

The Dynamics of Schematization: Pathways of Constructional Change

Elena Smirnova¹, Fabian Fleissner², & Regina Ruf¹

¹University of Neuchâtel ²University of Vienna

Abstract

This paper investigates the diachronic process of schematization, understood as the generalization and abstraction of a constructional schema over clusters of specific exemplars or instantiations of existing constructions. By looking at German complex prepositions and verbonominal constructions, the study pursues two central aims. First, we will argue that schematization does not always follow a uniform trajectory. While initial clustering may occur and structural coherence may increase among individual exemplars, such processes do not necessarily lead to the emergence of a constructional schema. In some cases, clusters dissipate, leaving competing constructions, one of which eventually conventionalizes into an individual substantive construction type. Conversely, a schema may also arise without a clearly identifiable clustering stage, instead emerging from instantiations dispersed across a broad semantic space. Second, we examine the role of different facets of similarity in these processes. Semantic similarity is crucial in the initial phase of cluster formation, enabling links between individual constructions, but clusters often fail to develop if not reinforced by structural or/and syntagmatic similarity. In contrast, constructional schemas may be generalized primarily on structural grounds, with semantic commonalities playing only a minor role. As schemas evolve, structural regularities increasingly dominate, while semantic constraints tend to weaken.

1 Introduction

By looking at verbonominal constructions and complex prepositions in German, this paper discusses the diachronic process of schematization, i.e., the emergence of new constructional schemas. By a constructional schema we mean (i) a formally complex construction which (ii) generalizes over a range of different instantiations and (iii) contributes a meaning or function that is neither predictable from the sum of its component parts nor reducible to other constructions. In this sense, a constructional schema is a morphosyntactic template with open slots, paired with a relatively abstract meaning that remains constant across all instantiations of the schema.

Constructional schemas are commonly thought to be productive (Barðdal 2008; Traugott & Trousdale 2013). “[T]he more schematic the construction, the more productive it will be” (Trousdale 2008: 170). Although there is an undeniable relation between schematicity and productivity, recent research (see esp. Perek 2016, 2018,

2020) has shown that schematicity and productivity should be seen as distinct properties of a construction.

From a diachronic perspective, schematization can be basically seen as a process leading to the formation of new constructional schemas. Most importantly, this process involves a gradual increase in schematicity. New constructional schemas are abstracted from previously existing less schematic, or more substantive, constructions, or from an array of instantiations of previously existing schematic constructions. This process is essentially accompanied by the creation and/or expansion of open slots and by the broadening of meaning. Regarding the position within a constructional network, schematization can also be characterized as the formation of a new superordinate node that subsumes either pre-existing lower-level constructions or instantiations of other, already established schematic constructions. Additionally, schematization can be conceptualized as a gradual and systematic process driven by analogical extension (cf. e.g. Croft 2001: 127f.; Bybee 2015: 172; Noël 2007; Perek 2016, 2018; Traugott & Trousdale 2013).

In this paper, we examine the process of schematization in greater detail and investigate whether observed instances of schematization follow a uniform diachronic tendency, particularly with respect to the role of analogy, cluster formation, and various types of similarity. We will argue that the development of constructional schemas constitutes a complex diachronic process that is shaped by several interacting factors. By diachronically investigating the development of German verbonominal constructions (henceforth VNC; e.g. (1) – (2)), e.g. and of German complex prepositions, (henceforth CP; e.g. (3)), we will show how different diachronic pathways towards a constructional schema correspond to distinct aspects of similarity between constructions, assuming that similarity is essential for establishing analogical relations and, ultimately, for the generalization of a schema. This study builds on previous research. We will not present new empirical data but rather focus on the theoretical implications derived from existing studies.

- (1) [NP_{Acc} *aufs Spiel setzen*] {put X at risk}
*Der folgende Text ist also nicht so gemeint, daß der Verfasser damit seine Selbstachtung **aufs Spiel setzen** möchte.* (Luhmann, 1997)
 ‘The following text is therefore not meant in such a way that the author wants to put his self-respect at risk.’
- (2) [*zur* N_{ung} *kommen*] {be X-ed}
*Das Seekriegsrecht **kommt** zwischen Kriegsführenden **zur Anwendung**.* (Aktuelles Lexikon 1974-2000)
 ‘The law of naval warfare is applied between belligerents.’
- (3) [*mit Hilfe* NP_{gen}] {with the help of X}
***Mit Hilfe** ihrer Gondeltechnik wollen die Biologen an einzelnen Blättern die Stoffwechselrate [...] mit hoher Präzision messen.* (Die Zeit, 1996)
 ‘With the help of their gondola technology, the biologists want to measure the metabolic rate of individual leaves [...] with high precision.’

German VNCs and CPs share several structural and functional characteristics. They mostly involve deverbal nouns in prepositional phrases of the form [P N_{dev}]. They exhibit apparent morphosyntactic irregularities, in that modifiers and/or determiners typically cannot intervene between the preposition and the noun N_{dev} (*mit *der/*einen Hilfe ihrer Gondeltechnik*, see, for example Stefanowitsch et al. 2020; Fleischer 1997; Pottelberge 2001; Winhart 2002; Kabatnik 2020; Harm 2021; Fleischhauer & Hartmann 2021; Fleischhauer 2022; Ruf & Smirnova 2025; Fleissner & Smirnova 2025). From a discourse-pragmatic perspective, CPs and VNCs are associated with the general function of information condensation and have been listed as examples of the

German “Nominalstil”. With respect to genre, CPs and VNCs are normally found in formal texts, especially in scientific writing (see Ruf & Smirnova 2025; Fleissner & Smirnova in press). Our previous research (see Ruf & Smirnova 2025; Fleissner & Smirnova 2025) has shown that CPs and VNCs behave similarly in that they show a considerable increase in usage frequency during the more recent stages of New High German.

Despite these commonalities, however, VNCs and CPs differ from each other with respect to the constructional schemas they instantiate. German VNCs of the general syntactic pattern [P N_{dev} V] are found across the full spectrum of schematicity, ranging from highly idiosyncratic, individual construction types, e.g. (1) and (4), via small groups of constructions sanctioned by lower-level semi-schemas, e.g. (5), to highly abstract schemas instantiating a large number of different realizations, (2) and (6).

- (4) [auf die Probe stellen] {put to the test}
*Aus einer Laune heraus beschließt der Graf, Rosinas Treue **auf die Probe zu stellen**.* (Fath, 1998)
 ‘On a whim, the count decides to put Rosina's loyalty to the test.’
- (5) [unter N stehen] {be under X}
*unter **Aufsicht/ Beobachtung/ Leitung/ Schutz/ Verdacht ... stehen***
 ‘be under supervision/ observation/ management/ protection/ suspicion ...’
- (6) [zur Nung bringen] {(bring) to X}
*Die Opposition wird alle parlamentarischen Möglichkeiten haben, ihre Auffassung **zur Darstellung und zur Geltung zu bringen**.* (Archiv der Gegenwart, 1966)
 ‘The opposition will have all parliamentary possibilities to bring its views to presentation and to effect.’

In contrast to VNCs, CPs of the general form [P₁ N_{dev} NP_{gen}/P₂] are limited to a relatively small number of highly specific individual construction types, e.g. (3) and/or (7) – (8). Crucially, these individual constructions are not sanctioned by some higher-level constructional schema(s) but exist as independent construction types at lower levels of the constructional hierarchy (Ruf & Smirnova 2025).

- (7) [mit Ausnahme NP_{Gen}] {with the exception of}
*Um zehn Uhr schlief das ganze Lager **mit Ausnahme** der beiden, die die Wache hatten...* (Schreiner, 1898)
 ‘At ten o'clock the whole camp was asleep with the exception of the two who were on watch...’
- (8) [in Bezug auf] {in relation to}
*Die Auswahl der Weide muß **in Bezug auf** Lage, Gras und Projection sehr sorgfältig gewählt werden.* (Baumstark, 1835)
 ‘The choice of pasture must be made very carefully in relation to location, grass and projection.’

In this paper, the diachronic shifts of German VNCs and CPs will serve to discuss the role of cluster formation in schematization. We will distinguish between three types of similarity that play different roles in the processes of cluster formation and schematization: *semantic* similarity, *structural* similarity, and *syntagmatic* similarity. We will demonstrate that while semantic similarity often motivates initial grouping into loose clusters, it does not necessarily lead to further generalization and schematization. By contrast, structural and syntagmatic similarity – reflected in

shared morphological patterns and converging syntactic environments – are important preconditions for the emergence of constructional schemas.

The paper is structured as follows. Section 2 introduces the concept of similarity as a motivation for cluster formation, generalization, analogical extension, and schematization. It will zoom in on our methodological choices. In Section 3, empirical findings on German VNCs and CPs are summarized and discussed in relation to the concepts of schematization and similarity introduced in Section 2. Section 4 proposes two routes to modelling schematization, depending on the source constructions.

2 Schematization: from individual constructions via cluster formation to schema extraction

2.1 Schematization and analogical thinking

A constructional schema is essentially understood as a generalization over a range of different instantiations or constructs. From a dynamic point of view, a schema is a result of a gradual and stepwise generalization process. From a diachronic perspective, it is widely recognized that the generalization of a schema fundamentally depends on analogy (see e.g. Diessel 2019; Goldberg 2019; Bybee 2010: Ch. 4; Langacker 2014; Traugott & Trousdale 2013; De Smet 2012; De Smet & Fischer 2017; Fischer 2010). As Diessel points out, “taxonomic relations are created by abstraction, which crucially relies on the recognition of similarity” (2019:16). Additionally,

constructions are understood to be emergent clusters of lossy memory traces that are aligned within our high-(hyper!) dimensional conceptual space on the basis of shared form, function, and contextual dimensions. (Goldberg 2019: 7)

Admittedly, many aspects of analogy and its operationalization remain only partially understood. As De Smet and Fischer admit, “the elusiveness of analogy still remains” (2017: 240). Although it might still be an elusive concept, analogy is essential for the emergence of schemas, and the process of schematization crucially relies on analogization and analogical thinking as the cognitive mechanism of identifying similarities among individual exemplars. Indeed, the gradual analogical extension that leads to the emergence of a new schematic construction occurs in different domains of language change. For example, Traugott and Trousdale (2013: 150) describe the diachronic development of so-called snow-clones as “schemas that grow from relatively fixed micro-constructions that are usually formulae or clichés” (see also Hartmann & Ungerer 2024). As an instance of schematization in the domain of morphology, Traugott and Trousdale describe the development of *-dom* in English as an example of “constructionalization at the schematic level resulting from speakers generalizing over individual micro-constructions and abducting a pattern” (2013: 172). In the domain of syntactic constructions, Barðdal (2008: Ch. 3) illustrates how an increasing number of semantically similar verb types gradually become integrated into an argument structure construction in Icelandic, thereby contributing to the abstraction of a schema.

Central to this view of schematization is the notion of exemplar representations and the idea that these are often organized in clusters based on perceived similarity (see Skousen 1989; Bybee 2010: Ch. 4).

[...] the general categories and units of grammar can emerge from the experience that is recorded in memory because exemplars are categorized by similarity to one another and

because contiguous experiences – such as meaning and acoustic shape – are recorded as linked to one another. (Bybee 2013: 52)

In accordance with this view, the generalization of constructional schemas is dependent on the existence of clusters of exemplars, as schemas are basically seen as generalizations over clusters of related constructions (see e.g. Suttle & Goldberg 2011; Goldberg 2019 for the synchronic view on cluster formation, Barðdal & Gildea 2015 for the diachronic view). In other words, individual constructions are first categorized into clusters by similarity to one another. An emergent cluster can then attract further exemplars, to the extent that they are similar to those already present in the cluster. Generalizations (in the form of constructional schemas) arise from the generalization of central tendencies within the clusters.

2.2 Operationalizing Similarity

As mentioned above and widely recognized in research on language change, the key concept in relation to analogy is similarity. For example, Bybee & Eddington (2006) find semantic similarity to be a significant determinant of the acceptability of infrequent uses of Spanish Verb-Adjective copular constructions with *quedarse* and *ponerse*. They interpret this as evidence for the view that analogy is crucially motivated by similarity (see also Bybee 2010; 2013). Barðdal (2008: Ch. 4) shows how analogical extensions on the basis of semantic similarity explain the occasional occurrence of novel verbs in syntactic argument structure constructions. Croft (2001: 130) links the analogical extension of constructions to innovative uses to changes that “follow connected paths in conceptual space”.

However, not only semantic similarity plays a role in the processes driven by analogy, but also other aspects of similarity, including collocational preferences, structural properties as well as contextual factors (see De Smet 2012 for a detailed assessment). To be able to assess different similarity aspects in the corpus data, we will operationalize the concept of similarity in terms of shared formal, semantic, and syntagmatic features. Accordingly, we will distinguish between semantic similarity, structural similarity, and contextual similarity in the following.

In the present study, our focus will be on the noun slot in German VNCs [P N_{dev} V] and CPs [P N_{dev} P] introduced in Section 1 above. Schematicity of VNCs and CPs will be basically operationalized by means of the type frequency of nouns that occur in the nominal slot [N_{dev}]. This means, more specifically, that the number of distinct nouns that are attested in the noun slot of a VNC or a CP will be taken as a measure of the degree of schematicity of a construction. In other words, the more nouns are allowed in the noun slot of the construction, the more schematic the construction is considered to be.¹

Semantic similarity will be used to refer to the shared lexical semantics of the nouns that occur in the noun slot. If the nouns belong to the same semantic field and can be considered synonymous outside of the relevant VNC and CP structures as well, they

¹ An anonymous reviewer has raised the question of whether limiting the measure to type frequency is sufficient to operationalize schematicity, suggesting instead that low-frequency types and hapax legomena should also be taken into account. Given the distinction between schematicity and productivity outlined in Section 1, we maintain that low-frequency types and hapax legomena are more closely related to productivity, understood as the extensibility of a constructional schema to an increasing range of instantiations. By contrast, type frequency, as we employ it here, provides a more reliable indicator of schematicity, which refers not only to the capacity of an open slot to accommodate a certain number of types, but also to the existence of an abstract, generalized meaning associated with the constructional schema.

will be characterized as semantically similar to each other. For example, the nouns *Bezug* ‘relation’ in (8), repeated here as (9) for convenience, and *Hinsicht* ‘regard’ in (10) are semantically similar to each other, whereas *Bezug* in (9) and *Ausnahme* ‘exception’ in (11), are not.

- (9) *Die Auswahl der Weide muß **in Bezug auf** Lage, Gras und Projection sehr sorgfältig gewählt werden.* (Baumstark, 1835)
‘The choice of pasture must be made very carefully in relation to location, grass and projection.’
- (10) ***In Hinsicht** der organischen Ordnung sehen wir ein mannigfaches sich veränderndes Verhältniß der Grundkräfte von Reproduction, Irritabilität und Sensibilität.* (Kerner, 1834)
‘In relation to the organic order we see a manifold changing relationship between the basic forces of reproduction, irritability and sensibility.’
- (11) *Zur Verkohlung im Großen find, **mit Ausnahme** des Reisigs, alle Gattungen von Holz tauglich.* (Baumstark, 1835)
‘With the exception of brushwood, all types of wood are suitable for charring on a large scale.’

In this study, we will calculate and illustrate semantic similarity by employing distributional semantics as a quantitative method and using word embeddings trained with the word2vec algorithm (Mikolov et al. 2013a,b). Specifically, we use pre-trained German embeddings from the GermanWordEmbeddings repository.² For visualization, we apply t-SNE (van der Maaten & Hinton 2008) to project the high-dimensional embeddings into a two-dimensional space. It should be emphasized, however, that the pre-trained German embeddings are derived from a contemporary corpus of German Wikipedia (2015) and German news articles (2015). The visualizations of semantic similarity presented in this study are therefore intended primarily for illustrative purposes. Nevertheless, we think that the results are sufficiently clear to demonstrate relative degrees of semantic closeness between individual nouns, which in turn lends support to our more general argument. Figure 1 illustrates this method. Words that occur in similar linguistic contexts, and are therefore semantically related, tend to cluster together in the space. For example, the nouns *Bezug*, *Rücksicht*, and *Hinsicht* appear close to one another, whereas body- or mind-related nouns such as *Herz*, *Kopf*, and *Seele* form a separate cluster further away.

² <https://devmount.github.io/GermanWordEmbeddings/>, accessed 01.09.2025.

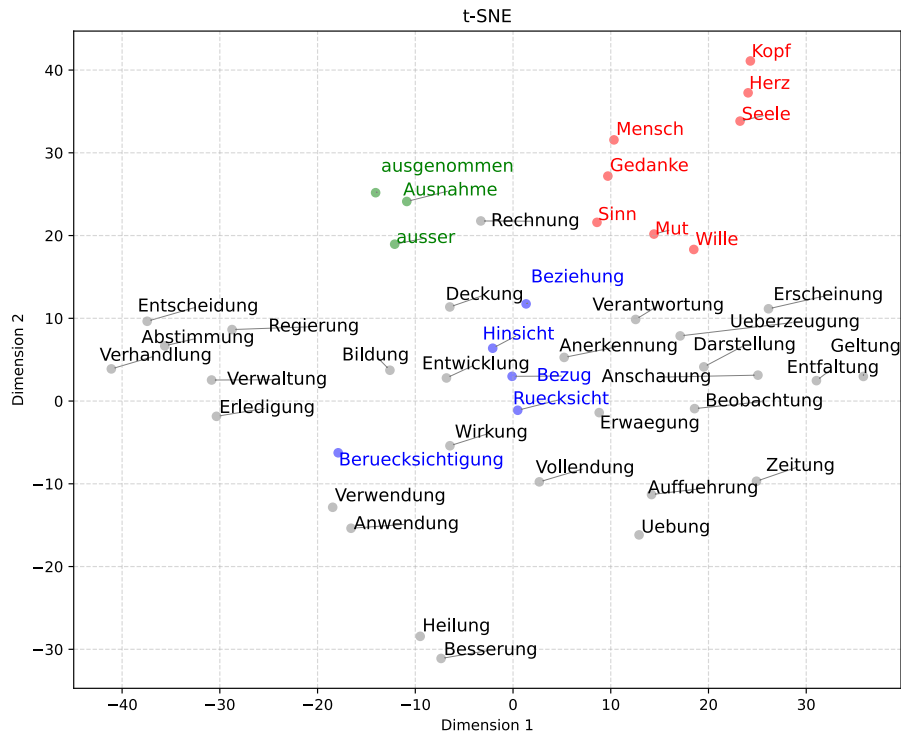


Figure 1: Semantic plot of individual nouns. The colours were added manually.

In the remainder of this paper, we will make use of selected parts of this plot to illustrate semantic similarity relevant to our analysis. We are aware of the fact that assessing semantic similarity is not a trivial task, and that different degrees of similarity may exist. However, the more important point for us is to disentangle semantic similarity from other types of similarity. In our case, we are dealing with a limited number of nouns that are attested in the relevant structures; some of them are closer to one another in terms of lexical semantics, whereas others are less similar. It is thus the relative similarity as compared to other nouns attested in the structures under investigation that is of relevance here, not some absolute similarity value between isolated lexical items.

Structural similarity is operationalized in terms of shared internal morphological structure between the nouns in the slot [N_{dev}]. For example, if the nouns are derived from their respective verbal bases through the same word formation mechanism, e.g. by using the same suffix *-ung*, cf. (12) – (13), they are considered structurally similar. Nouns originating from different word-formation processes and therefore differing in terms of their morphological structure, such as *-ung*-nominalizations in (12) – (13) versus other derivational processes in (9) – (11), are regarded as structurally dissimilar.

- (12) *Mit **Berücksichtigung** aller dieser Umstände liefert die heutige vervollkommnete Ringmaschine ca. 40 % mehr Garn...* (Samter, 1896)
 ‘With consideration of all these circumstances, today's perfected ring machine produces approx. 40% more yarn...’
- (13) *Die **ausgedehnteste Anwendung** des Begriffs von philosophischem Mythos, welchen man aber in **Beziehung** auf das alte und neue Testament besser als den dogmatischen bezeichnet...* (Strauß, 1835)
 ‘The most extensive application of the concept of philosophical myth, which in relation to the Old and New Testaments is better described as dogmatic...’

Additionally, we will use the aspect of *syntagmatic* similarity, meaning the amount of shared syntagmatic context as it applies to the linear structures under investigation. This third type of similarity is important because the diachronic process of schematization leads to the convergent fixation of a shared template with open slots, i.e. a complex structure that supports analogical extension to new fillers. For example, the CPs following the general pattern $[P_1 N_{dev} NP_{gen}/P_2]$ show different collocational profiles with respect to P_1 . Consider for instance (9), (10), and (13), where P_1 is realized as *in* ‘in’. In contrast, in (11) – (12) *mit* ‘with’ serves as P_1 . Such preferences may change over time, e.g. (14) vs. (9), where (14) represents a variant that became more frequent only recently.

- (14) *Man kann fie aber **mit Bezug auf** die verschiedene Behandlungsweise in eigentliche Obstgärten und Weingärten eintheilen.* (Baumstark, 1835)
 ‘However, one can divide them into actual orchards and vineyards with relation to the different methods of treatment.’

In this paper, we aim to develop two central ideas. First, we will show that the diachronic process of schematization does not always follow the same trajectory. In some cases, while initial clustering may occur, and there may be evidence of increasing structural coherence among exemplars within a cluster, this process does not lead to the generalization of a constructional schema. Instead, it may result in competition among individual constructions, with one ultimately prevailing. On the other hand, we will demonstrate that a schema can emerge without a clearly identifiable prior stage of cluster formation. Rather than abstracting from a semantically organized cluster of exemplars, a constructional schema may arise from instantiations that are seemingly “scattered” across a broad semantic space.

Second, we will examine how different aspects of similarity, such as semantic and structural similarity, contribute to cluster formation and to the potential generalization of a schema. We will argue that *semantic* similarity plays a dominant role in the cluster formation, facilitating connections between individual exemplars based on lexical meaning. However, a cluster may fail to expand if semantic similarity is not reinforced by *structural* and/or *syntagmatic* similarity. Conversely, schemas may also emerge primarily due to structural similarity, with semantic features playing only a minor role. In other words, as a schema develops, structural regularities take precedence in shaping the constructional schema, while semantic constraints progressively weaken.

3. German verbonominal constructions and complex prepositions

In this section, we will discuss some cases of diachronic shifts where the initial cluster formation on the basis of semantic similarity did not result in the generalization of a schema, see Section 3.1. In Section 3.2, we will turn to the case of schematization on the basis of structural similarity.

3.1 Initial cluster formation without further schematization

3.1.1 Complex prepositions

The German CP *mit_{pl} Ausnahme_N* (NP_{gen}) ‘with the exception (of)’, exemplified in (15), has been attested since the middle of the 18th century (see Ruf in prep.).

- (15) *Zur Verkohlung im Großen find, **mit Ausnahme** des Reisigs, alle Gattungen von Holz tauglich.* (Baumstark, 1835)
 ‘With the exception of brushwood, all types of wood are suitable for charring on a large scale.’

Mit Ausnahme is not the only preposition with exceptive meaning in German, and alternative expressions are *ausgenommen* ‘excluded’ (16), *außer* ‘except’ (17), and *bis auf* ‘except for, apart from’ (18).

- (16) *Er erhebt das Einkommen jeder Art selbst oder durch seine Untergebenen, **ausgenommen** das Einkommen besonderer Stiftungsfonds.* (Baumstark, 1835)
 ‘He collects income of any kind himself or through his subordinates, with the exception of the income of special endowment funds.’
- (17) *Erwähnt muss nur werden, dass **ausser** dem Fortschritt in der Stahlbereitung ganz besonders die Fortschritte in der Bearbeitung von Stahl und Eisen hervorragend in die Augen fielen.* (Beck, 1903)
 ‘It must be mentioned that except for the progress in steel production, the advances in the processing of steel and iron were particularly striking.’
- (18) ***Bis auf** Malz kommt fast Alles auf dem Seewege herein.* (von Lehnert, 1891)
 ‘Apart from malt, almost everything comes in by sea.’

These expressions are synonymous to each other, and the individual expressions *Ausnahme*, *ausser*, and *ausgenommen* are close to each other in the semantic space (see Figure 2).

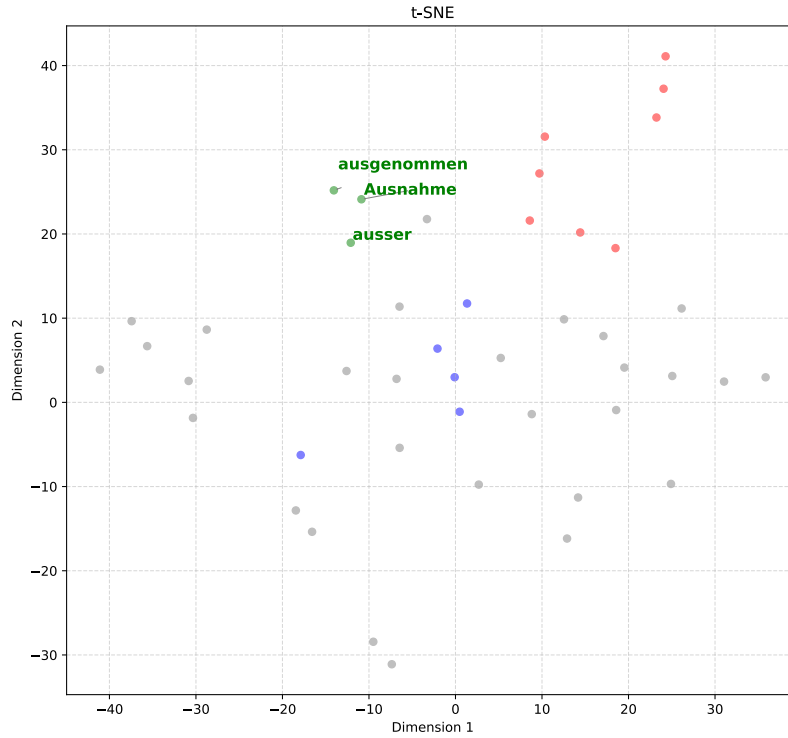


Figure 2: Semantic plot of individual nouns, cluster $\{Ausnahme, ausser, ausgenommen\}$.³

This constitutes a very clear example of expressions that exhibit semantic similarity but no structural (or syntagmatic) similarity. Although *ausgenommen* und *Ausnahme* share a verbal base *ausnehm-* ‘take out’, they result from different morphological processes: *ausgenommen* is a participial form of the verb, and *Ausnahme* is a derived noun with the suffix *-e*. *Ausnahme* combines with P1 *mit* ‘with’ to form a complex preposition. The simple preposition *außer* does not have a transparent morphological structure. *Bis auf* ‘up to’ is a so-called “compound” preposition formed by two independent prepositions *bis* ‘till’ and *auf* ‘(up)on’. Although these expressions are similar in meaning, they lack structural and syntagmatic similarity, and without such similarity, we would not expect the abstraction of a schema as a form–meaning pairing.

This is reflected in the development of their usage frequency over time, see Figure 3. As can be seen, *außer* is the most frequent preposition between 1600 and 1899, followed by the compound preposition *bis auf*. *Ausgenommen* and *mit Ausnahme* are less frequent and appear to be in competition with each other since the first appearance of *mit Ausnahme* in the middle of the 18th century. Importantly, each of the diachronic trajectories of the four prepositions in terms of frequency seems to represent changes that are rather independent from each other.

While these expressions may be seen to form a relatively loose semantic cluster, they lack structural and syntagmatic similarity. From a dynamic point of view, each of these exceptive prepositions follows its own diachronic trajectory. That is, the case of *mit Ausnahme* and its competitors serves to illustrate in a very straightforward way what we mean by the difference between the semantic, structural, and syntagmatic aspects of similarity.

³ The preposition *bis auf* is not displayed in the t-SNE plot in Figure 3. Its absence results from the fact that the expression consists of two lexical items and, consequently, no corresponding entry is available in the embedding model.

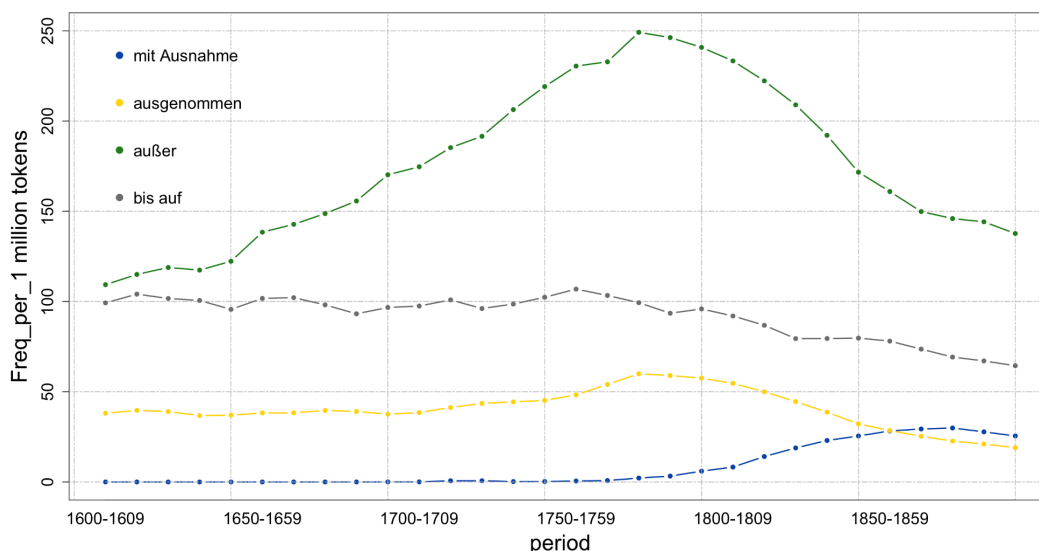


Figure 3: Changes in usage frequency of four exceptive adpositions between 1600 and 1899

The case of the CP *in Bezug auf* ‘in relation to’ and the related CPs which we turn to now is slightly more complex. It should be noted that diachronically, most recent German CPs originate in the instantiations of a very abstract schema, a regular syntactic pattern forming complex prepositional phrases $[P_1 [N NP_{\text{gen}}/P_2]_{NP}]_{PP}$. This pattern has a wide range of possible instantiations, each depending on the lexical semantics of the individual nouns, see e.g. *in den Augen meiner Freunde* ‘in the eyes of my friends’, *mit der großzügigen Unterstützung seiner Familie* ‘with the generous support of his family’, or *mit der Hoffnung auf gutes Wetter* ‘with the hope of good weather’. It is the reanalysis of this pattern towards the structure $[[P_1 N]_P NP_{\text{gen}}/P_2]_{PP}$ that marks the turning point and the emergence of a CP. As we will show below, only some of the structures discussed qualify as reanalyzed CPs, whereas others remain connected to the general syntactic pattern $[P_1 [N NP_{\text{gen}}/P_2]_{NP}]_{PP}$.

In the corpus data from 1600–1899 (see Ruf & Smirnova 2025 for details), we find several deverbal nouns with similar lexical meaning that are used in the syntagmatic pattern $P_1 N_{\text{dev}} NP_{\text{gen}}/P_2$, e.g. (19) for *in/mit_{P1} Bezug_N auf_{P2}* ‘in/ with relation to’, (20) for *mit_{P1} Berücksichtigung_N NP_{gen}* ‘with consideration of’, (21) for *in_{P1} Beziehung_N auf_{P2}* ‘in relation to’, (22) for *mit_{P1} Rücksicht_N auf_{P2}* ‘with consideration of’, and (23) for *in_{P1} Hinsicht_N auf_{P2}* ‘with regard to’. The semantic similarity between the nouns is illustrated in Figure 4.

- (19) *Aus dem ersten dieser beiden Gesichtspunkte ist es zu bewundern, und **in Bezug auf** die Größe der Revolutionen [...] von wichtiger Bedeutung.* (Blumenbach, 1799)
 ‘From the first of these two points of view it is admirable, and of great importance in relation to the magnitude of the revolutions.’
- (20) ***Mit Berücksichtigung** aller dieser Umstände liefert die heutige vervollkommnete Ringmaschine ca. 40 % mehr Garn.* (Samter, 1896)
 ‘With consideration of all these circumstances, today's perfected ring machine produces approx. 40 % more yarn.’
- (21) *Die ausgedehnteste Anwendung des Begriffs von philosophischem Mythos, welchen man aber **in Beziehung auf** das alte und neue Testament besser als den dogmatischen bezeichnet.* (Strauß, 1835)

‘The most extensive application of the concept of philosophical myth, which in relation to the Old and New Testaments is better described as dogmatic.’

- (22) *Die Vergleichung des Kraftaufwandes mit dem Effekte der Maschine lässt sich [...] **mit Rücksicht auf** die Einfalls- und Förderungshöhe auf folgende Art aufstellen.* (von Gerstner, 1834)

‘The comparison of the force required with the effect of the machine can be made, with consideration of the height of incidence and delivery, in the following way.’

- (23) *In **Hinsicht** der organischen Ordnung sehen wir ein mannigfaches sich veränderndes Verhältniß der Grundkräfte von Reproduction, Irritabilität und Sensibilität.* (Kerner, 1834)

‘With regard to the organic order we see a manifold changing relationship between the basic forces of reproduction, irritability and sensibility.’

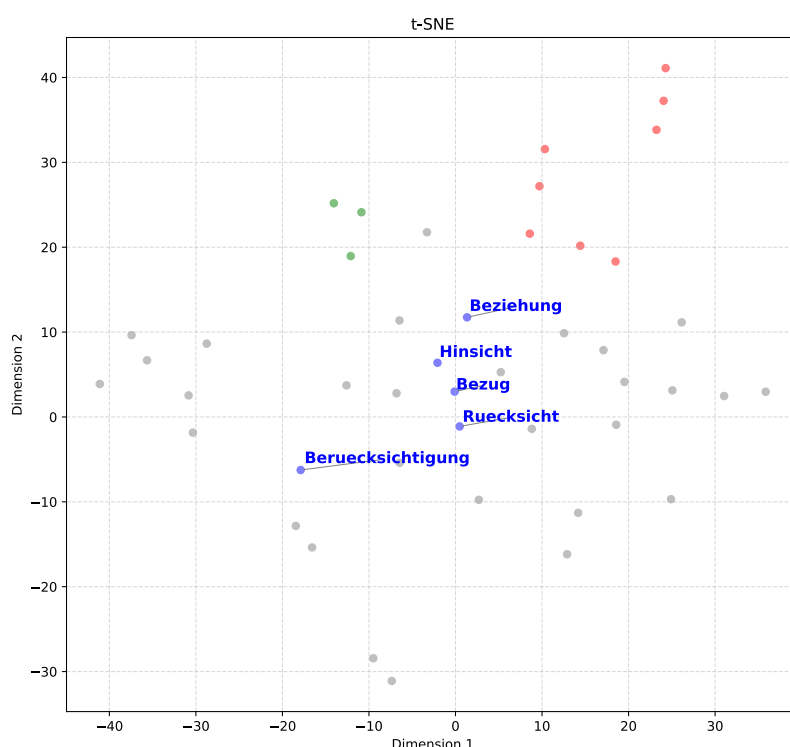


Figure 4: Semantic plot of individual nouns, cluster {*Beziehung*, *Hinsicht*, *Bezug*, *Rücksicht*, *Berücksichtigung*}.

From a structural perspective, some of the nouns are more similar than others. For instance, *Bezug* and *Beziehung* are derived from the same verb stem *bezieh-* ‘relate’. *Hinsicht* and *Rücksicht* can be traced back to the same verb stem *sicht-* ‘sight’, and they are both derivations with the suffix *-t*. *Beziehung* and *Berücksichtigung* are both *-ung*-nominalizations. This makes these nouns at least partially structurally similar. In Ruf & Smirnova (2025), we argue for the existence of a strong cluster for these five structures in the first half of the 19th century. Over time, each of them develops its own syntagmatic preferences. As can be seen in Figure 5,⁴ *Bezug* and *Beziehung* shift to more variability and appear in two syntagmatic variants at the end of the 19th century: *Bezug* is combined with the two P_1 , *in* ‘in’ and *mit* ‘with’; *Beziehung* shifts

⁴ *Berücksichtigung* ‘consideration’ is not displayed here due to its very homogeneous behaviour over the time span between 1800 and 1899: it always occurs in the structure [*mit* N_{dev} NP_{gen}].

towards more variability in the postnominal slot. *Hinsicht* and *Rücksicht*, on the other hand, develop in the opposite direction of reduced variability: *Hinsicht* gets fixed to [*in* N NP_{gen}], and the dominant structure for *Rücksicht* is [*mit* N *auf*]. That is, with respect to syntagmatic similarity, we observe a rather divergent behavior among the nouns.

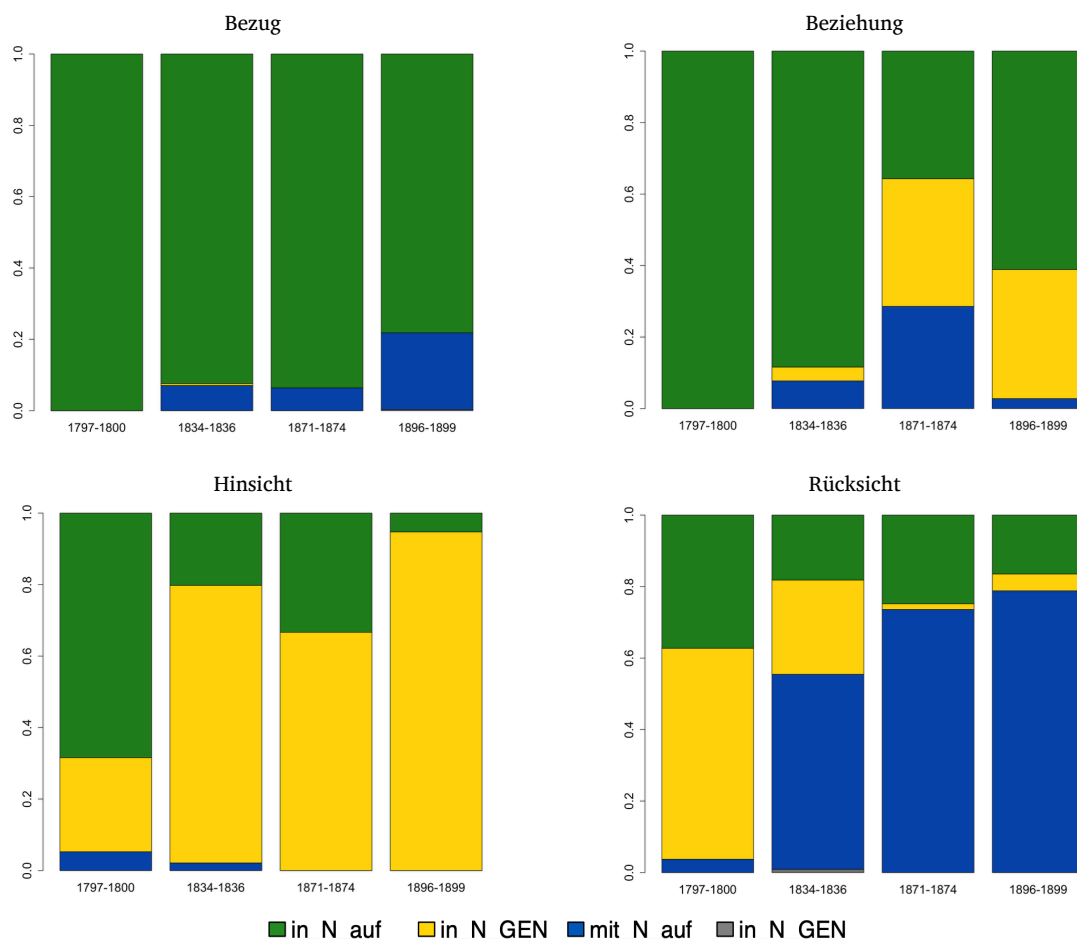


Figure 5: *Bezug*, *Beziehung*, *Hinsicht*, and *Rücksicht* and their relevant syntagmatic structures

Furthermore, as shown in Figure 6, not all syntagmatic patterns represented in Figure 5 establish themselves in the long term. In fact, only *in*_{P1} *Bezug auf*_{P2} (yellow line) shows an increase in token frequency over time.

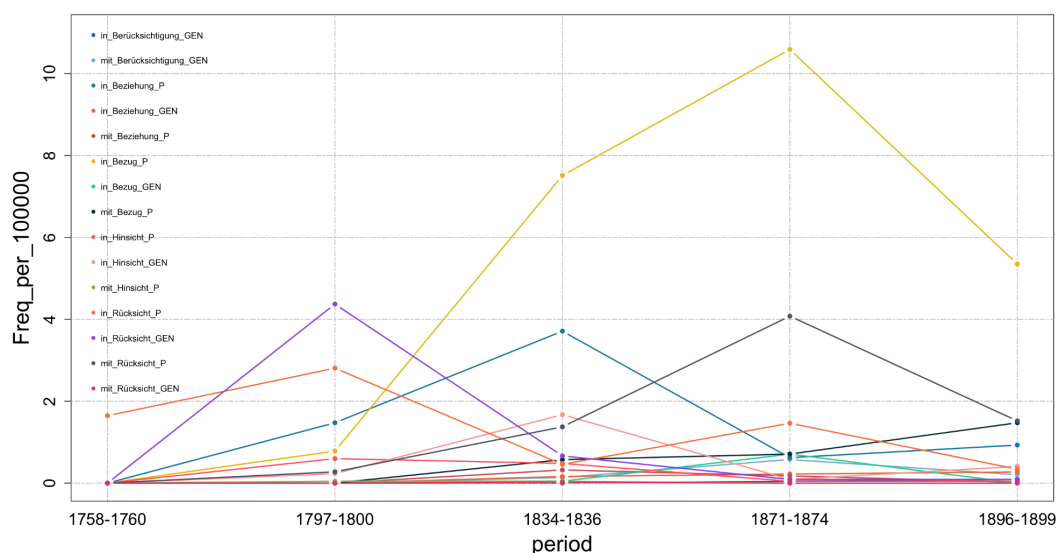


Figure 6: Changes in usage frequency of relevant syntagmatic variants with *Bezug*, *Berücksichtigung*, *Beziehung*, *Hinsicht*, and *Rücksicht*

More recent data from the end of the 20th century (timespan between 1990 and 1999) confirm the trend depicted in Figure 6, cf. Table 1.

Table 1: Frequency of the present-day complex prepositions (1990–1999)

RELEVANT SYNTAGMATIC STRUCTURE	FREQ
<i>in Bezug auf</i>	213
<i>in Beziehung auf</i>	8
<i>in Hinsicht NP_{gen}</i>	9
<i>mit Rücksicht auf</i>	44

In Bezug auf is clearly the most frequent syntagmatic configuration and can be considered a reanalyzed CP in present-day German: it represents the most entrenched and conventionalized construction type as compared to the others.

To sum up, the structures with the deverbal nouns *Bezug*, *Berücksichtigung*, *Beziehung*, *Rücksicht*, and *Hinsicht* do share semantic and some structural characteristics with each other. However, only *in Bezug auf* becomes relatively strongly entrenched as a CP in the long term. That is, although these potential complex prepositions did initially form a cluster due to their semantic and partially due to their structural similarity, they have not converged into a more general schema after all.

3.1.2 Verbonominal Constructions

Building on this, we now turn to VNCs. One particularly illustrative case is the general pattern [P N *kommen*] ‘P N come’ that is associated with the semantics of MOVEMENT denoting change of location. This abstract pattern has served as the source for several constructions over time. In what follows, we first discuss one such case in detail, while the second will be taken up in the next section, see Section 3.2.

The diachronic source pattern [P_{loc} N_{loc} *kommen*] is transparent and compositional, it denotes a change of location of a moving or movable entity. Some instantiations of this pattern have exhibited the so-called ‘come to mind’ interpretation since the earliest stages of German, cf. (24) – (26) from the Old High German period.

- (24) *Ouh ther wídarwerto thín nî quém er innan **múat** mîn* (Otfrid, I, 2, 29)⁵
 ‘But your enemy may not come into my mind’
 (25) *in **hérza** imo quámi so iz fora góte zami* (Otfrid, III, 2, 14)
 ‘It came into his heart, as is fitting before God’
 (26) *thie dāti mir quément in **githáhti*** (Otfrid, III, 1, 8)
 ‘The deeds came to my mind’

In the earlier stages of German, the nominal slot could be more or less flexibly filled with different MIND nouns, cf. (24) – (26); Table 2 provides an overview of the lexical MIND nouns in the structure [*in* N_{mind} *kommen*] over time (see Fleissner 2025a for details). This lexical diversity was most likely motivated by a fundamental metaphorical shift in the West Germanic languages, where MENTAL CONTENT came to be conceptualized as MIND (see Fleissner 2025a). This initial shift provided new potential nouns for the structure, expanding the lexical inventory available for expressing mental processes. West Germanic languages make use of deverbal abstract nouns inherited from Proto-Germanic and Proto-Indo-European like *sin* (< PGmc. **sinnaz* ‘sense, perception’ < PIE. **sentnós* < **sent-* ‘to feel’) or *wan* (< PWGmc. **wāni* ‘hope, expectation’ < PGmc. **wēniz* < PIE. **wenh₁-* ‘to love’), **hugi* (< PGmc. **hugiz* ‘thought’ < PIE. **ḱk-éy-s*, from **ḱek-* ‘to be able, capable’) and **sebo* (< PGmc. **sebô* ‘mind, taste, perception’ from PIE. **sep-* ‘to taste’). In Old High German, the shift MENTAL CONTENT > MIND appears to coincide with a metaphorical progression from MINDS ARE PHYSICAL SPACES to MINDS ARE CONTAINERS, creating various formations within [*in* N_{mind} *kommen*].

Table 2: MIND-nouns in the N slot in the history of German

OHG	MHG	ENHG	1700–1799	1800–1899	1980–1999	Translation
<i>sin</i>	<i>sin</i>	<i>sinn</i>	<i>Sinn</i>	<i>Sinn</i>	<i>Sinn</i>	‘mind’
<i>muot</i>	<i>muot</i>	<i>muat</i>				‘mind’
<i>gimuot</i>	<i>gemuot</i>	<i>gemüet</i>				‘mind’
	<i>sel</i>	<i>sele</i>	<i>Seele</i>			‘soul’
<i>gidrahta</i>	<i>getrecht</i>	<i>getrecht</i>				‘thought’
<i>gidahta</i>	<i>gedanc</i>	<i>gedenke</i>				‘thought’
<i>gihuht</i>						‘thought’
<i>wan</i>	<i>wan</i>					‘expectation’
	<i>munt</i>					‘memory’
		<i>wille</i>				‘will’
	<i>man</i>	<i>mensch</i>				‘man’
<i>herz</i>	<i>herz</i>	<i>herz</i>	<i>Herz</i>	<i>Herz</i>		‘heart’
	<i>kopf</i>	<i>haupt</i>	<i>Kopf</i>	<i>Kopf</i>		‘head’
	<i>busen</i>					‘breast’

⁵ The Old High German examples are taken from the Referenzkorpus Altdeutsch of the DDD project (Deutsch Diachron Digital, <https://korpling.german.hu-berlin.de/annis/ddd>).

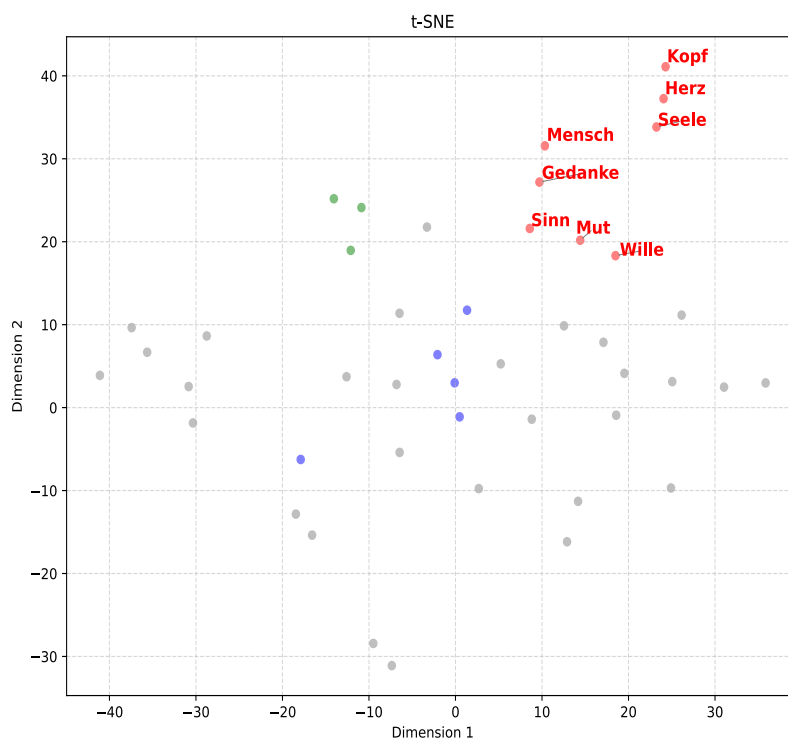


Figure 7: Semantic plot of individual nouns, cluster {*Kopf*, *Herz*, *Seele*, *Sinn*, *Mensch*, *Gedanke*, *Mut*, *Wille*}.⁶

There are some newly formed deverbal nouns in Old High German like *gidahti*, *gidrahti* and *gitrahta*, (Table 2), which stem from different verbs of thinking. Middle High German exhibits several related lexemes, with MIND CONTAINERS such as *sin* ‘sense’, *herz* ‘heart’, *kopf* ‘head’, *muot* ‘mind’, and *gedanc* ‘thought’ serving as central elements. This lexical variation constitutes a case of semantic similarity, as the items involved share conceptual links to MENTAL CONTENT, cf. also Figure 7.

While these nouns form a semantic cluster within this specific conceptual domain, they are etymologically unrelated and do not share a consistent morphological pattern, thus lacking structural similarity. Moreover, they do not behave uniformly in terms of their syntagmatic environments, see Figure 8. Notably, only the structure with the noun *Sinn* has developed towards an independent construction with its own formal and semantic characteristics, whereas structures with other nouns remained closely connected to the instantiating abstract pattern with the (metaphoric) semantics of movement. In modern German, the noun *Sinn* is hardly used outside of this specific MIND-construction. The data in Figure 8 show how the structure with *Sinn* has shifted towards one fixed syntagmatic pattern over time (grey bars represent the structure with a determiner before the noun, ART=article). As a result, an independent substantive construction has emerged, with the fixed structure [*in den Sinn kommen*] prevailing.

As concerns other nouns in the same structure, see Figure 8, they exhibited great structural flexibility throughout the historical periods of German, including instances with and without determiners as well as prenominal adjectival modification (MOD=prenominal adjectival modifiers, NONE=no determination or modification

⁶ Due to the limitations of the word2vec word embeddings model, only those lexemes that are still attested in modern German are represented in Figure 7.

of the noun). That is, other MIND nouns, contrary to *Sinn*, have retained a relatively high degree of syntagmatic variability and did not develop their own constructions.

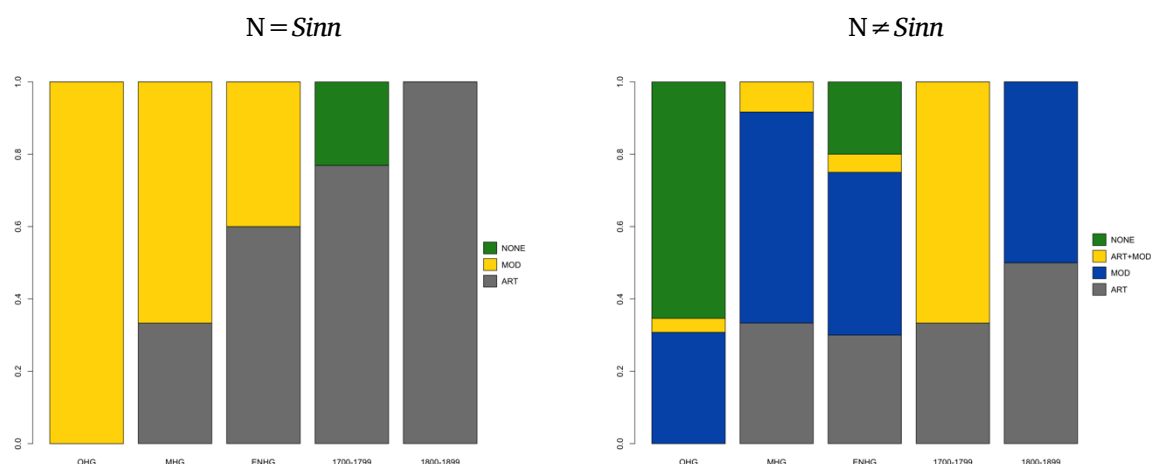


Figure 8: Changes in syntagmatic variability of the pattern *in N_{mind} kommen*

In sum, while instantiations of the general pattern $[P_{loc} N_{loc} kommen]$ with the metaphorical ‘come to mind’-interpretation and with different MIND-nouns were semantically similar to each other and constituted a cluster of semantically related exemplars, their coexistence did not lead to the emergence of an independent constructional schema. Instead, they entered a phase of competition, rather than the generalization towards a more schematic construction.

Cases of the CP *in Bezug auf* and of the ‘come to mind’-construction [*in den Sinn kommen*] illustrate diachronic processes where an initial phase of clustering occurs. However, the development does not progress beyond this initial stage towards further schematization of a new constructional schema. While individual instantiations appear in similar contexts and are recognized as belonging to a broader semantic domain, i.e., a coherent semantic field, they lack the structural and syntagmatic similarity that would be necessary for further generalization, in our view. In both cases described above, there exists a highly abstract schema, either of the type $[P_1 [N NP_{gen}/P_2]_{NP}]_{PP}$ or $[P_{loc} N_{loc} kommen]$, which gives rise to a wide range of different instantiations. All these instantiations can be adequately accounted for by reference to this schema alone. Only a few of these individual instances have developed their own semantic as well as structural characteristics over time – such as the CP *in Bezug auf* and *in den Sinn kommen* – and have thus been reanalyzed and detached from the source constructional schema, now serving as independent constructions.

3.2. Schematization without cluster formation

Let us now turn to constructions that, in contrast to those discussed in Section 3.1, clearly underwent a diachronic process of schematization. The object of investigation is the structure *zur* ‘to’ $N_{ung} kommen/bringen$ ‘come/bring’, (27) – (28).

- (27) a. *Auch die Wasserregulatoren kamen zuerst in England zur Anwendung und bestanden daselbst ursprünglich aus einem langen, viereckigen Blechkasten...* (Beck, 1897)
 ‘The water regulators were also first used (lit. came to operation) in England and originally consisted there of a long, rectangular metal box...’

- b. **Kommt der Plan zur Ausführung**, so ist Leopoldshafen so ziemlich antiquirt, und Karlsruhe selbst... (Augsburger Allgemeine, 1840)
 ‘If the plan is carried out (lit. comes to execution), Leopoldshafen will be more or less obsolete — and Karlsruhe itself as well...’
- (28) a. *Der Richter hat nur wirkliches Recht zur Anwendung zu bringen.* (Gerber, 1865)
 ‘The judge is to apply (lit. bring to execution) only the law as it actually stands.’
- b. *Nachdem dies Exempel statuirt war, brachte der Kaiser die übrigen Artikel des Edictes nicht zur Ausführung.* (Berg, 1864)
 ‘After this example had been set, the emperor did not carry the remaining articles of the edict into effect.’

In present-day German, [*zur N_{ung} kommen*] and [*zur N_{ung} bringen*] are constructional schemas that are in a paradigmatic opposition to each other (see Fleissner 2025b for details). The construction [*zur N_{ung} kommen*] serves to reduce the verbal scene by omitting the agent, thus being deagentive, (27). The semantic differences between the individual realizations in (27a-b) arise from the semantics of the respective deverbal noun, i.e. *Anwendung* ‘application’ or *Ausführung* ‘execution’, which, in turn, maintain a transparent relationship with their base verbs *anwenden* ‘to apply’ and *ausführen* ‘to execute’. The construction [*zur N_{ung} bringen*], on the other hand, acts as a transitive counterpart of the construction [*zur N_{ung} kommen*], restoring the agent role of the verbal scene, (28).

This diathetic meaning is not compositionally predictable from a free combination of MOVEMENT (*kommen*) or TRANSFER (*bringen*) verb plus a locative PP but is conventionally associated with the two constructional schemas. The close paradigmatic relationship between the two schemas is motivated, on the one hand, by the respective lexical filling of the open nominal slot and, on the other hand, by the semantics of the productive and schematic constructions.

Figure 9 represents the synchronic network analysis of two time periods, 1650–1699 and 1850–1899, based on data from the DTA corpus.

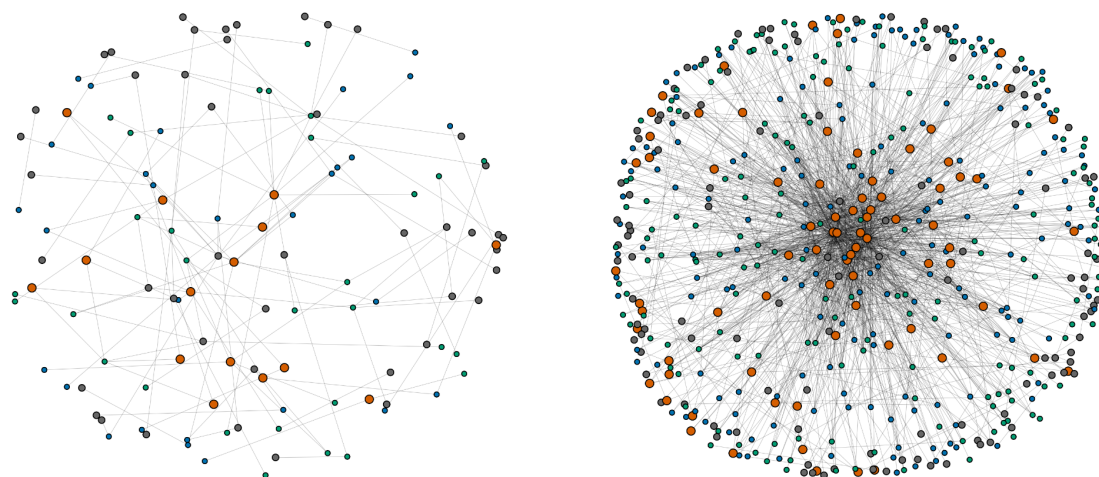


Figure 9: Networks of nouns in [*zur N_{ung} kommen*] and [*zur N_{ung} bringen*] 1650–1699 (left) and 1850–1899 (right)

The networks in Figure 9 illustrate the nouns used in the noun slots of the two constructions and highlight the overlap between them. The visualization employs a spring layout, in which nodes are arranged based on their connection strength: the more connections a node has, the closer it moves toward the center. Each node represents a noun. Red nodes correspond to nouns that appear in both constructions, i.e., shared nouns. As seen in Figure 9, they tend to cluster more to the center of the network, while exclusive nouns remain at the periphery: blue nodes represent nouns in combination with *kommen*, while green nodes indicate nouns used with *bringen*.

A comparison of the two networks reveals a clear increase in shared nouns over time. While the network for 1650–1699 is relatively sparse and contains many exclusive nouns, the network for 1850–1899 is significantly denser, with a greater number of shared nouns.⁷ This shift indicates a gradual convergence in usage patterns, where nouns that were previously restricted to one construction have become more acceptable in the other. Hapax and other low-frequency types are poor indicators for overlap, yet they are theoretically informative about the construction's capacity for extension. The late network exhibits precisely this: while the shared core grows, the periphery does not collapse; instead, it expands with many one-off or rare instantiations. The result is token-heavy but type-sparse core, and type-rich but token-sparse periphery, the hallmark of an open, productive schema.

This increase in shared lexemes that occur in the nouns slot of [*zur N_{ung} kommen*] and [*zur N_{ung} bringen*] is also reflected in the results of a collostructional analysis (cf. Gries & Stefanowitsch, 2004). Table 3 provides an overview of the 10 lexemes most strongly attracted to each construction.⁸ Many instantiations with the verb *kommen* in the earlier period exhibit a tendency toward deagentivization, which is characteristic of its metaphorical use (see Fleissner, in press b). That is, they often conceptualize abstract events. A deagentive perspective is particularly evident in expressions such as *zur Zeitigung kommen* 'to come to maturation', *zur Vereiterung kommen* 'to come to suppuration', or *zur Wirkung kommen* 'to come into effect'. Here, a transformation or the onset of a state is described without explicitly naming a cause or actor. As a result, these processes appear to unfold autonomously, even though they may have an underlying cause. While an agent or experiencer is often implied in cases like *zur Regierung kommen* 'to come to government' or *zur Verantwortung kommen* 'to come to responsibility', they are not necessarily the determining force behind the process. The construction [*zur N_{ung} kommen*] thus backgrounds agency.

As seen in Table 3, the nouns involved in these constructions remain difficult to categorize because their semantic diversity is quite high. They encompass a wide range of meanings, from political and legal processes to biological and emotional developments. In the 17th century, *-ung*-nouns in combination with *bringen* allow for a CAUSATIVE interpretation derived from the TRANSFER construction, which is evident in cases like *zur Verzweiflung bringen* 'to bring to despair' or *zur Heilung bringen* 'to make heal', where the noun denotes an event that is externally motivated. The subject of *bringen* introduces an external force that induces this event. The deagentive constructional meaning becomes apparent in the 19th century. The top lexemes in Table 3 show a substantial degree of overlap, with several nouns prominently appearing in both constructions. Among these are *Anwendung* 'application', *Geltung* 'validity', *Ausführung* 'execution', *Erscheinung* 'appearance', *Abstimmung* 'vote', and *Darstellung* 'representation'. These shared nouns function as prototypical

⁷ This trend is also reflected in the Jaccard Index, a metric used to quantify the degree of lexical overlap between the two constructions. In the earlier time period, the Jaccard value is 0.25, indicating that 25% of the nouns are used in both constructions. In the later time period, however, the value rises to 0.42, suggesting that *kommen* and *bringen* are increasingly selecting the same nouns.

⁸ A more comprehensive list with additional nouns and their collostructional strength values is available in our OSF repository.

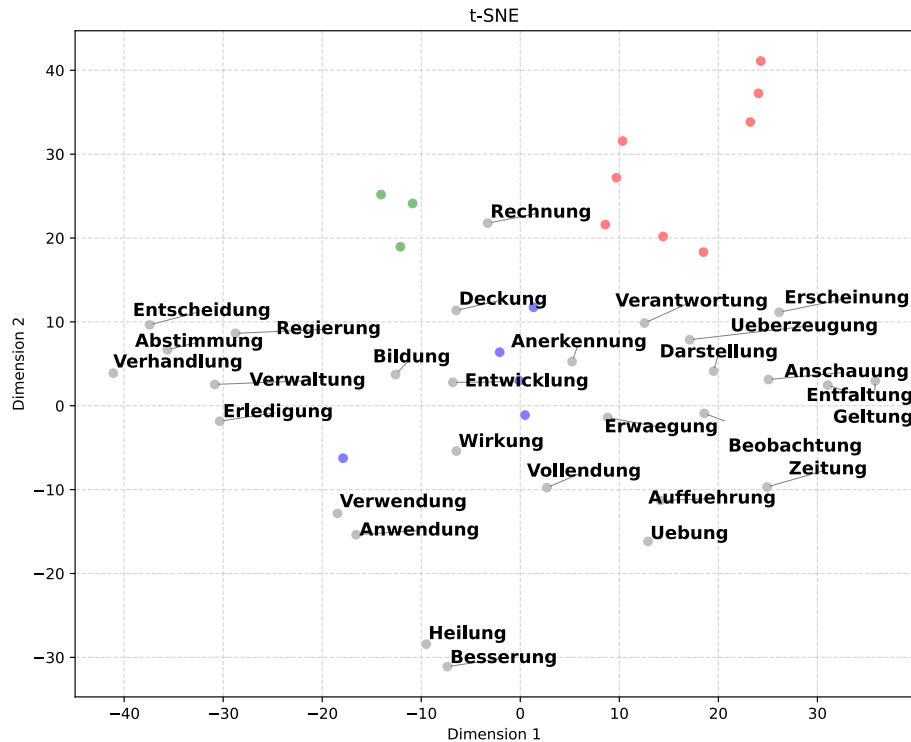
representatives of the converse meaning associated with [*zur N_{ung} kommen*] while simultaneously reinforcing the reciprocal relationship to the anti-converse [*zur N_{ung} bringen*]. The presence of *Geltung* and *Erscheinung* demonstrates that a transitive base verb is not a prerequisite for a converse reading. Instead, the meaning is contributed by the construction itself, emphasizing a state or condition coming into existence or gaining prominence without requiring an explicit agent or causative action.

Table 3: Most attracted nouns in [*zur N_{ung} kommen*] and [*zur N_{ung} bringen*]

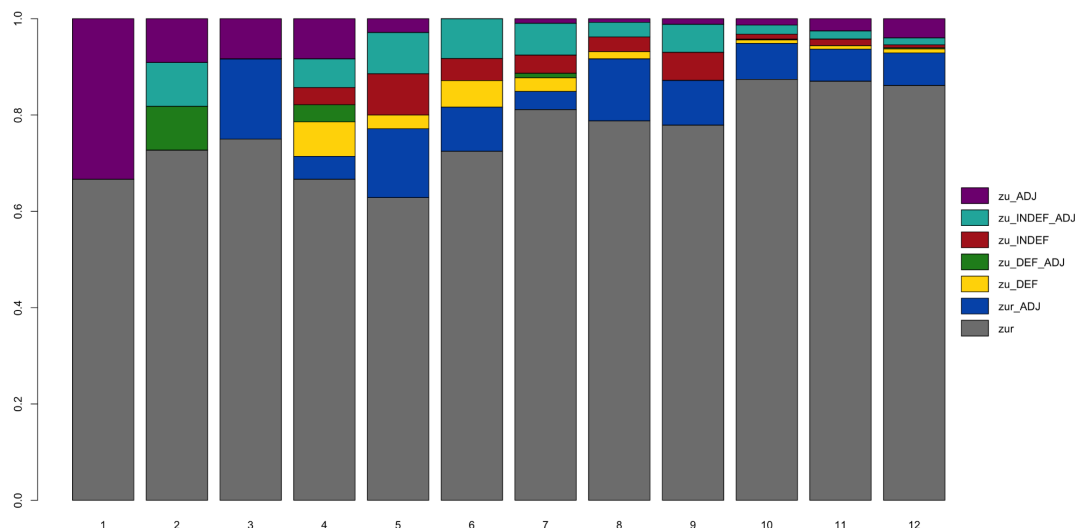
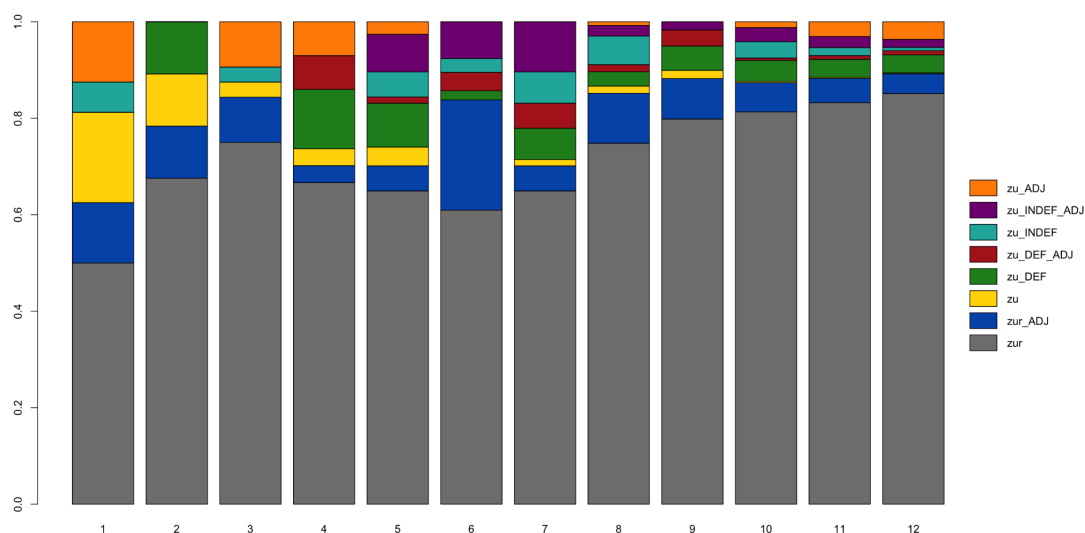
1650–1699	[<i>zur N_{ung} kommen</i>]	[<i>zur N_{ung} bringen</i>]
1	<i>Zeitigung</i> 'maturation'	<i>Verzweiflung</i> 'despair'
2	<i>Regierung</i> 'government'	<i>Heilung</i> 'healing'
3	<i>Pfändung</i> 'seizure'	<i>Besserung</i> 'improvement'
4	<i>Verwaltung</i> 'administration'	<i>EntschlieÙung</i> 'resolution/decision'
5	<i>Lernung</i> 'learning'	<i>Vereiterung</i> 'suppuration'
6	<i>Reifung</i> 'ripening/maturation'	<i>Zeitigung</i> 'maturation'
7	<i>Vereiterung</i> 'suppuration'	<i>Zeitung</i> 'newspaper'
8	<i>Wirkung</i> 'effect/impact'	<i>Übung</i> 'exercise/practice'
9	<i>Verantwortung</i> 'responsibility'	<i>Verbesserung</i> 'improvement'
10	<i>Abrichtung</i> 'training/disciplining'	<i>Rechnung</i> 'bill/calculation'
1850–1899		
1	<i>Anwendung</i> 'application/use'	<i>Geltung</i> 'validity/relevance'
2	<i>Geltung</i> 'validity/relevance'	<i>Anschauung</i> 'view/perception'
3	<i>Ausführung</i> 'execution'	<i>Anwendung</i> 'application/use'
4	<i>Verwendung</i> 'use'	<i>Ausführung</i> 'execution'
5	<i>Erscheinung</i> 'appearance'	<i>Darstellung</i> 'representation'
6	<i>Besinnung</i> 'reflection/contemplation'	<i>Anerkennung</i> 'recognition'
7	<i>Überzeugung</i> 'conviction/belief'	<i>Abstimmung</i> 'vote/coordination'
8	<i>Entwicklung</i> 'development/evolution'	<i>Entscheidung</i> 'decision/verdict'
9	<i>Abstimmung</i> 'vote/coordination'	<i>Verzweiflung</i> 'despair'
10	<i>Darstellung</i> 'representation/depiction'	<i>Erscheinung</i> 'appearance'

Figure 10 shows that the nouns in both constructions display a great lexical diversity. This suggests that the similarity effect in schematization is not derived from the semantics of the nouns themselves. We suggest that the interplay between the constructional meaning and the word formation pattern *-ung* plays a crucial role here. That is, the relationship between *kommen/bringen* and *-ung* nominalizations is not a lexical preference based on semantic similarity of the nouns, but an emergent structural property of a new schema. The repeated co-occurrence with this word formation type points to a form of structural similarity that supports the construction's schematization.

Another motivation for schematization is the increasing syntagmatic similarity between [*zur N_{ung} kommen*] and [*zur N_{ung} bringen*]. Figures 11 and 12 illustrate these tendencies for both constructions. The timespan between 1600 and 1899 is represented in 12 periods of 25 years each.

Figure 10: Semantic plot of individual *-ung*-nouns.

The convergence of both constructions toward reduced variability further underscores their interrelated development. Instead of maintaining full syntagmatic flexibility, the constructions develop towards an increasingly fixed pattern. While some degree of variability persists, the degree of noun modification steadily decreases. A similar trend in Figures 11 and 12 is the preference for the cliticized form *zur* over both definite and indefinite articles. This shift suggests that determinacy and countability, which are typically relevant for nominal interpretation, become secondary to the constructional function. Since the construction does not require individuated or referential readings of the noun, the choice of *zur* as the default prepositional determiner further reinforces the stabilization of the schema. In contrast to the constructions discussed in Section 3.1, the fixation observed in Figures 11 and 12 is a development that applies to the constructional schemas rather than to individual construction types. This fixation is not tied to lexical selection but rather to structural abstraction.

Figure 11: Changes in syntagmatic variability of *[zu N_{ung} bringen]*Figure 12: Changes in syntagmatic variability of *[zu N_{ung} kommen]*

The development of constructional schemas *[zur N_{ung} kommen]* and *[zur N_{ung} bringen]* illustrates how schematization may proceed without the initial stage of cluster formation based on lexical similarity. In this case, the structure with *kommen* was already an established pattern within the domain of MOVEMENT constructions, denoting physical MOVEMENT as well as (metaphorical) CHANGE OF STATE. The introduction of deverbal *-ung*-nominalizations did not merely extend the range of lexical items that could combine with *kommen*; rather, it fundamentally altered the semantic interpretation. With the development of the schema *[zur N_{ung} kommen]*, the deagentive interpretation became systematically and conventionally linked to a specific structural pattern. The use of *-ung*-nominalizations introduced new constraints on argument realization, reinforcing deagentive structures and thereby restructuring the construction itself. Unlike other nominalizations, *-ung*-nouns are

derived from transitive verbs, meaning that they inherently carry an argument structure in which an accusative object is obligatory. The *-ung*-nominalizations constrained the possible interpretations of constructions with *kommen*, reinforcing a converse interpretation. Crucially, this made it possible for the construction with *bringen* to establish a functional counterpart that could ‘restore’ the agentivity of the construction.

In sum, we argue that in the case of [*zur* N_{ung} *kommen*] and [*zur* N_{ung} *bringen*] semantic similarity between the individual nouns in the nominal slot N_{ung} played only a minor role. Rather, it was structural similarity, manifest in the recurring use of *-ung*-nominalizations, and syntagmatic similarity at the constructional level, involving stable patterns of argument realization and noun modification, which provided the foundation for schematization.

4. Discussion and Conclusion

In this study, we set out to examine the diachronic process of schematization in greater detail, focusing on two central questions: first, the role of initial clustering in this process, and second, the contribution that different types of similarity make. Our case studies clearly demonstrate two different scenarios.

The first concerns CPs like [*in Bezug auf*] and VNCs like [*in den Sinn kommen*]. Here, we observe initial clustering based on semantic similarity, which however does not suffice to lead to a formation of a constructional schema. Even though individual instantiations appear in similar contexts and share semantic information, they do not give rise to a constructional schema over time. Cases discussed in Section 3.1 highlight a crucial point: Without a (shift toward) structural and syntagmatic regularity, semantically similar exemplars within a cluster often enter competition with each other, rather than being generalized into a more abstract schematic pattern. Figure 13 illustrates this kind of development.

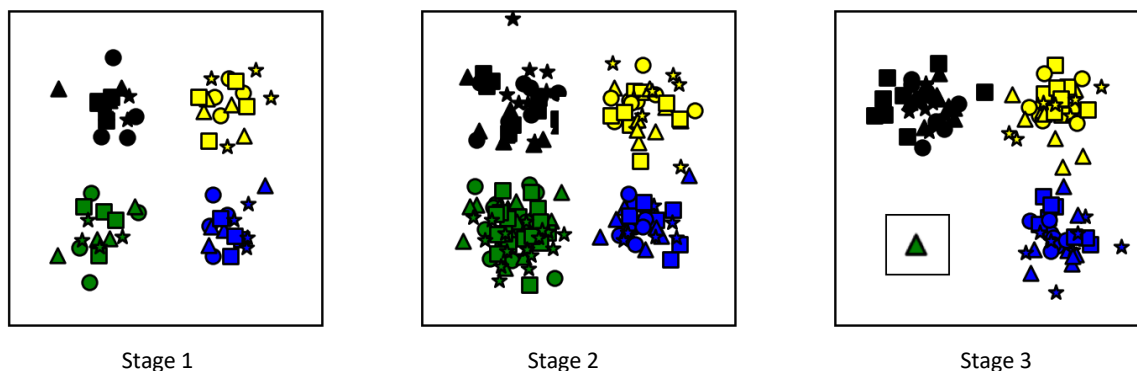


Figure 13: Cluster formation without further schematization

Figure 13 illustrates a situation in which several small clusters exist at a given point in time (Figure 13, left-hand box). These clusters are motivated by semantic similarities, represented by the different colours of the shapes, while the shapes themselves represent structural configurations. Such clusters may underlie small-scale changes over time, either growing by attracting new exemplars or shrinking by losing some of them. This process is depicted in Stage 2 (Figure 13, middle box), where one of the clusters – visualized by the green forms – expands. Over time, however, individual constructions within this cluster enter a phase of competition, since semantic similarity alone is insufficient to motivate both the generalization of a structural pattern and of a stable semantics. Ultimately, only one construction within

the cluster survives (Figure 13, right-hand box, green triangle). The case of [*in den Sinn kommen*]-construction exemplifies this scenario: despite the presence of multiple historically attested types with the nouns like *Kopf*, *Herz*, *Seele*, *Sinn*, *Mensch*, *Gedanke*, *Mut*, *Wille*, no stable formal schema emerged, and in the long run, only [*in den Sinn kommen*] survived as the lexically entrenched ‘come to mind’-construction. Regarding CPs, [*in Bezug auf*] emerges as the dominant form, outcompeting its semantically similar competitors with the nouns *Berücksichtigung*, *Beziehung*, *Rücksicht*, and *Hinsicht*. While competing forms still exist within the investigated time frame, they gradually decline in frequency. The model presented here is therefore both generalizing and idealizing in its treatment of the conventionalization of specific constructions, abstracting away from potential diachronic dynamics or variational processes.

The second scenario represents a different line of development: the schematization of a new constructional schema without prior cluster formation on the basis of semantic similarity. Schematization in this case arises through structural reorganization within an existing higher-level schema. That is, the emergence of a schema is not necessarily a result of incremental lexical expansion. Instead, the primary mechanism is a reorganization motivated by structural and syntagmatic similarity. Figure 14 visualizes this process.

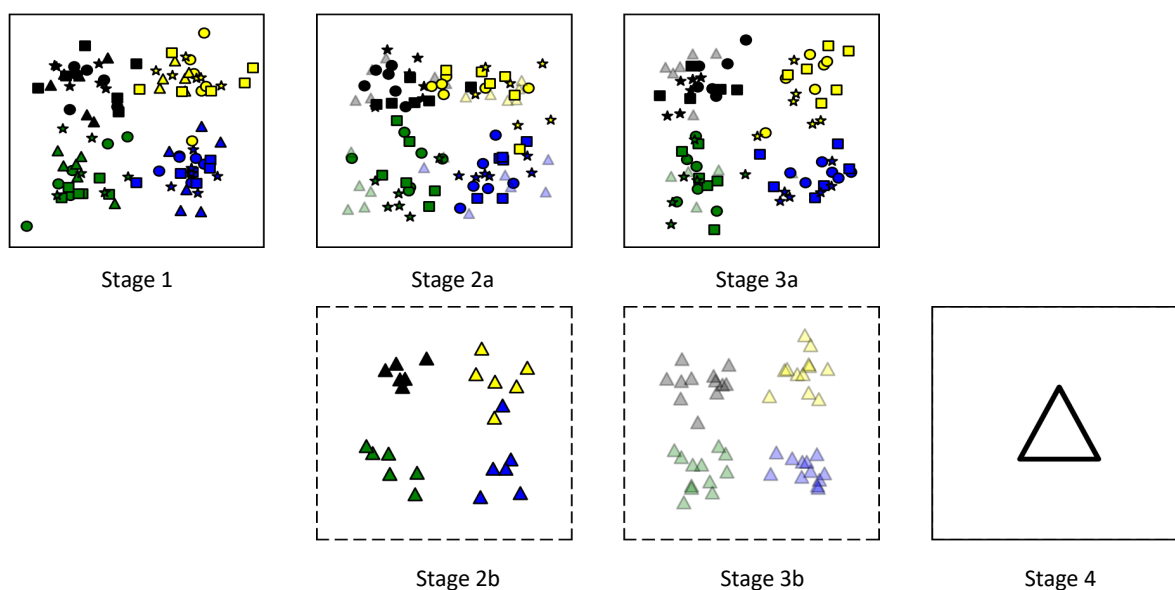


Figure 14: Schematization without prior cluster formation

In Stage 1, there is an existing abstract constructional schema with various semantic clusters, which are represented by different colors. These clusters reflect an initial state of the different MOVEMENT (for *kommen*) and TRANSFER (FOR *BRINGEN*) constructions in which lexical items can be grouped together based on lexical meaning. Their formal properties (shapes) remain highly diverse within each cluster. However, as a particular formal pattern (here, triangles representing the *ung*-nouns) becomes increasingly prominent within certain contexts, reorganization occurs. This results in a gradual separation of these exemplars from their original constructional schema. Stage 2a demonstrates the first effect of this restructuring. While the semantic clusters are still intact, the association with certain formal shapes begins to diminish. This suggests that while semantic relations remain stable, certain forms begin to exhibit a structurally based independence, see Stage 2b. Note that partial overlaps persist, showing that while a new structure is emerging, the previous semantic affiliations are not entirely erased, hence the transparent triangles in Stage 2a.

In Stage 3b, this process continues with a more explicit separation. The semantics of individual nouns recede into the background. As a result, they lose their original connections to the previously instantiating abstract schema (Stage 3a), represented here by the reduction of transparent triangles. Stage 4 shows the full dissociation from the source schema, indicating that some of its former nominal representatives have been extracted to form a new, distinct constructional schema. This schema is inherently tied to its structural form, meaning that the overall constructional meaning takes precedence over the individual semantics of its exemplars. As a result, the internal lexical variation becomes secondary, and the structure itself emerges as the primary bearer of meaning. This shift is visually represented by the large, unfilled triangle in Stage 4, which symbolizes the abstraction of the construction beyond its specific lexical instantiations.

The diachronic developments of different types of German CPs and VNCs discussed in this paper illustrate these tendencies: While structural and syntagmatic similarity tends to stabilize constructional patterns, semantic similarity alone does not necessarily lead to schematization. The findings from both case studies demonstrate that constructional development is not necessarily a linear process of analogical expansion based on semantic clustering but can also involve structural reorganization.

Moreover, the findings of this paper align with the observation that schematization is primarily a process of restructuring and reorganization rather than the emergence of entirely new patterns. As Diessel (2019: 62) notes “[...] usually, language change involves the extension and modification of existing schemas rather than the rise of entirely new ones”. In line with this remark, we assume the existence of established schemas not only as an endpoint, but as a starting point. From there, constructional development can follow different trajectories: one leading to the conventionalization of specific constructions, where individual constructions become increasingly fixed and less productive, and another leading to schematization, where structural generalization fosters abstraction of new productive schemas.

Acknowledgments

This work was supported by the funded by the Swiss National Science Foundation under Grant No. 197124. We sincerely thank the SNSF for their generous support. We also wish to thank the two anonymous reviewers for their constructive feedback and the editors of the journal for their insightful comments and valuable suggestions.

Conflict of interest statement

The authors declare none.

Data availability statement

The data and analysis scripts for the present paper are available at <https://osf.io/p5dfx/>, DOI [10.17605/OSF.IO/P5DFX](https://doi.org/10.17605/OSF.IO/P5DFX).

License

This work is licensed under a “[CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)” license.

References

- Barðdal, Jóhanna. 2008. *Productivity: Evidence from Case and Argument Structure in Icelandic*. Amsterdam, Philadelphia: John Benjamins.

- Barðdal, Jóhanna & Spike Gildea. 2015. Diachronic Construction Grammar: Epistemological context, basic assumptions and historical implications. In Jóhanna Barðdal, Elena Smirnova, Lotte Sommerer & Spike Gildea (eds.), *Diachronic Construction Grammar*, 1–50. Amsterdam, Philadelphia: John Benjamins. doi.org/10.1075/cal.18.01bar
- Bybee, Joan. 2010. *Language, Usage and Cognition*. Cambridge: Cambridge University Press. doi.org/10.1017/CBO9780511750526
- Bybee, Joan. 2015. *Language Change*. Cambridge: Cambridge University Press. doi.org/10.1017/CBO9781139096768
- Bybee, Joan. 2013. Usage-based Theory and Exemplar Representations of Constructions. In Thomas Hoffmann & Graeme Trousdale (eds.), *The Oxford Handbook of Construction Grammar*, 49–69. Oxford: Oxford University Press. doi.org/10.1093/oxfordhb/9780195396683.013.0004
- Bybee, Joan & David Eddington. 2006. A Usage-based Approach to Spanish Verbs of ‘Becoming’. *Language* 82(2). 323–355. doi.org/10.1353/lan.2006.0081
- Croft, William. 2001. *Radical construction grammar: Syntactic theory in typological perspective*. Oxford: Oxford University Press. doi.org/10.1093/acprof:oso/9780198299554.001.0001
- De Smet, Hendrik. 2012. *Spreading Patterns: Diffusional Change in the English System of Complementation*. Oxford: Oxford University Press. doi.org/10.1093/acprof:oso/9780199812752.001.0001
- De Smet, Hendrik & Olga Fischer. 2017. The Role of Analogy in Language Change: Supporting Constructions. In Marianne Hundt, Sandra Mollin & Simone E. Pfenninger (eds.), *The Changing English Language*, 240–268. Cambridge: Cambridge University Press. doi.org/10.1017/9781316091746.011
- Diessel, Holger. 2019. *The Grammar Network: How Linguistic Structure Is Shaped by Language Use*. Cambridge: Cambridge University Press. doi.org/10.1017/9781108671040
- Fischer, Olga. 2010. An iconic, analogical approach to grammaticalization. In C. Jac Conradie, Ronél Johl, Marthinus Beukes, Olga Fischer & Christina Ljungberg, (eds.), *Iconicity in Language and Literature*, 279–298. Amsterdam, Philadelphia: John Benjamins. doi.org/10.1075/ill.9.17fis
- Fleischer, Wolfgang. 1997. *Phraseologie der deutschen Gegenwartssprache*. Berlin: De Gruyter. doi.org/10.1515/9783110947625
- Fleischhauer, Jens. 2022. *Stehen unter* -Funktionsverbgefüge und ihre Familien. *Zeitschrift Für Germanistische Linguistik* 50(2). 247–288. doi.org/10.1515/zgl-2022-2055
- Fleischhauer, Jens & Stefan Hartmann. 2021. The emergence of light verb constructions: A case study on German *kommen* ‘come’. *Yearbook of the German Cognitive Linguistics Association* 9(1). 135–156. doi.org/10.1515/gcla-2021-0007
- Fleissner, Fabian. 2025a. How to get into Containers: The emergence of German ‘Come to mind’ constructions. In Natalia Filatkina & Sabine Arndt-Lappe (eds.), *Dynamics at the lexicon-syntax interface: Creativity and routine in word-formation and multi-word expressions*, 131–164. Berlin, Boston: De Gruyter. doi.org/10.1515/9783111321905-006
- Fleissner, Fabian. 2025b. From Linguistic Creativity to Conformity: the case of [zur Nung kommen/bringen]. *Yearbook of the German Cognitive Linguistics Association*, 20250005. doi.org/10.1515/gcla-2025-0005.
- Fleißner, Fabian & Elena Smirnova. 2025. Funktionsverbgefüge unter Druck: Ein Vorschlag zur Typologisierung verbonominaler Konstruktionen des Deutschen. *Zeitschrift für germanistische Linguistik* 53(1), 126–165. doi.org/10.1515/zgl-2025-2004
- Fleissner, Fabian & Elena Smirnova. in press. Musterbasierte Wissenschaftssprache. Schematische paper constructions des Neuhochdeutschen. In Vilmos. Ágel (ed.), *Grammatik des Neuhochdeutschen zwischen Gegenwart und Geschichte*. Berlin, Boston: De Gruyter.
- Goldberg, Adele. 2019. *Explain Me This: Creativity, Competition, and the Partial Productivity of Constructions*. Princeton: Princeton University Press. doi.org/10.1515/9780691183954
- Gries, Stefan Th. & Anatol Stefanowitsch. 2004. Extending collostructional analysis: A corpus-based perspective on ‘alternations’. *International Journal of Corpus Linguistics* 9(1), 97–129. doi.org/10.1075/ijcl.9.1.06gri
- Harm, Volker. 2021. *Funktionsverbgefüge des Deutschen: Untersuchungen zu einer Kategorie zwischen Lexikon und Grammatik*. Berlin, Boston: De Gruyter. doi.org/10.1515/9783110661255
- Hartmann, Stefan & Tobias Ungerer. 2024. Attack of the snowclones: A corpus-based analysis of extravagant formulaic patterns. *Journal of Linguistics* 60(3), 599–634. doi.org/10.1017/S0022226723000117

- Kabatnik, Susanne. 2020. *Leistungen von Funktionsverbgefügen im Text: Eine korpusbasierte quantitativ-qualitative Untersuchung am Beispiel des Deutschen und des Polnischen*. Tübingen: Narr Francke Attempto.
- Langacker, Ronald. W. 2014. *Foundations of cognitive grammar. Vol. 1: Theoretical prerequisites*. Stanford: Stanford University Press.
- Mikolov, Tomas, Kai Chen, Greg Corrado & Jeffrey Dean. 2013a. Efficient Estimation of Word Representations in Vector Space. arXiv:1301.3781
- Mikolov, Tomas, Ilya Sutskever, Kai Chen, Greg Corrado & Jeffrey Dean. 2013b. Distributed Representations of Words and Phrases and their Compositionality. arXiv:1310.4546
- Noël, Dirk. 2007. Diachronic construction grammar and grammaticalization theory. *Functions of Language* 14(2). 177–202. doi.org/10.1075/fol.14.2.04noe
- Perek, Florent. 2016. Using distributional semantics to study syntactic productivity in diachrony: A case study. *Linguistics* 54(1). 149–188. doi.org/10.1515/ling-2015-0043
- Perek, Florent. 2018. Recent change in the productivity and schematicity of the way - construction: A distributional semantic analysis. *Corpus Linguistics and Linguistic Theory* 14(1). 65–97. doi.org/10.1515/cllt-2016-0014
- Perek, Florent. 2020. Productivity and schematicity in constructional change. In Lotte Sommerer & Elena Smirnova (eds.), *Nodes and Links in the Network: Advances in Diachronic Construction Grammar*, 141–166. Amsterdam, Philadelphia: John Benjamins.
- Ruf, Regina. in prep. *Komplexe Präpositionen im Deutschen. Entstehungstendenzen und diachrone Entwicklung*.
- Ruf, Regina & Elena Smirnova. 2025. Mit Hilfe von Kreativität? How German complex prepositions are shaped. In Natalia Filatkina & Sabine Arndt-Lappe (eds.), *Dynamics at the Lexicon-Syntax Interface*, 165–192. Berlin, Boston: De Gruyter. doi.org/10.1515/9783111321905-007
- Skousen, Royal. 1989. *Analogical Modeling of Language*. Dordrecht: Springer. doi.org/10.1007/978-94-009-1906-8
- Stefanowitsch, Anatol, Elena Smirnova & Matthias Hüning. 2020. Complex adpositions in three West Germanic Languages: German, Dutch, and English. In Benjamin Fagard, Jose Pinto de Lima, Dejan Stosic & Elena Smirnova (eds.), *Complex adpositions in European languages: A micro-typological approach to complex nominal relators*, 65–138. Berlin, Boston: De Gruyter Mouton. doi.org/10.1515/9783110686647-003
- Suttle, Laura & Adele Goldberg. 2011. The partial productivity of constructions as induction. *Linguistics* 49(6). 1237–1269. doi.org/10.1515/ling.2011.035
- Traugott, Elizabeth Closs & Graeme Trousdale. (2013). *Constructionalization and constructional changes*. Oxford: Oxford University Press.
- Trousdale, Graeme. 2008. A constructional approach to lexicalization processes in the history of English: Evidence from possessive constructions. *Word Structure* 1(2). 156–177. doi.org/10.3366/E1750124508000202
- van der Maaten, Laurens & Geoffrey Hinton. 2008. Visualizing Data using t-SNE. *Journal of Machine Learning Research* 9(86), 2579–2605.
- Van Pottelberge, Jeroen. 2001. *Verbonominale Konstruktionen, Funktionsverbgefüge: Vom Sinn und Unsinn eines Untersuchungsgegenstandes*. Heidelberg: Winter.
- Winhart, Heike. 2002. *Funktionsverbgefüge im Deutschen: Zur Verbindung von Verben und Nominalisierungen*. PhD Dissertation, Universität Tübingen.