Tr.   | Sum   |
|---------------|--------|-------|-------|
| Accusative    | 1591   | 592   | 2183  |
| Dative        | 5395   | 1754  | 7149  |
| Sum           | 6986   | 2346  | 9332  |

*Note* Intr. = Intransitive, Tr. = Transitive.

Figure 2: Case in relation to the location of the preposition within the sentence.

b. *Was sagen Vierzehnjährige über die Demokratie?*  
   'What say 14-year-olds about the democracy?'

Next, the location of the preposition within the sentence was targeted. Figure 2 depicts the interaction of case and the location of the prepositions in the form of boxplots. The location value expresses the linear distance of the preposition to the center of the sentence. Zero represents the center of the sentence, negative values indicate locations left of the center closer to the beginning of the sentence, and positive values locations right to the center in the direction of the end of the
Table 12: Collocational strength of preposition and its lexical head.

| Head      | Preposition | Validity |
|-----------|-------------|----------|
| warnen    | vor         | 0.063    |
| verfügen  | über        | 0.058    |
| leiden    | unter       | 0.034    |
| informieren | über      | 0.016    |
| Angst     | vor         | 0.013    |
| steigen   | auf         | 0.012    |
| stecken   | hinter      | 0.011    |
| sterben   | an          | 0.011    |
| erinnern  | an          | 0.010    |
| freuen    | über        | 0.010    |

sentence. The left box indicates that half of the prepositions with accusative were located in a relatively narrow range around the centers of their sentences. The remaining prepositions (vertical lines and dots) occupied more distant locations both left and right of the centers. The horizontal black line represents the median at 0.2. By comparison, the box on the right suggests that half of the prepositional phrases with dative were spread more widely across the sentences and more often occurred to the left of the center of their sentences, with a median of −0.2. Simply put, prepositional phrases close to the center of the sentence were commonly used with accusative; in contrast, phrases to the left of the center frequently occurred with dative. However, both dative and accusative occurred at all locations in the sentence. The difference between the means was significant, although the effect size was small, \( t(4, 533.4) = 22.79, p \leq .001, d = 0.49 \).

To assess the influence of the meaning of the preposition on the assigned case, differences in the collocational strength of preposition and lexical head and complement were analyzed. As measure of collocational strength, the information value of the lexical head or complement as cue to the preposition (cue validity) was used. The more predictable from context the preposition is, the more its literal meaning is normally lost and the preposition is used with nonliteral meaning. For example, the most strongly collocated head-preposition and preposition-complement lemma pairs are listed in Tables 12 and 13, along with their cue validity. Higher values indicate stronger association of preposition and head or complement, lower values weaker association. As expected, none of the prepositions in the head-preposition examples profiles local or temporal relationships (with the single exception of Die Feuerwehrleute stiegen auf das Dach der Schule ‘The firefighters climbed onto the roof of the school’). Rather, they are part of multiword units whose meaning does not primarily derive from their lexical components.
In these contexts, the prepositions are used nonliterally to profile schematic relationships. In contrast, the list of strongly collocated preposition-complement pairs contains only four idiomatic multiword units where prepositions are used nonliterarily (*hinter (die/den) Kulissen* ‘behind the scenes’, *vor allem* ‘especially’, *unter Druck* ‘under pressure’, and *unter anderem* ‘among other things’). In the remaining pairs (*an* followed by weekdays, as in *am Montag* ‘on Monday’), the preposition profiles temporal relationships, even though the strings are obviously idiomatic.

The literature suggests that nonliteral usage is associated with accusative. The distribution of collocational strength across case is depicted in Figures 3 and 4. The cue validity values were logarithmized. As is evident, there was not much difference between accusative and dative, indicating that case was used independently of the collocational strength between preposition and head and between preposition and complement, respectively. The slightly higher cue validity for preposition-complement pairs with dative might have been due to frequent *an*-weekday pairs which are strongly associated and require dative (e.g., *Das Oktoberfest geht am Montag zu Ende* ‘The Oktoberfest closes on Monday’). The mean differences between accusative and dative were significant according to t-tests but the effect size magnitudes were (close to) negligible, \( t(2, 913.07) = 5.25, p \leq .001, d = 0.15 \) for heads and \( t(5, 241.71) = -11.67, p \leq .001, d = -0.24 \) for complements.

### 3.2.3 Regression analysis confirms item-specific effects

So far the different influencing factors have been analyzed separately. To assess their effects jointly, they were included in a binomial regression model with case
Figure 3: Case in relation to the collocational strength of preposition and its lexical head.

Figure 4: Case in relation to the collocational strength of preposition and its lexical complement.
Table 14: Results of logistic regression analysis predicting dative case.

|                                | b    | SE  | z    | p    |
|--------------------------------|------|-----|------|------|
| Intercept                      | 2.15 | 0.62| 3.46 | ***  |
| Contracted (vs. stand-alone) preposition | 1.63 | 0.15| 11.11| ***  |
| Transitive (vs. intransitive) verb | -0.39| 0.08| -4.86| ***  |
| Location                       | -0.79| 0.05| -15.35| ***  |
| Past participle (vs. no past participle) | -0.53| 0.09| -5.83| ***  |
| Particle verb (vs. no particle verb) | -0.31| 0.15| -2.06| *    |
| Adjunct (vs. object)           | 1.17 | 0.08| 14.3 | ***  |
| Complement cue validity        | 0.1  | 0.01| 7.37 | ***  |
| Number of observations         | 9332 |     |      |      |
| C                              | 0.88 |     |      |      |
| Kappa                          | 8.48 |     |      |      |

Note *p ≤ .05; **p ≤ .01; ***p ≤ .001.

(accusative vs. dative) as dependent variable and the following explanatory variables: the POS of the lexical complement of the preposition (noun vs. pronoun), the contraction of the preposition with the following article (stand-alone vs. contracted), the transitivity of the sentence verb (intransitive vs. transitive) and its form (past participle vs. no past participle, particle verb vs. no particle verb), the location of the preposition within the sentence, the syntactic role of the prepositional phrase (adjunct vs. prepositional object), and the cue validity of the head and of the complement. The POS of the lexical head of the preposition was not included in the model. As pointed out above, the variable was “collinear” with the syntactic role of the prepositional phrase which poses a problem to this type of statistical analysis (e. g., Field, Miles, and Field 2012: 274–276). Since the analysis of its frequency distribution indicated no effect of the POS of the head on case, the variable was left out of the model. Moreover, to account for at least part of the detected item-specific effects, random intercepts for preposition lemmas were included in the regression. Table 14 summarizes the results of the analysis.

The results suggest significant effects of all variables except of the cue validity of the lexical head of the preposition and the POS of its complement, which contributed little to the explanatory power of the model and were therefore dropped. The leftmost column of Table 14 contains the intercept and the predictor variables or their levels, followed by the estimate of the effect (b), standard errors (SE), and z and p values which indicate the statistical significance of the estimate. Positive estimates indicate that the respective level increased the odds of dative compared to the intercept value, negative estimates those of accusative.
Larger estimates indicate larger effects. The intercept represents the variables at their reference level. For continuous variables the reference level is their lowest value. For categorical variables the reference levels are indicated in parentheses. The estimate for contracted prepositions suggests that, compared to stand-alone prepositions, contracted prepositions increased the odds of dative. The other variables are kept constant at their intercept level. In contrast, comparing intransitive to transitive verbs and with all other variables at their intercept level, the odds of dative decreased (in other words, those of accusative increased) with transitive verbs. Next, the model estimated that locations closer to the end of the sentence increased the odds of accusative. The use of past participles and of particle verbs also increased the odds of accusative. Comparing syntactic roles, the odds of dative were higher with adjuncts than with prepositional objects. Last and in line with what was found above, increasing complement cue validity increased the odds of dative.

Low standard errors, high \( z \), and low \( p \) values suggest robust estimates and statistical significance. There was no problematic level of correlation of the predictor variables and the relationship between the logit of the dependent variable and the interval predictor variables (i.e. location and complement cue validity) was linear (with slightly skewed residuals for complement cue validity). Bootstrapping the model without random effects produced low optimism values indicating low risk of overfitting.

Despite that, different measures of the explanatory power of the model suggest that the different predictor variables contributed little to the model fit. Instead, the random effects (i.e. the individual prepositions) were much more important. First, the conditional and marginal \( R^2 \) values indicate that the proportion of the total variance explained by the model was much higher with than without the random effects (0.57 vs. 0.16). Moreover, the classification accuracy (i.e. accuracy of the model’s predictions) was much higher with than without random effects (0.88 vs. 0.77). Without random effects, the model performed not much better than a naive model (0.77). This suggests that almost all of the variability in the data was captured by the preferences of individual prepositions and that the variables contributed only little to explaining case variation.

The model’s intercept adjustments for individual prepositions are depicted in Figure 5. In line with the results of the collostructional analysis above, the adjustments indicate that \( \text{über} \) and \( \text{auf} \) strongly preferred accusative, whereas \( \text{unter} \), \( \text{zwischen} \), \( \text{hinter} \), \( \text{neben} \), and \( \text{vor} \) were associated with dative. Above, \( \text{in} \) and \( \text{an} \) were weakly attracted to dative; here, the adjustments indicate weak attraction to accusative, suggesting that \( \text{in} \) and \( \text{an} \) were used indifferently.
4 Discussion

A sample of 9,332 sentences with two-way prepositions was annotated for specific lexical items and several context variables that, according to the literature, influence the case of two-way prepositions. The results indicated that accusative and dative were strongly associated with individual prepositions and co-occurring lexical items. On the one hand, accusative occurred with the prepositions über and auf and, in addition, was most common in the context of verbs profiling force-dynamic movement through space, such as gehen ‘walk’, stellen ‘put’, and ziehen ‘pull.’ Moreover, accusative was often used as part of multiword units such as prepositional verbs with fixed preposition and case, e.g., denken an ‘think of’ and freuen über ‘be happy about.’ Dative, on the other hand, was associated with the prepositions unter, zwischen, hinter, neben, and vor, and surfaced more often than expected in the context of posture verbs and verbs describing states or static scenes, such as sitzen ‘sit’, liegen ‘lie’, befinden ‘be placed’, verstecken ‘hide’, and of time nouns referring to the day of the week or the month. There were also common multiword units that force dative, e.g., vor allem ‘especially’ and unter anderem ‘among other things.’ Only the prepositions in and an had no clear preference for either accusative or dative but were associated with both to similar degrees (even though dative was much more frequent).

Concerning the context variables, the results indicated significant effects of the form of the prepositions (contracted vs. stand-alone), the transitivity of the verb (intransitive vs. transitive), the location of the two-way preposition in the sentence, the presence or absence of past participles and particle verbs in the sentence, the syntactic role of the prepositional phrase (adjunct vs. object), and
the degree of nonliteral meaning of the preposition (operationalized as contextual predictability). The odds of accusative improved in the context of stand-alone prepositions, transitive verbs, at locations further to the right in the sentence, with prepositional objects, and in the presence of past participles and particle verbs. In contrast, the odds of dative increased with contracted prepositions, intransitive verbs, at locations further to the left of the sentence, with prepositional adjuncts, and in the absence of past participles and particle verbs. Moreover, the odds of dative increased with the nonliteral use of prepositions. Importantly, even though all of these effects were statistically significant, none of them was large, suggesting that they had actually little influence on case.

The results suggest that the case of two-way prepositions strongly depends on individual prepositions and other lexical items in the context, in particular, specific verbs. This is in line with several studies that give weight to the immediate lexical context of two-way prepositions. For instance, in good agreement with the current results, De Knop (2008) mentions that accusative often occurs with movement verbs, whereas dative is often used in the context of posture verbs. Similar verbs are listed in the grammar by Helbig and Buscha (2001: 359). In addition, applied research highlights the importance of multiword units (Baten 2009; Wilmots and Moonen 1997) which are also prominent in the current results.

In contrast, the results do not reflect the more general classes of verbs and nouns proposed in the literature. Many studies pay much attention to particle verbs (e.g., Smith 1995; Rehbein and van Genabith 2006) which might be important for theoretical reasons but have little influence on case in actual language use. Moreover, the relevance of word classes that derive from image schemas is not supported by the results. For instance, Serra-Borneto (1997) suggests that dative preferentially occurs with container nouns and compatible verbs, whereas accusative requires more force-dynamic verbs. The typical accusative and dative verbs at least do not contradict the proposed images. As for the nouns, however, the results indicate that dative is associated not with container but with time nouns. Proponents of this approach might object that units of time are metaphorically conceptualized as containers. This objection misses the point that case apparently depends not so much on highly general meaning representations as on sharply contoured groups of semantically similar specific lexical items.

Even though these studies emphasize the importance of individual lexical items for case, they fall back on more general heuristics in contexts where individual words do not seem to be reliable predictors of case. In this way, their initial insight that case is associated with specific lexical items is lost. For instance, to explain case in contexts of partial and figurative motion, illustrated in (18-a) and (18-b), respectively, De Knop (2008) proposes to conceive of Tafel as surface (or container) towards which the trajector (here, the writing hand) moves and to
interpret abstract activities like übersetzen metaphorically as motion. This way of post-hoc explanation might be attractive to descriptive linguists but is of little use to anyone trying to predict case, for example, (foreign) language users. For instance, the use of dative in (19) sounds perfectly normal despite movement towards (or rather, along) a surface and abstract activity.

(18) a. etwas an die Tafel schreiben
    something at the-ACC board write
    ‘write something on the board’
b. in eine andere Sprache übersetzen
    in a-ACC other-ACC language translate
    ‘translate into a different language’

(19) a. etwas an der Tafel schreiben
    something at the-DAT board write
    ‘to write something on the board’
b. in einer anderen Sprache sprechen
    in a-DAT other-DAT language speak
    ‘to speak in a different language’

Instead, following research in usage-based construction grammar, the characteristic lexical contexts of accusative and dative are best understood and described as case-marked constructions at different levels of schematicity. Construction grammarians (Hoffmann and Trousdale 2013) describe linguistic knowledge not as words and rules (that is, as mental lexicon and grammar) but as a single repertoire which in principle contains both lexical and grammatical units. Both lexical and grammatical units are described as two-sided constructions of form and meaning. The general rationale of this approach is best understood with idiomatic multiword expressions such as ins Gras beißen (literal translation in-the gras bite, a vulgar expression for to die, equivalent to English to kick the bucket). Even though the expression is grammatical and in structure identical to, say, ins Brot beißen (literal translation in-the bread bite ‘to bite into the bread’), its meaning is entirely different and does not derive from its parts in any regular way. Instead, ins Gras beißen is acquired and used en bloc and its form as a whole is conventionally associated with a particular meaning.

Against this background, the observed item-specific effects on case are best interpreted as evidence of chunked lexical strings akin to idiomatic expressions. These results suggest that accusative and dative are often used as parts of multiword units of verbs followed by fixed prepositions and case, such as freuen über ‘be glad about’, verzichten auf ‘relinquish’, denken an ‘think of’, warnen vor ‘warn about.’ In addition, case markers occur in other lexically fixed contexts like in der
Regel ‘normally’, unter anderem ‘among other things’, and Angst vor ‘fear of.’ In a usage-based construction grammar paradigm, these units emerge from strings of lexical items that are strongly associated and invariant in language use. They are stored in memory at item-specific levels of representation and (re-)used as wholes. At this level, the preposition and case of these strings do not derive from grammatical rules and do not seem to be motivated by underlying image schemas, at least not in any straightforward and reliable way. They are little more than forms that complete routinized idiomatic patterns. In many of these units, the two-way preposition is probably not followed by a highly schematic case slot but by only semi-open slots with case-marking material, for instance, Angst vor ART-em N, where ART is open to definite and indefinite articles, as in Angst vor dem Tod ‘fear of death’ and Angst vor einem Bürgerkrieg ‘fear of civil war.’ In addition, there seem to be at least two more low-level constructions that represent the repetitive use of dative with specific time nouns, namely, am DAY ‘on DAY’ and im MONTH ‘in MONTH.’

Researchers in construction grammar propose that all linguistic structures (both lexical and grammatical) are best described as conventional pairs of form and meaning that emerge from language use (Diessel 2015). This is not to say that linguistic knowledge consists of nothing but memorized lexical strings. Instead, researchers in this field argue that more schematic constructions emerge from generalizations over the lexical strings that language users encounter in their input. The parts that are invariant across different usage events are reinforced and gradually entrenched in memory. For example, the idiom ins Gras beißen is only used in this form and each time refers to death in a disrespectful way; the idiom is used in informal situations and only among interlocutors with no close connection to the deceased. As a consequence, the expression is entrenched in memory “as is,” as invariant string of forms linked to a specific meaning (including its disrespectful connotations and usage conditions). In contrast, more variable strings allow language users to extract more schematic patterns. For example, consider the strings in das Brot beißen, in den Apfel beißen, and in die Banane beißen ‘bite into the bread /apple / banana.’ Since constructions preserve only invariant parts across usage events, the emerging representation is more schematic and consists of the invariant lexical frame around a more variable and open noun phrase slot for eatable entities, in NP beißen.

The results suggest that lexically half-open constructions emerge as language users generalize across more and more diverse input to capture more schematic similarities. Consider accusative first. The head slot generalizes mostly over verbs that designate force-dynamic events and is particularly strongly associated with telic movement verbs such as stellen ‘put’, legen ‘lay’, setzen ‘sit down’, and gehen ‘walk.’ The preposition slot is in principle open to any preposition but in particular
attracts the prepositions *auf* and *über*. The following nominal slot is more general and has only little item-specific characteristics. The slot is linked to the accusative case markers and semantically open to all words that refer to non-relational concepts, that is, to nouns and pronouns. By comparison, the head slot of the dative construction is mostly populated by posture verbs like *stehen* ‘stand’, *liegen* ‘lie’, and *sitsen* ‘sit’ and verbs with similar meanings. The preposition slot is more general than in the accusative construction and more open to different prepositions. This is followed by the slot for the noun phrase with associated dative markers. The emergence of a higher-level construction does not automatically lead to the dissolution of lower-level representations. For instance, other typical accusative verbs like *verfügen* ‘possess’, *freuen* ‘be glad’, and *informieren* ‘inform’ are not represented at this level but stored as part of multiword units tied to *über* at lower levels of representation. These and other verb-preposition strings have different meanings and are probably frequent enough in language use to make separate entries in memory.

This kind of half-open item-specific representations form the prototypes which determine linguistic decisions in novel contexts. When language users encounter novel strings, they implicitly compare them to the prototypes they have already acquired and categorize the novel strings based on their similarity to the prototypes. In other words, they recognize and process the novel string as an exemplar of an already existing category or construction (Diessel 2019: 126–130).

For example, verbs like *befinden* ‘be located’, *stecken* ‘stick’, *verbergen* ‘disguise’, and *verstecken* ‘hide’ are more similar in meaning to posture verbs than to movement verbs. Observe that similarity is a matter of degree. There is at least some semantic overlap with movement verbs but the verbs are intuitively closer to posture verbs. As a consequence, the dative prototype outcompetes the accusative prototype and dative is used, as in (20-a). Often, the overlap is larger. For example, in (20-b), the verb *treten* is semantically close to the movement verbs and, in addition, the preposition *auf* is strongly associated with accusative. That leads to accusative. Motivations may also compete with each other. In competitive contexts, similarities at lower levels normally override similarities at higher, more general levels because of their larger context-construction overlap and higher association strength. Association strength is not absolute but probabilistic and depends on co-occurrence in language use. More frequent co-occurrence patterns are stored as lower-level constructions which are deeply rooted in memory and therefore tend to override higher-level constructions. For example, in (20-c), the verb *warten* in its prototypical use evokes scenes of standstill and is thus semantically more similar to posture than to movement verbs. Accordingly, *warten* often occurs with dative but in (20-c), the prepositional verb *warten auf* ‘wait for’ is strongly asso-
ciated with accusative and thus quickly overrides the link to the dative prototype and activates accusative instead.

(20)  

a. *Mitten im Ort befindet sich ein Campingplatz.*

in the middle in-the-DAT village is located REFL a camping site

‘In the middle of the village is a camping site.’

b. *Das Unternehmen tritt auf die Kostenbremse.*

the company steps on the-ACC cost breaks

‘The company cuts down costs.’

c. *Ich wartete jetzt jeden Tag auf das Ergebnis.*

I waited now every day on the-ACC results

‘I waited for the results every day.’

Prototypes often form the basis from which or around which more schematic constructions evolve. The more schematic constructions are form-meaning extensions of their prototypical cores. As the verb clusters around accusative and dative constructions grow larger, the constructions gradually break away from individual verbs and acquire verb slots with more general meaning profiles. The resulting verb slots are not semantically empty but retain the general meaning “outline” of the lexical verb clusters from which they derived. At this level, the constructions are similar to the image-schema-based constructions proposed by cognitive linguists (Langacker 1999). The emerging higher-level constructions are productive, that is, they apply to novel verbs and lexical contexts that are not immediately compatible with their meaning profile. The novel lexical items are then coerced into an interpretation that is in accordance with the constructions (Diessel 2019: 158).

By way of illustration, consider example (1) again, repeated as (21) below.

(21)  

a. *Das Holznilpferd Susi reist in die Heimatländer der Schulkindere.*

the wodden hippo Susi travels in-the-ACC homelands of the school children

‘The wodden hippo named Susi travels into the school children’s homelands.’

b. *Das Holznilpferd Susi reist in den Heimatländern der Schulkindere.*

the wodden hippo Susi travels in-the-DAT homelands-DAT of the school children

‘The wodden hippo named Susi travels in the school children’s homelands.’
In (21-b) the verb *reisen* is not immediately compatible with the meaning profile of the dative construction. The verb invokes some kind of movement, whereas the verb slot of the dative construction derived from posture verbs such as *stellen* ‘put’, *legen* ‘lie’, and *setzen* ‘sit down’ and therefore invokes no movement but rather a static and more confined scene. Moreover the results indicated no usage preference for the preposition *in* nor strong collocational attraction of *in* to *reisen* so that there is likely no lower-level item-specific representation activated that would out-compete the higher-level construction. The dative construction therefore imposes its general meaning profile on the context and the verb is interpreted accordingly to “fit” into the constructional verb slot. This results in the intended reading of somebody moving around in a confined space.

This approach is also in principle able to account for the results of recent research. As mentioned above, both Rys, Willems, and De Cuypere (2014) and Willems, De Cuypere, and Rys (2018) find that accusative and dative are associated with different verb senses. From a usage-based perspective, this is because different verb senses exhibit different degrees of similarity with the prototypical verb clusters. For example, in the current sample, the verb *befinden* is used with two different senses, illustrated in (22): in one sense, *befinden* means ‘be located’ (22-a), whereas in another sense, *befinden* means ‘decide’ (22-b). When used in the first sense, *befinden* is similar to posture verbs and, accordingly, used with dative only. When used in the second sense, there is no obvious semantic overlap with either of the two prototypical verb classes (posture or movement verbs); instead, in (22-b), the preposition *über* motivates the use of accusative.

(22)  

a. *Über dem Westportal befindet sich ein Radfenster.*
   above the-DAT west gate is located refl a window
   ‘A window is located above the west gate.’

b. *Die Verfassungshüter hatten über die Zulässigkeit von Namensketten zu befinden.*
   the constitutional judges had above the-ACC legitimacy of double names to decide
   ‘The judges had to decide about the legitimacy of double names.’

Since constructions are gradual generalizations over lexical strings, they retain probabilistic connections to the items from which they emerged. Many grammatical constructions are associated with specific lexical items and the connections are weighted by the frequency of co-occurrence of item and construction in language use (Diessel 2016; Diessel and Hilpert 2016). Moreover, constructions are related to each other based on semantic and functional overlap. The emerging construction network is therefore shaped by language use and processing expe-
Figure 6: Network of case constructions and associated lexical items.

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From this perspective, case may be understood as a network of interlinked case-marked constructions at different levels of schematicity. Prototypes connect the constructions to specific lexical items, with the weight of the connections depending on the frequency of co-occurrence in language use. This is illustrated in Figure 6. Dashed lines indicate connections between constructions at the same level of schematicity. Solid lines represent connections of items to constructions at different levels of schematicity. The weighted connections of the constructions to specific lexical items and strings account for the context-sensitive use of case with two-way prepositions. Like in a connectionist network, activation spreads from the context to the constructions depending on overlap and association strength. Strong prototypical connections which are printed in bold occur more frequently in language use and become entrenched in memory. They outcompete weaker connections and override context-construction overlap at higher levels.

Notably, from this viewpoint, two-way prepositions are no grammatical “misfits” anymore. There is no fundamental difference between two-way prepositions on the one hand and other prepositions with only one particular case on the other hand. The difference lies in the connections of the prepositions to different case-
marked constructions. Two-way prepositions are used with both accusative and
dative and are therefore connected to different constructions, with the connection
strength depending on the frequency of co-occurrence in language use. Associative links to movement and posture verbs (and their semantic neighbors) are re-
sponsible for the difference in meaning. In contrast, prepositions such as zu ‘to’
and um ‘around’ occur with only one case and no particular class of verbs in lan-
guage use. As seen in Figure 6, they are linked to either accusative or dative but
not to any of the verb clusters and, as a consequence, bring about no comparable
meaning difference.

The outlined approach is preliminary and requires more research. The re-
sults indicate that the case of two-way prepositions depends on individual lexical items in the context and fixed multiword strings much more than previously thought. This suggests a change in perspective from constraints and factors located at higher levels of analysis (e.g., correlations of case with coarse-grained semantic two-way distinctions or structural properties of the context) to more fine-grained, lower-level investigations. The current study has primarily looked at individual lexical items and incidentally shed some light on the role of strings and multiword units. Future studies on case with two-way prepositions should therefore focus on the effect of lexical strings, experience-based anticipation of upcoming items and categories, and in general the mutual predictability of case and context.

Little attention has been paid in the discussion to the more general variables that were proposed in the literature and included in the current research design, such as the syntactic role of the prepositional phrase, the use of particle verbs and verb participles, the transitivity of the verb, and so on. The results confirm that the case of two-way prepositions is influenced by its context in multiple ways. In particular, in line with recent research (Rys, Willems, and De Cuypere 2014; Willems, De Cuypere, and Rys 2018), the results indicate associations of accusative with transitive verbs and prepositional objects and of dative with intransitive verbs and prepositional adjuncts. Several other variables from the literature were examined and the results indicate significant effects, even though not always in the expected direction. For instance, contrary to expectations, the use of particle verbs and of past participles in the context of two-way prepositions improved the odds of accusative rather than dative.

Critical evaluation of the statistical results revealed that these and other pro-
posed variables had little to no explanatory power, despite their statistical sig-
nificance. With large enough data samples, effects might cross the conventional threshold of statistical significance, even though the observed differences are in fact only minor. Different effect size and model evaluation measures indicated that the difference between the observed distribution of accusative and dative
and the distribution expected by chance was always (close to) negligible. This suggests that the explored variables are of little general importance for the case of two-way prepositions. Apparently, the effects reported in the literature only hold for the specific samples studied and probably do not generalize to other contexts.

5 Conclusion

The current study has investigated case variation in the context of so-called two-way prepositions in German. Unlike regular German prepositions with fixed case, two-way prepositions are used with accusative and dative case depending on differences in meaning and context. In particular, the results indicated that the different cases are associated with individual prepositions and specific lexical items in the context of use. Adopting usage-based construction grammar as descriptive framework, item-specific constructional prototypes have been described that account for the context sensitivity and meaning of the case of two-way prepositions.

Surprisingly, the results indicated that most of the more general variables proposed in the literature such as verb transitivity, particle verbs, past participles, and the nonliteral use of the preposition have little to no influence on the case of two-way prepositions. This suggests that the reported effects only hold in specific contexts. This is not to say that multivariate approaches to two-way prepositions are completely off the track. Future research should focus its attention on lower levels of analysis and approach two-way prepositions and case bottom up.

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