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A Frame Approach to German Nominal Word Formation

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Zusammenfassung

Barsalou (1992b) zufolge bilden Frames – verstanden als Attribut-Werte-Strukturen – das universelle Format unseres Denkens. Darauf basierend, entwickelten Petersen (2007), Petersen & Osswald (2012) und Löbner (2017) einen modelltheoretischen Ansatz, der Löbners (2011) Theorie der Begriffstypen in den Frame-Ansatz inkorporiert. In der vorliegenden Dissertation wird dieser Ansatz auf drei linguistische Phänomene angewendet. Ziel ist es zum einen, die Adäquatheit des frame-theoretischen Modells zu prüfen, und zum anderen, neue Erkenntnisse über die Phänomene per se zu erhalten. Erster Untersuchungsgegenstand ist die Metonymie. Eine frametheoretische Definition wird erarbeitet, die Metonymien als konzeptuelle Operationen auf Attributen versteht. Deshalb bietet die Frame-Analyse der Metonymie Einblicke in die potentiellen Attribute von Nomen-Bedeutungen. Des Weiteren wird eine These Löbners (2011) diskutiert, wonach Metonyien nur dann möglich sind, wenn sie das Kriterium der Bidirektionalität erfüllen. Es wird konstatiert, dass es sich bei dieser Hypothese bisher nur um eine Beobachtung handelt, die leider noch nicht theoretisch begründet werden kann. Den zweiten Untersuchungsgegenstand bilden deverbale Nomen des Deutschen, die mit den Suffixen *-er* und *-ung* gebildet werden. Es wird begründet, welchen frame-theoretischen Prozessen die Interpretation solcher Ausdrücke unterliegt. Diese Prozesse modellieren, wie der Begriffstyp deverbaler Nomen in Abhängigkeit vom Basisverb festgelegt wird. Eine solche begriffstypentheoretische Analyse fehlt in den bisherigen Arbeiten zur Nominalisierung. Der dritte und letzte Untersuchungsgegenstand ist die deutsche Nomen-Nomen-Komposition. Löbner (2013) unterscheidet vier Klassen von Kompositatypen, die von ihm frame-theoretisch begründet werden. Diese Klassen werden diskutiert und mit alternativen linguistischen Klassifikationen verglichen. Wegen der konzeptuellen Ausrichtung der Frame-Theorie ergeben sich aber nicht nur Anknüpfungspunkte zu linguistischen Ansätzen, sondern auch zu Arbeiten aus der kognitiven Psychologie.

Abstract

According to Barsalou (1992b), human thinking is organized in frames, understood as attribute-value structures. Petersen (2007), Petersen & Osswald (2012), and Löbner (2017) developed a model-theoretic approach that combines Barsalou's frame theory and Löbner's (2011) theory of concept types. In this thesis, this approach is applied to three linguistic phenomena. The aim is twofold. On the one hand, it is aimed at validating the adequacy of the frame approach; on the other hand, it is pursued to further insights into the phenomena as such. First, it is focused on metonymy. This type of meaning shift is frame-theoretically defined as an operation on frame attributes. Thus, the investigation of metonymy sheds light on the attributes that frames of nouns contain. Furthermore, it is discussed whether bidirectionality is a necessary condition for metonymy. This point of view goes back to Löbner (2013). It will be argued that bidirectionality is, unfortunately, only an observation, but not a causally motivated relation. Second, this thesis investigates deverbal nouns in German that result from *-er* and *-ung* suffixation. The frame-theoretic patterns underlying the interpretation of such nominals will be explicated. These patterns make it obvious how the concept type of deverbal nouns arise, depending on the semantics of the base verb to which suffixation is applied. Such an explanation in terms of concept types is missing in recent research. Third, it will focus on German N-N compounding. In this regard, Löbner (2013) developed a frame-based classification of compounds that distinguishes between four types of compounds. There will then be a discussion of the extend to which this distinction interferes with rival classifications that have been developed in semantic research. Moreover, the frame-based classification will be related to theories in experimental psychology.

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1 Introduction

The term *frame* labels a number of approaches in psychology, computer sciences, linguistics, and philosophy (for a comprehensive overview on frame approaches see Busse 2012 and Konerding 1993). Conditioned by the respective disciplinary traditions, the approaches differ with respect to their focus and their degree of formalization, but they all aim at capturing knowledge structures, be they the ones underlying human thinking or the ones underlying complex technical formations like databases. The first frame approach heading for questions of linguistic semantics was proposed by Fillmore (1968, 1976). Fillmore's approach has always been understood as an improvement of his case-grammar theory and focuses widely on representing the meaning of verbs (see Busse 2012: Chapter 2 for a complete overview about the development of Fillmore's approach). The meanings of nouns, by contrast, are treated less explicitly.

Petersen (2007), Petersen & Osswald (2012), and Löbner (2017) developed a frame approach that allows both a representation of the meanings of verbs as well as the meanings of nouns. They build on Barsalou's (1992b) theory that human thinking is organized in attribute-value structures which he refers to as *frames*. Petersen (2007), Petersen & Osswald (2012), and Löbner (2017) provide a semantic model that captures the basic ideas of Barsalou's (1992b) approach and combines them with Löbner's (2011) theory of concept types. As a result, the authors provide a semantic approach that allows a description of the decomposition as well as the composition of concepts. In the following, I refer to this approach as the *frame approach*.

The frame approach is innovative because linguistic frameworks usually focus either on decompositional or compositional aspects of meanings. Formal semantics tend to consider meanings of words as atomic and focus on how these atomic units can be regularly composed to complex meanings. However, formal semantics neglects the decompositional aspects of the meanings of lexemes. By contrast, cognitive semantics shows the opposite tendency. Cognitive semanticists consider the meanings of lexemes as some kind of connections of associations. It primarily aims at a deeper understanding of the decomposition of the meaning of lexemes, but widely neglects how these networks of associations can be combined to generate complex meanings. From this point of view, the frame approach can be seen as an attempt to create a bridge between formal and cognitive semantics.

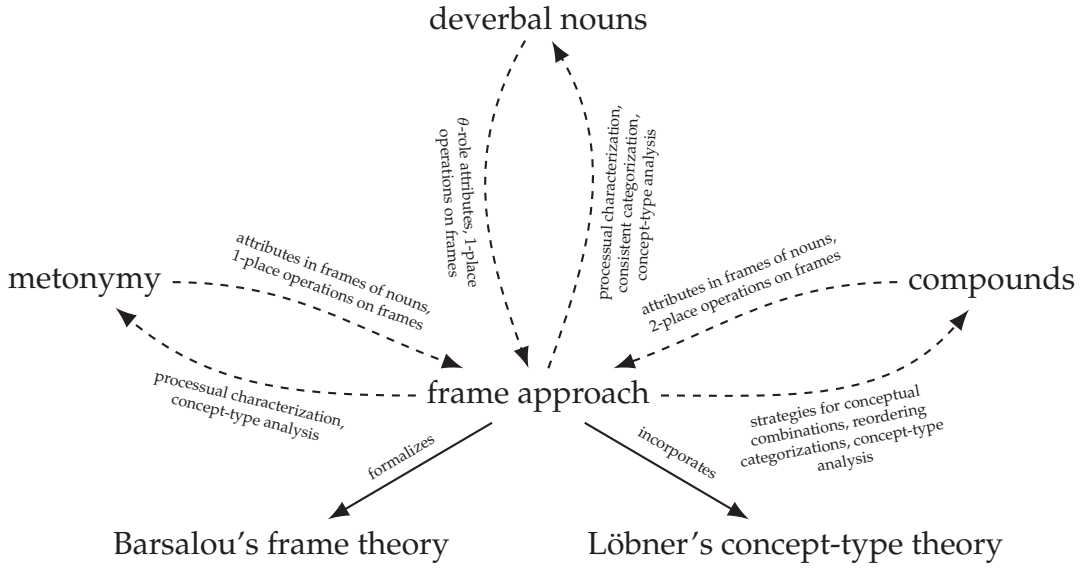

Figure 1.1 The approach used in this thesis and its influences. New insights are marked by dashed arcs.

1.1 Contributions

As Figure 1.1 illustrates, the frame approach builds on Barsalou's (1992b) theory which is formally modeled, and incorporates Löbner's (2011) theory of concept types. This approach constitutes the starting point of this thesis. Building on this, I will apply the frame approach to three phenomena: metonymy, deverbal nominalization, and compounding. My aim is twofold: On the one hand, modeling the phenomenon in frames should provide new insights into these phenomena as such. On the other hand, assuming that human thinking is organized in frames, frame analyses are expected to elucidate which meaning components the frames of nouns represent. The first aim provides purely linguistic results and the latter delivers results for frame theory.

Figure 1.1 depicts the contributions to results about frames as well as those about the linguistic objects of investigation by means of dashed arcs. The results on frames take two aspects into account. Both of them are related to the fact that, from a purely semantic angle, the meanings of metonymic expressions, deverbal *-er* and *-ung* nouns, as well as compounds are expected to be derived from the literal meaning of the expression, the underlying base verb, or from the lexemes combined to a compound, respectively. As will be pointed out, the way in which these meanings are derived is a conceptual process that can be explicated in frames. On the one hand, the analyses will shed light on the question which operations are possible using frames. On the other hand, the operations usually operate on frame attributes

such that the analyses also provides an insight into the attributes frames potentially contain.

Analyzing the meaning derivations involved in the mentioned linguistic phenomena as operations on frames offers not only results for frames, but also results regarding the phenomena as such. The explication of the underlying frame operations offer insights into the conceptual processes underlying these phenomena. This allows a characterization of what metonymy is based on the underlying conceptual processes. In the case of deverbal *-er* and *-ung* nouns as well as in the case of compounding, the uncovering of the underlying operations sheds new light on already existing categorizations of these phenomena.

Beyond that, the frame analyses are developed against the background of Löbner's (2011) concept-type theory which has not been applied to the analysis of metonymy, deverbal *-er* and *-ung* nominalization, and compounding to such an extent. The considerations will have implications for the frame-theoretic representation of concept types developed by Petersen (2007) and Petersen & Osswald (2012).

1.2 Train of thought

This thesis can be divided into a theoretic constitutional and an analytical part. The theoretic constitutional includes Chapter 2 in which the theoretic framework used in this thesis will be developed. The chapter will provide an overview about the basic ideas of Barsalou's (1992b) frame theory and outlines how the theory is formally modeled by Petersen (2007), Petersen & Osswald (2012) as well as Löbner (2017). Furthermore, it explains the central aspects of Löbner's (2011) concept-type theory, which the frame analyses will take into account, and its incorporation in the frame approach.

The analytical part of this thesis can be found in Chapter 3 to 5 in which the frame analyses will be developed. In Chapter 3, I will investigate the metonymic use of nouns in German and English. In the subsequent Chapter 4, I will analyze deverbal nouns in German that are generated with the suffixes *-er* and *-ung*. The analysis will build on some of the considerations developed in the context of metonymy. It will also point out the extent to which the interpretation of metonymy corresponds to the interpretation of deverbal *-er* and *-ung* nouns from the perspective of frames.

Finally, in Chapter 5, I analyze subordinate noun-noun compounds in German. The analysis makes use of results of the preceding chapters. On the one hand, results on metonymy build the basis for the analysis of those compounds that are usually designated as *possessive*, whereas the results on deverbal *-er* and *-ung* nominalization build the basis for the analysis of so-called synthetic compounds. On the other hand, considerations of the frame representation of concept types from Chapter 3 and 4

will be applied and continued in the analysis of compounds. The same holds for attributes in frames uncovered in the investigation of metonymy.

1.3 Acknowledgment

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2 Concept types and frames

In the following, I introduce the theoretic framework that forms the basis for the analyses of metonymy, deverbal nominals, and compounding that will be developed in the subsequent chapters. The chapter is organized into two parts. Section 2.1 focuses on Löbner's (2011) concept-type theory, which is summarized as far as is necessary in the context of this thesis. Subsequently, Section 2.2 deals with the frame model developed by Löbner (2017), Petersen (2007), and Petersen & Osswald (2012), in which the theory of concept types is incorporated. The aim of this section is twofold: On the one hand, it explicates the general assumptions upon which my analyses will be based; on the other hand, it points to some open questions in frame theory which I will repeatedly address in the forthcoming chapters.

2.1 Löbner's theory of concept types

According to Löbner (2011), nouns can be semantically divided into four categories that correspond to four types of concepts. Löbner's theory of concept types was first approached in Löbner (1979). It was continued in Löbner (1985), where the original approach is related to definiteness. In Löbner (2011), the approach is also linked to grammatical determination. The following overview is based on Löbner (2011) and treats the introduction of the theory of concept types from a purely theoretical perspective. For a corpus-based approach to concept types, see Horn & Kimm (2014); for typological evidence, see Ortmann (2014); and for psycho-linguistic support, see Brenner et al. (2014) and Brenner (2016). I will restrict the overview to those aspects that are relevant for the analyses developed in this thesis.

2.1.1 Four types of nouns

Löbner (2013) holds a conceptual view on semantics according to which the meanings of words are concepts. In the following, I refer to concepts that represent the meanings of nouns and NPs as *nominal concepts*. Following Löbner (2011), nominal concepts can be categorized on the basis of two features: relationality and uniqueness. A nominal concept is relational iff its reference depends on the specification

of a possessor, and a nominal concept is unique iff it necessarily applies to exactly one referent in any appropriate context of utterance. Building on Löbner (2011), I mark (non)uniqueness as [±U] and (non)relationality as [±R]. Since both features are binary, the distinction results in four classes of nominal concepts, which Löbner refers to as *sortal*, *individual*, *relational*, and *functional*. Correspondingly, nouns are also called *sortal*, *individual*, *relational*, or *functional* iff they have sortal, individual, relational, or functional concepts as meanings, respectively.

- **Sortal nouns** "characterize their potential referents in terms of properties" (Löbner 2011: 280). "They can refer to any number of objects, including zero." They are [−U][−R]. Examples: *dog*, *table*, *house*.
- **Individual nouns** "assign a unique referent to every appropriate context of utterance" (Löbner 2011: 281). They are [+U][−R]. Examples: *pope*, *moon*, and also proper names.
- **Relational nouns** "characterize their referents in terms of a particular relation to some other object" (Löbner 2011: 281). If a possessor is given, they still may have zero, one or more than one referent. Thus they are [−U][+R]. Examples: *sister*, *finger*, and *member*.
- **Functional nouns** identify their referent uniquely depending on a possessor. According to Löbner (2011: 282), they "are restricted to a domain of appropriate possessors and of appropriate contexts of utterance." They act like functions in the mathematical sense in that they require a possessor as argument that they map to the referent as value. "The value for a given argument, in a given context of utterance, constitutes the uniquely determined referent of the noun" (Löbner 2011: 282). Thus they are [+U][+R]. Examples: *father*, *age*, and *president*.

According to (Löbner 2011: 280–282), the four noun types correspond to logical types as they are used in formal semantics in the tradition of Montague (1974). Since sortal nouns characterize their potential referents as having certain properties, they correspond to one-place predicates $\langle e, t\rangle$. By contrast, individual nouns are of the type e since they designate their referents uniquely. Relational nouns express a relation between two entities and are therefore two-place predicates $\langle e, \langle e, t\rangle\rangle$. Finally, functional nouns correspond to the logical type $\langle e, e\rangle$ because they identify their referent uniquely in relation to a possessor.

This noun distinction is "relativized by polysemy" insofar as "a noun represents a certain type only with respect to a given lexical reading" (Löbner 2011: 282). According to lexicon theory, each lexicalized meaning variant of a noun is assumed to have a separate lexical entry in the mental lexicon. In the lexical entries of each

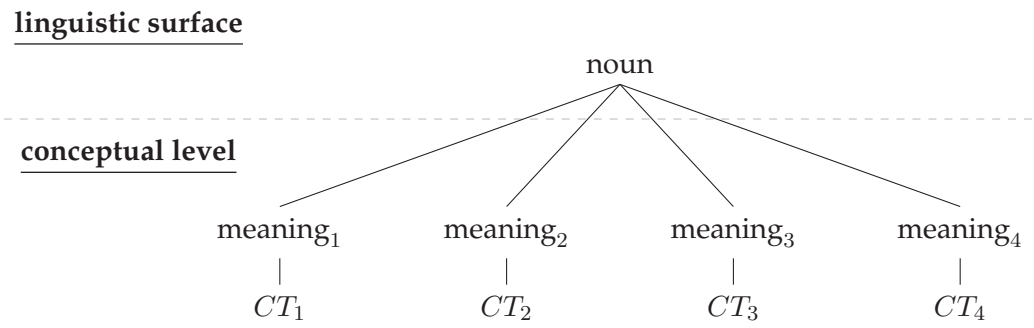


Figure 2.1 The relationship between a noun, its meaning variants, and their concept type (CT): In the case of polysemy, a noun has diverse meaning variants, where each meaning variant has one and only one concept type.

meaning variant, the features [±R] and [±U] cannot be left open, as Löbner (2011: Section 2.2, 2.3, 2.4) argues. The explanation he provides is this: The four types of concepts correspond to disjoint logical classes; i.e., one-place predicates in the case of sortal nouns, individual constants in the case of individual nouns, two-place predicates in the case of relational nouns, and function constants in the case of functional nouns. The defining properties of these logical classes constitute the meaning of sortal, individual, relational, and functional nouns, respectively. Consequently, it would not be possible to specify the lexical entry of the meaning variant of a noun without defining the aforementioned logical classes to which the noun in the given meaning variant belongs.

Figure 2.1 illustrates the relationships between nouns and their meanings: A noun can have multiple meaning variants, where each meaning variant has one and only one concept type. In order to organize the discussion about concept types more straightforwardly, I generally speak of *meanings of nouns* instead of the *meaning variants of nouns* for the sake of simplicity, and I use the term *meaning variant* only if I want to address a case of polysemy explicitly.

The correspondence between noun types and logical types suggests that relational and functional nouns are always binary; yet Löbner (1979: 37f) notes that there are also two-place functional nouns; e.g., *Unterschied* 'difference' or *Entfernung* 'distance.' An analogous result holds for relational nouns; e.g., *Kooperation* 'cooperation.' However, the noun distinction is not incomplete when considering the arguments of n-place functional or relational nouns, with $n > 1$, as n-tupels so that the n-place arity collapses to a unary arity.

2.1.2 Congruent vs. incongruent determination

Following Löbner (2011), the concept type of a noun correlates with the set of determinations in which the noun is preferred because its features of relationality and uniqueness are reflected in the preference of being used in possessive and definite determination, respectively. Sortal and individual nouns are both preferably used nonpossessively because both are nonrelational. However, they differ in that sortal nouns are preferably used indefinitely whereas individual nouns are preferably used definitely since sortal nouns are nonunique while individual nouns are not. What relational and functional nouns have in common is that they are preferred in possessive constructions due to their relationality, but they differ in that relational nouns are preferably used indefinitely and functional nouns definitely because relational nouns are nonunique and functional nouns are unique. The examples in (1) show the preferred use of sortal, individual, relational, and functional nouns.

(1) a. I found a stone.
b. The Pope is blessing the audience.
c. A member of the parliament invalidated his ballot paper.
d. Peter's mother is 42 years old.

However, sortal, individual, relational, and functional nouns can also be used in a nonpreferred manner and therefore in a way that is not in line with their concept type, as the examples in (2) demonstrate.

(2) a. My stone is yellow-striped.
b. A pope has to be a religious person.
c. The member has been relieved of his duties.
d. He is thoughtful like a mother.

Löbner (2011: 287), refers to the determinations in (1) as *congruent* and to those in (2) as *incongruent*. His basic idea on which the distinction builds is to consider grammatical determination as an operator on nominal meanings that may change the [±R, ±U] features. In congruent determination, the original values of these binary features, and thus the concept types of the nominal meanings to which the determination is applied, are maintained. By contrast, incongruent determination modifies one or both values of the binary features. In this case, the concept type of the nominal concept is shifted. Löbner (2011) refers to such shifts as *type shifts*.

Let us consider the examples in (2), where type shifts occur. In (2b), the individual noun *pope* carries indefinite determination. That is why the feature [+U] is converted into [–U], whereas the feature [–R] is maintained. Thus, the noun undergoes a type shift from individual to sortal. In (2c), the relational noun *member*

carries definite determination and does not have a possessor specification. Thus, its features [+R, –U] are changed to [–R, +U], and the noun undergoes a type shift from relational to individual. In (2d), the functional noun *mother* has indefinite and nonrelational determination. As a consequence, its features [+R, +U] are changed to [–R, –U]. Consequently, the noun undergoes a type shift from functional to sortal.

The example in (2a) is more complex than the former examples and requires some preliminary remarks. Since *stone* is a sortal noun, it has the features [–R, –U]. In particular, "no predefined possessor relation comes with the meaning of the noun": *my stone* can mean 'the stone I am holding in my hand,' 'the stone I threw,' 'the stone I am carving,' [...] and so on" (Löbner 2011: 286). Due to the expressed relation, the feature [–R] is shifted to [+R]. As Löbner (2011: 320) points out, personal pronouns tend to be interpreted uniquely. Thus, the original feature [–U] is also shifted to [+U]. Consequently, *stone* undergoes a type shift from sortal to functional.

Moreover, the analysis of example (2a) sheds light on a crucial difference between those relational and functional nouns that are originally of this type and those that are shifted to it. In the former case, the relationality is specified in the lexical entry of the nouns and thus provides a default interpretation for possessive constructions (Löbner 2011: 286). For instance, the NPs *my tooth* and *my mother* are per default interpreted as 'a tooth that has grown in the speaker's mouth' and 'the person that has given birth to the speaker.' By contrast, those nouns whose relationality results from a type shift, do not provide a default interpretation. In that case, possessive constructions are ambiguous, as in (2a). Table 2.1 lists the congruent determinations of each noun type in contrast to its incongruent determinations that evoke type shifts.

2.1.3 Inheritance of uniqueness and relationality for relational and functional nouns

This section deals with how the concept type of complex NPs arises compositionally from their ingredients. Before going into Löbner's (2011) explanation, let us consider the example below in order to illustrate the phenomenon on which we have to focus.

(3) The Pope's mother was born in Buenos Aires.

The noun *mother* is functional, whereas *pope* is individual. The former noun carries definite and possessive determination, while the latter carries absolute definite determination. Thus, both nouns are used congruently and maintain their concept type. The individual noun specifies the possessor argument of the functional noun. As individual nouns refer uniquely and the reference of functional nouns is determined uniquely by a given possessor, the referent of the whole NP is uniquely

	[−U]	[+U]
[−R]	**Sortal nouns** ✓ indefinite, plural, quantified, demonstrative ↱ singular definite ✓ absolute ↱ relational, possessive	**Individual nouns** ↱ indefinite, plural, quantified, demonstrative ✓ singular definite ✓ absolute ↱ relational, possessive
[+R]	**Relational nouns** ✓ indefinite, plural, quantified, demonstrative ↱ singular definite ↱ absolute ✓ relational, possessive	**Functional nouns** ↱ indefinite, plural, quantified, demonstrative ✓ singular definite ↱ absolute ✓ relational, possessive

Table 2.1 Concept types and their expected type of determination (Löbner 2011: 307): Congruent determination is marked by ✓ and incongruent determination by ↱.

determined. Thus, the NP as a whole is individual: it refers uniquely to a person without requiring arguments.

The NP in (3) has a simple structure in that it only consists of a possessor and a possessum. Beyond that, possessive constructions can be recursively iterated in many languages and thus be more complex. Löbner (2011: Section 4.3) provides a more general analysis of the compositional mechanisms based on which the concept type of an NP is fixed. The analysis addresses the conceptual level of interpreting possessive constructions in terms of concept types. Thus, if a language provides different realizations of possessive constructions, these constructions are considered as equivalent. For instance, English allows left and right possessives as well as mixed types; see the examples in (4a), (4b), and (4c), respectively. As all NPs in (4) express the relationship cousin $\xrightarrow{\text{of}}$ wife $\xrightarrow{\text{of}}$ father $\xrightarrow{\text{of}}$ Peter, they are assumed as equivalent in Löbner's (2011) approach.

(4) a. Peter's father's wife's cousin
b. The cousin of the wife of the father of Peter
c. The cousin of the wife of Peter's father

Let us, more generally, consider a possessive chain in the sense of Löbner (2011: 302) that consists "of a head (denoting the possessum), a possessor specification, and possibly recursively embedded further possessor specifications." According to

head	type	possessor	type	head with possessor	type
RC	[−U][+R]	SC	[−U][−R]	SC	[−U][−R]
RC	[−U][+R]	RC	[−U][+R]	RC	[−U][+R]
RC	[−U][+R]	IC	[+U][−R]	SC	[−U][−R]
RC	[−U][+R]	FC	[+U][+R]	RC	[−U][+R]
FC	[+U][+R]	SC	[−U][−R]	SC	[−U][−R]
FC	[+U][+R]	RC	[−U][+R]	RC	[−U][+R]
FC	[+U][+R]	IC	[+U][−R]	IC	[+U][−R]
FC	[+U][+R]	FC	[+U][+R]	FC	[+U][+R]

Table 2.2 Combination of noun types in possessive construction. The nouns can evoke sortal concepts SC, relational concepts RC, functional concepts FC, or individual concepts IC. The table is taken from Löbner (2011: 329).

the theory of concept types, the nonfinal elements are [+R] and thus relational or functional: the respective nouns are either originally of this type or as a result of a type shift triggered by the fact that they are used in the role of the possessum (Löbner 2011: 302). The final element in a possessive chain, however, has to be [−R] and thus sortal or individual, as Löbner (2011: 299) argues inductively: "The constraint [that referential NPs may not have open arguments] derives from the simple fact that the utterance meaning of an NP cannot be determined as long as there is an open possessor argument." The nonfinal elements which are either relational or functional nouns, transfer the features [±R] and [±U] in a systematic way, as is summarized in Table 2.2. Hence, functional nouns always inherit the concept type of the possessor. That is, they do not change, but transfer the features [±R] and [±U] of their possessors. By contrast, relational nouns only inherit the feature [±R] of their possessor, but not their feature [±U]. Instead, relational nouns lose the uniqueness of their possessors and thus always return the feature [−U], even if their possessors are [+U]. Consequently, relational nouns yield the possessive construction either to be sortal or relational (Löbner 2011: 303).

Based on the previous considerations, the concept types of possessive chains are easy to analyze. Example (5) shows the analysis of the NP in (3). To evaluate the concept type of the whole NP, the possessive chain is reversely analyzed according to Table 2.2, starting by the last element and ending with the final one. This leads to the result that the whole NP is individual.

(5) $\underbrace{\text{the } \underbrace{\text{mother}}_{[+U,+R]} \text{ of the } \underbrace{\text{pope}}_{[+U,-R]}}_{[+U,-R]}$

There are further processes that may operate on the concept types of possessive chains that have been arisen according to Table 2.2. For instance, applying these compositional rules to the NPs in (4) lead to [−U, −R]. Below, the NP in (4a) is analyzed. The analyses of (4b) and(4c) lead to equivalent results.

(6) $\underbrace{\text{Peter's}}_{[+U][-R]}\ \underbrace{\text{father's}}_{[+U][+R]}\ \underbrace{\text{wife's}}_{[+U][+R]}\ \underbrace{\text{cousin}}_{[-U][+R]}$

$\underbrace{\underbrace{\underbrace{\underbrace{\text{Peter's}}_{[+U][-R]}\ \underbrace{\text{father's}}_{[+U][+R]}}_{[-U][+R]}\ \underbrace{\text{wife's}}_{[+U][+R]}}_{[-U][+R]}\ \underbrace{\text{cousin}}_{[-U][+R]}}_{[-U][-R]}$

2.2 The representation of concepts in frames

The frame approach developed in Löbner (2017) enables a precise representation of nominal concepts and is moreover able to incorporate a representation of case frames in the sense of Fillmore (1968, 1976), which is useful for the analysis of deverbal nominals. The frame approach builds on the theory of Barsalou (1992a,b) and continues its first formalization by Petersen (2007) and Petersen & Osswald (2012). This section retraces how Löbner (2017) adopts Barsalou's cognitive-psychological theory into a representational format of concepts. Structurally, Section 2.2.1 summarizes the core statements of Barsalou's (1992a; 1992b) approach. Based on this, its adoption by Löbner (2017) is developed in the Sections 2.2.2 to 2.2.4. Finally, Section 2.2.5 discusses how Löbner's (2011) concept-type distinction can be incorporated into the frame approach. The incorporation builds on the results of Petersen (2007) and Petersen & Osswald (2012).

2.2.1 Barsalou's (1992b) frame theory

According to Barsalou (1992b), human thinking is organized in frames, understood as mental structures that represent individuals or categories. These structures are assumed to consist of four ingredients: attributes, values, structural invariants, and constraints. Attributes describe general properties of categories or entities, such as *color* or *age*, whereas values are specifications of attributes such as *red* or *15 years* (Barsalou 1992b: 31).[1]

[1] The definition of values as subordinated concepts of attributes given by Barsalou (1992b) lacks explanatory value, as Petersen (2007) points out. This is why I keep the description of attributes and values widely informal. The modeling of frames in the sense of Löbner (2017) avoids these problems.

Barsalou (1992b) leaves open the question as to which aspects attributes may potentially specify. Nevertheless, he distinguishes broadly between two types of attributes. The first type of attributes is what he calls *core attributes*. Core attributes specify aspects that are relevant for certain categories or entities in most contexts and are thus usually contained in the frames that represent those categories or entities (Barsalou 1992b: 34). Beyond that, Barsalou also assumes subjects to be able to generate attributes on the fly, if this is required by the given context. Due to the assumption of these noncore attributes (which are not referred to by a technical term), Barsalou assumes that the totality of potential attributes is unrestricted and, from time to time, depends on the context.

Structural invariants "represent relatively constant relations" (Barsalou 1992b: 37) and are, therefore, constitutive for the given kind of category or entity. Barsalou illustrates structural invariants by referring to the engine of a car. The information that the engine is operated by the car's driver (Barsalou 1992b: 30, 36), is contained in every frame that represents a car and cannot vary. In contrast to structural invariants which are constant, i.e., never-changing, relations in frames, constraints are dynamic relations that capture dependencies between the values of different attributes: For instance, the duration of a ride decreases when the velocity of the vehicle used for the ride increases, and vice versa.

One of the crucial points of the frame approach is the assumption that frames are recursive because values are represented by further frames (Barsalou 1992b: 40)[2]. For instance, the value *4-cylinder* specifying the *engine* attribute in the frame representing a car could be represented in a separate frame which contains information about its producer or its horsepower.

2.2.2 Frame structures and their associated frame graphs

Löbner's (2017) approach formalizes the basic ideas developed in Barsalou (1992b). Whereas Barsalou's description of frames remains vague in several points (Petersen 2007: 151), Löbner (2017) aims at a frame model that is defined as accurately as possible, specifically focusing on its application to semantic analysis. To this end, frames are defined as directed graphs whose nodes correspond to values and whose arcs correspond to attributes. So far, structural invariants and constraints are not implemented in this model. Nevertheless, the expressive power of this model satisfies

[2] Beyond that, Barsalou (1992b) assumes that attributes, constraints, and structural invariants are also represented by further frames. Löbner's (2017) frame model, however, only represents the recursiveness of values. As Petersen (2007) points out, this does not restrict the expressive power of the model.

the demands that are made on the analyses that will be developed in the following chapters.

In the most general sense, Löbner (2017: Definition 1 on page 101) defines frames as follows:

Definition 2.1 Frame structure
A frame structure is a sextuple $\langle V, r, A, \mathsf{att}, T, \mathsf{typ}\rangle$*, such that*

a. V *is a finite set of nodes.*
b. $r \in V$ *is a distinguished node, the "central node."*
c. A *is a finite set of edge labels.*
d. att *is a function that maps pairs of an* n*-tuple of nodes* ($n \geq 1$) *and an edge label on another node.*
e. T *is a set of type labels*
f. typ *is a partial function that assigns type labels to nodes.*
g. With $E =_{def} \{\langle \vec{x}, y\rangle \mid \exists a \in A\ \mathsf{att}(\vec{x}, a) = y\}$, $\langle V, E\rangle$ *is a connected digraph with* n*-to*1 *hyperedges* ($n \geq 1$).

Hence, a frame structure consists of individual terms and links between them, where the individual terms and the links constitute a network with a center. Note that the function typ may be empty. Consequently, assigning a class label to an individual term is always optional. Note, furthermore, that the definition allows frames that only consist of the node r. In Section 2.2.3, I will refer to frames consisting of exactly one node as *trivial frames*.

An example of a frame structure is given below.

V :	r, x, y, z
A :	ENGINE, PRODUCER, HORSEPOWER
T :	car, 4 cylinder, number, factory
att :	$\mathsf{att}(r, \text{ENGINE}) = x, \mathsf{att}(x, \text{HORSEPOWER}) = y, \mathsf{att}(x, \text{PRODUCER}) = z$
typ :	$\mathsf{typ}(r) = \text{car}, \mathsf{typ}(x) = 4\text{ cylinder}, \mathsf{typ}(y) = \text{number}, \mathsf{typ}(z) = \text{factory}$

Although it might be intuitively clear that the frame structure can be interpreted as a description of a car, it has to be noted that frame structures are symbolic: The labels as such do not have meanings before they are provided with an interpretation in the logical sense. Denotations are assigned to frame structures by the ontology that is addressed in Section 2.2.3. After assigning denotations to a frame structure, the frame structure corresponds to what Barsalou (1992a,b) considers as a frame in the first place, namely a representation of a category or an individual.

Frames as provided by Definition 2.1 can be depicted as frames in that each node in the graph corresponds to one and only one individual term of the frame structure. The elements in V, A and T serve as labels. The associated frame graph of the frame

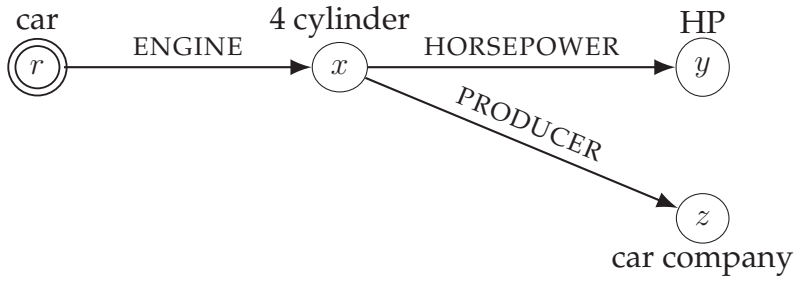


Figure 2.2 Example of an associated frame graph.

structure above is shown in Figure 2.2. In the graphical notation, elements of T, which can be considered as terms, are written at the top of the frame nodes. The central node of the frame structure is double-bordered. As already indicated, one may think of this node as the node that designates the object or category represented by the whole frame, when a denotation is assigned to it via an ontology. For instance, the frame graph in Figure 2.2 is going to represent the category of the objects that are considered members of the class of cars, if it is assigned to an appropriate ontology.

2.2.3 An ontology for frames

So far, I have dealt with individual terms, attribute labels, and class labels, given by the sets I, A, and C, respectively. These expressions are meant to denote individuals, attributes, and classes. In this section, I explain which objects they denote in order to develop an interpretation for the structures defined in the foregoing section. Before going into the technical details, I start with an informal explanation of the terms *individuals*, *attributes*, *sorts*, and *classes* in the sense of Löbner (2017: 101ff). These ideas build the cornerstone for defining an ontology for frames.

Attributes are understood as partial functions mapping individuals to individuals. Consequently, individuals are potential arguments or values of attributes. According to the terminology in formal semantics, the set of all individuals is referred to as *universe* U. Attributes can have unary or multiple arity. In the most general sense, they are partial functions $a : U^n \longrightarrow U$ with $n \geq 1$. Nevertheless, most attributes I use in this thesis will be one-place functions. An example is the partial function COLOR that maps material objects to their colors. Löbner (2017: 102f) assumes that the set of attributes is closed under functional composition. For instance, the attributes COLOR and HAIR can be composed to create the attribute HAIR COLOR. Furthermore, it is assumed that if an attribute is injective, its inversion is also an attribute. For instance, the attribute HEAD maps every subject to its head. Since a

head cannot be the head of multiple subjects, the attribute is injective. The inversion HEAD^{-1} maps heads to their possessors and is also an attribute.

Löbner (2017: 102f) postulates that the universe is partitioned into sorts in such a way that each individual is of one and only one sort. Examples for sorts are the sets of physical objects, numbers, or temperatures. Since an attribute $a : U^n \longrightarrow U$ is a partial function, it is usually not defined for all tuples $\langle x_1, ..., x_n \rangle \in U^n$. Rather, the i-th domain of a is restricted to individuals of the same sort.

Classes impose a type hierarchy in the sense of Carpenter (1992: 16f) on the universe. Formally, classes are subsets of U. In contrast to sorts, individuals may belong to more than one class. Moreover, there are no classes that contain elements of different sorts. Löbner (2017: 102f) postulates that the set of classes is closed under intersection as well as the image and preimage operation on attributes. For instance, the class of hair forms a subclass of the domain of the attribute COLOR.

To define an ontology formally, I make use of the following notation that builds on Löbner (2017: 103).[3]

Definition 2.2 Domain, co-domain
Let $f : A = \tilde{A}_1 \times \cdots \times \tilde{A}_n \longrightarrow B$ be a partial function. The domain $\mathsf{dom}(f)$, the i-th domain $\mathsf{dom}_i(f)$ and the co-domain $\mathsf{cod}(f)$ of f are

$$\begin{aligned} \mathsf{dom}(f) &:= f^{-1}(f(A)) = \{x \in A : \exists y \in B\, f(x) = y\}, \\ \mathsf{dom}_i(f) &:= \left(f^{-1}(f(A))\right)_i, \\ \mathsf{cod}(f) &:= f(A) = \{y \in B : \exists x \in A\, f(x) = y\}. \end{aligned}$$

Based on this, an ontology is given as follows. The definition is taken from Löbner (2017: Definition 2 on page 103) ($\mathcal{P}$ denotes the power set operator).

Definition 2.3 Sorted frame ontology
A sorted frame ontology $\mathcal{O}$ is a quadruple $\langle U, \mathcal{S}, \mathcal{A}, \mathcal{T} \rangle$ such that:

a. U, the universe, is a nonempty set of individuals.
b. $\mathcal{S}$, the system of sorts, is a partition of U: every individual in U belongs to exactly one sort in $\mathcal{S}$.
c. $\mathcal{A}$, the set of attributes, is a nonempty set of partial functions $\text{A} : U^n \longrightarrow U$. The attributes are restricted to sorts: For every $\text{A} : U^n \longrightarrow U$, there are sorts $\boldsymbol{s}_1, ..., \boldsymbol{s}_n, \boldsymbol{s} \in \mathcal{S}$ such that $\mathsf{dom}_i(\text{A}) \subseteq \boldsymbol{s}_i$ for $i = 1, ..., n$ and $\mathsf{cod}(\text{A}) \subseteq \boldsymbol{s}$.
d. $\mathcal{T}$, the set of types, is a proper subset of $\mathcal{P}(U)$: every type $\boldsymbol{t}$ is a subset of U. For every $\boldsymbol{t} \in \mathcal{T}$, there is an $\boldsymbol{s} \in \mathcal{S}$ with $\boldsymbol{t} \subseteq \boldsymbol{s}$: types contain individuals of only one sort.

Closure conditions on the set $\mathcal{A}$ of attributes

e. $\mathcal{A}$ is closed under functional composition.

[3] Definition 2.2 is also provided in the unpublished manuscript Löbner & Naumann (2014: 9).

f. If a one-place attribute $A \in \mathcal{A}$ is injective, there is a partial function $A^{-1} \in \mathcal{A}$, such that for every $x, y \in U, A^{-1}(y) = x$ iff $A^{-1}(x) = y$.

Closure conditions on the set $\mathcal{T}$ of types

g. Every sort is a type: $\mathcal{S} \subseteq \mathcal{T}$.
h. For every $x \in U, \{x\} \in \mathcal{T}$. $\{\{x\} : x \in U\}$ is the set of atomic tpyes in $\mathcal{T}$.
i. If $A \in \mathcal{A}, \boldsymbol{t} \in \mathcal{T}, \boldsymbol{t} \in \mathsf{dom}(A)$, then the image of $\boldsymbol{t}$ under A, $A[\boldsymbol{t}]$, is in $\mathcal{T}$.
j. For every $\boldsymbol{t}, \boldsymbol{t}' \in \mathcal{T}$, $\boldsymbol{t} \cap \boldsymbol{t}' \in \mathcal{T}$.
k. $\mathcal{T}$ contains no other types than those defined by (h)-(k).

Frame structures can be related to an ontology as follows (Löbner 2017: Definition 3 on page 104).

Definition 2.4 Frame structure related to an ontology
For a frame structure $\langle V, r, A, \mathsf{att}, T, \mathsf{typ}\rangle$ related to an ontology $\mathcal{O} = \langle U, \mathcal{S}, \mathcal{A}, \mathcal{T}\rangle$

a. The elements of V are variables for individuals in U;
b. The elements of A are labels for attributes in $\mathcal{A}$;
c. The elements of $\mathcal{T}$ are labels for types in $\mathcal{T}$.

In the following, I refer to frames that are related to an ontology as *ontologically specified*.

When frames are interpreted, individual terms, attribute labels, and class labels of ontologically specified frame structures denote individuals, attributes, and classes in the given ontology, respectively. For instance, in order to assign a meaning to the frame structure represented by the associated frame graph in Figure 2.2, one has to define which individuals the individual variables r, x, y, and z refer to, what the class of cars, 4 cylinder engine, HP, and factories are, and which attributes the attribute labels ENGINE, HORSEPOWER, and PRODUCER denote. Afterwards, the frame structure and its associated frame graph can be interpreted as the representation of an entity in or a category of the universe.

Since every individual $x \in U$ corresponds to the class $\{x\}$, frames for individuals can be represented in two ways: On the one hand, if there is an individual constant i that designates x, it is possible to label the node representing x with i. On the other hand, the node can be labeled with an individual variable and the class label that designates the class $\{x\}$. Figure 2.3 contrasts the two possibilities to represent an individual named *Peter*. However, in the following analysis, I always use the first possibility.

Convention 2.5 Representation of individuals in frames
Frame nodes representing individuals are always labeled with an individual label inside the node.

A Using individual terms. **B** Using class labels.

Figure 2.3 Two ways of representing individuals in frame graphs.

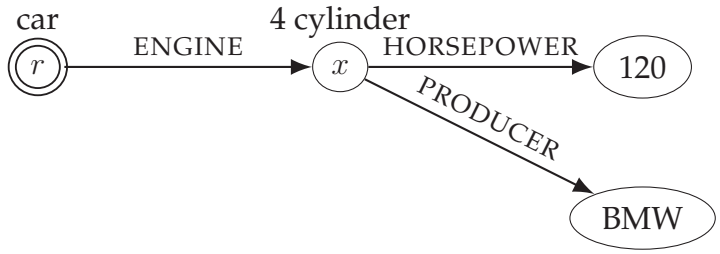


Figure 2.4 Individual constants as labels of nodes. Expressions for individual terms are used to label nodes. r and x are individual variables, whereas *120* and *BMW* are individual constants.

To represent individuals, the nodes are immediately labeled with appropriate individual terms, as in Figure 2.3A. When class labels are assigned to nodes labeled with individual variables, the resulting frame can be interpreted in such a way that these nodes are underspecified in such a way that they represent a nonspecific individual of a certain class, but it is unknown which individual is represented exactly. For instance, in Figure 2.4 the nodes *120* and *BMW* are labeled with individual expressions so that they denote uniquely determined individuals. By contrast, the x and the r node are labeled with individual variables and class labels. Thus, they have to be interpreted as nodes that represent entities of the sort of class or 4 cylinders, respectively, but does not limit which individual they denote specifically.

2.2.4 Attribute labels and functional nouns

Following Definition 2.3, attributes are partial functions that map individuals to individuals. Functional nouns behave very similarly because they identify their referent uniquely in relation to a possessor. More formally speaking, they assign a unique value to the possessors to which they can be applied. Hence, Petersen (2007) and Löbner (2015a) relate attributes to functional nouns in such a way that every functional noun corresponds to a potential attribute in frames. The opposite direction, however, does not hold: It is not assumed that every attribute corresponds to

a functional noun, because attributes can, in principle, be subject to lexical gaps. Since functional nouns correspond to frame attributes, they are potential labels of attributes in frame graphs. In the following, the correspondence of attribute labels and functional nouns is explicated in more detail.

As initially mentioned, functional concepts act like functions in the mathematical sense. Consequently, functional nouns can be considered as function constants whose arguments are specified by possessive constructions, as example (7) illustrates (the example is taken from Schulzek 2014: 230).

(7) $\underbrace{\text{Bart Simpson}}_{\text{argument } x}\text{'s}\ \underbrace{\text{mother}}_{\text{function } \mathcal{F}} \mapsto \underbrace{\text{Marge Simpson}}_{\text{value } \mathcal{F}(x)}$

Based on the idea that functional nouns designate functions in the mathematical sense, Petersen (2007: 162f) uses the notion of the relational and the denotational interpretation that was originally developed by Guarino (1992).[4]

Definition 2.6 Denotational vs. referential interpretation
Let $\mathcal{F}$ be a functional noun. The denotational interpretation $\mathsf{den}(\mathcal{F})$ *and the relational interpretation* $\mathsf{rel}(\mathcal{F})$ *of $\mathcal{F}$ are*

$$\mathsf{den}(\mathcal{F}) := \{y : \exists x\, \mathcal{F}(x) = y\}\,,$$
$$\mathsf{rel}(\mathcal{F}) := \{\langle x, y\rangle : \mathcal{F}(x) = y\}\,.$$

Hence, the denotational interpretation of a functional noun covers the set of its potential referents, whereas its relational interpretation reflects the relation between entities in the universe for which a referent is uniquely determined in a given context. For instance, the denotational interpretation of ›mother‹ is the set of all mothers, whereas its relational interpretation is the set of all tuples $\langle x, y\rangle$, where y is the mother of x. The set of these tuples is, mathematically speaking, the function that maps children to their mothers. In language use, functional nouns may be reduced to their denotational interpretation. For instance, in (8a), *mother* refers to women having children and thus to the denotational interpretation, whereas the relational interpretation is not relevant. In such cases, it is possible to reduce the meaning of functional nouns to their denotational interpretation via a type shift. In (8a), the noun *mother* undergoes a type shift from functional to sortal. In congruent use, the relational interpretation and the denotational interpretation always occur simultaneously. For instance, in (8b), the relational interpretation of *mother* determines the referent of the NP *Peter's mother* and enables the NP to refer to an entity of the denotational interpretation of the functional noun *mother*.

[4] Definition 2.6 is loosely based on Petersen (2007: 162f). Furthermore, it has to be noted that Guarino (1992) refers to relational nouns in a general sense and therefore not only to those that are additionally inherently unique. For this reason, his notation is similar, but not identical to the notation used here.

A Attributes as relationally interpreted functional nouns.

B Attributes as denotationally interpreted functional nouns.

Figure 2.5 Functional nouns as attribute labels.

(8) a. Not every mother is married.
b. Peter's mother is 42 years old.

According to Petersen (2007) and Löbner (2015a), attributes in frames are relational interpretations of functional nouns. Consequently, attributes reduce functional nouns to their relational interpretation. The co-domains of attributes are the denotational interpretations of the functional nouns to which the attributes correspond. For instance, Figure 2.5A shows a frame graph representing a red-colored car. The attribute COLOR is the relationally interpreted[5] functional noun *color*. The attribute maps the node representing the car to the node representing the car's color. The value *red* is permitted for the attribute because red is a color and thus belongs to the denotational interpretation of the functional noun *color*. The functional noun *color* serves as an attribute label in the frame graph. Furthermore, the distinction between the denotational and the relational interpretation of functional nouns justifies the fact that functional nouns can occur as labels for attributes and classes. As the frame graph in Figure 2.5B suggests: The attribute label COLOR denotes the referential interpretation of the functional noun *color*, whereas the class label ⌜color⌝ denotes its denotational interpretation, understood as the class of colors.

Since attributes correspond to relationally interpreted functional nouns, two questions I have left open so far are answered: First, the correspondence of attributes and functional nouns delivers a simple test to infer attributes in frames of nouns. If the noun is allowed to occur in possessor position of a functional noun, the attribute corresponding to the functional noun can be assumed as a potential attribute in the frame of the noun. For instance, the possessive construction *color of the car* suggests that COLOR is a potential attribute in the frame of *car*. Second, the correspondence of attributes and functional nouns clarifies which values an attribute can take: An attribute can take values that refer to the members of the denotational interpretation of its corresponding functional noun. Against this background, functional nouns

[5] Note that *relationally interpreted* refers to the relational interpretation in the sense of Guarino (1992), as introduced in Definition 2.6. It does not refer to the notion of relationality in the sense of Löbner (2011).

provide a metalanguage to label attributes: A frame-based description of meanings of words is expected to be a semantic decomposition in terms of functional nouns (provided that the respective attributes are not subject to lexical gaps).

2.2.5 Representing concept types in frames

As already mentioned, the approach of Löbner (2017) focuses strongly on frame representations for sortal concepts. The approaches used by Petersen (2007) and Petersen & Osswald (2012) deal with frames for individual, relational, and functional concepts. The aim of this section is to incorporate the general ideas of Petersen (2007) and Petersen & Osswald (2012) into the frame approach represented in the preceding sections.

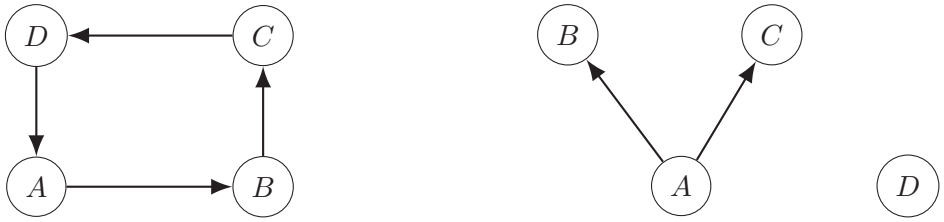
Although the frame definitions introduced by Petersen (2007) and Petersen & Osswald (2012) differ from those of Löbner (2017), the incorporation is possible because the approaches allow an interpretation of frames as connected directed graphs in which frame values are represented by nodes and frame attributes are represented by arcs. Thus, graph theory can be considered as a metalanguage for comparing the approaches and for relating them to each other. Thus, I will consequently speak of *edges* and *vertices* when dealing with these approaches, understood as representations of values and attributes, respectively.

Petersen (2007) and Petersen & Osswald (2012) represent different ways of modeling concept types frame-theoretically: Petersen (2007) develops an approach of how frames can be modeled by directed graphs, where different graph structures are related to certain types of concepts. However, Petersen & Osswald (2012) note that there are concepts that do not fit these correspondences between graph structures and concepts. Thus, Petersen & Osswald (2012) aim at a more general approach of how concept types can be distinguished in terms of frames. In the following, I will start by discussing these approaches in isolation. Afterwards, I will relate them to the slightly generalized frame approach of Löbner (2017), which has been introduced so far.

When considering the approaches of Petersen (2007) and Petersen & Osswald (2012), it has to be noted that the authors do not distinguish between class and individual labels. When discussing their approaches, I will respect their notation, i.e., I will write the class as well as individual labels inside the nodes.

2.2.5.1 The approach of Petersen (2007)

In this approach, Petersen develops frame representations for sortal, relational and functional concepts, whereas individual concepts are ignored. She postulates that



A A graph in which every node is a root. **B** A graph with two sources, but no roots.

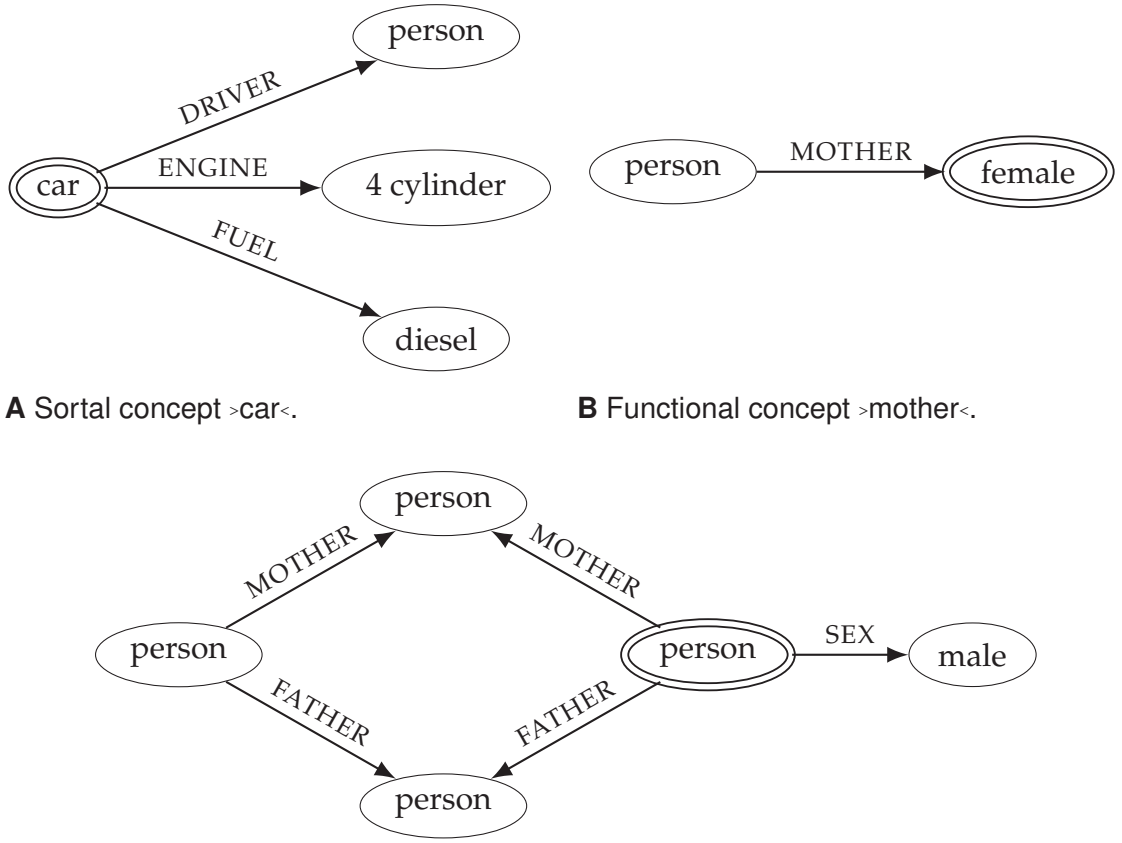
Figure 2.6 The occurrence of nodes and sources in graphs.

frame graphs for sortal, relational, and functional concepts differ in their structure. The distinction of different structures builds on the notion of *root* and *source* nodes (Petersen 2007: 157). Roots are those nodes from which every node in a graph can be reached. By contrast, sources are those nodes that do not have ingoing arcs. For instance, the nodes A, B, C, and D in the graph shown in Figure 2.6A are roots because each node can be reached from them. However, none of the nodes is a source because every node has an ingoing arc. By contrast, the graph in Figure 2.6B does not contain roots because there is no node from which every node can be reached. Certainly, the graph has two sources, namely, the nodes A and D because they do not have ingoing arcs.[6]

The notion of roots and sources builds the starting point for Petersen's (2007) characterization of frame graphs for sortal concepts. Note Petersen (2007: 157) only deals with acyclic frame graphs; i.e., the reference of sortal concepts is assumed as independent from the existence of another object. Afterwards, frame graphs of relational and functional concepts are characterized in comparison to frame graphs of sortal concepts. Frame graphs of sortal concepts are considered as containing a central node that is a source as well as a root (Petersen 2007: 157f). An example is shown in Figure 2.7A. However, the author does not provide evidence for the thesis that sortal concepts are always structured this way, but only illustrates it via examples. Presumably, frame graphs for sortal concepts are assumed to be structured this way because they describe their potential referents in terms of properties that are frame-theoretically represented by attributes specifying values of the central node.

Frame graphs of functional concepts are considered as differing fundamentally from those of sortal concepts because their central nodes are not a source. Instead, they have an ingoing arc that starts from the node representing the possessor argument of the functional concept. Figure 2.7B, for instance, shows the frame graph of

[6] Note, however, that the example in Figure 2.6B does not represent a frame graph because the definition of frames graphs excludes the occurrence of isolated nodes. This holds for the definitions provided by Löbner (2017), Petersen (2007), and Petersen & Osswald (2012).



A Sortal concept ›car‹.

B Functional concept ›mother‹.

C Relational concept ›brother‹.

Figure 2.7 Representing sortal, relational, and functional concepts in frames according to Petersen (2007).

the functional concept ›mother‹. The frame graph contains a MOTHER attribute that describes a child-mother relation. The attribute starts from the node representing the possessor of the concept and ends in the node representing its referent. The assumption that the described structure is prototypical for frame graphs representing functional concepts is motivated by the correspondence between frame attributes and functional nouns, which was already discussed in Section 2.2.4.

The characterization of frame graphs of functional nouns does not exclude the possibility that the central node may be a source. This could be the case, for example, if the possessor node can be reached from the central node via a chain of attributes. The frame graph would contain a circle, because there is a link from the possessor node to the central node and vice versa. Such examples are not considered in Petersen (2007: 157), however, because she focuses only on acyclic frames.

Frame graphs of relational concepts are assumed to differ from sortal and funtional concepts because they have two sources that represent the referent and the possessor of the concept (Petersen 2007: 158f). These nodes are not immediately

linked and have to represent different entities (Petersen 2007: 159). An example is given in Figure 2.7C, where ›brother‹ is described as a male person that shares his parents with another person, specified by the possessor of the concept ›brother‹. "Since the relation between a person and his or her mother (or father) is a many-to-one relation, the *brother* frame does not set up a functional relation between the possessor argument and the referents of the central node." (Petersen 2007: 159) However, the postulated structure of frame graphs of relational concepts is not motivated based on properties of relational concepts, but only illustrated by the example of the *brother* frame. Thus, it is in dispute whether the structure is the only possible one.

The structural properties proposed by Petersen (2007) can be summarized as follows. Note that the postulates are assumed to hold only for acyclic frames graphs.

Postulate 2.7 Structure of sortal frame graphs
In sortal frames, each node can be reached from the central node. The central node does not have ingoing arcs.

Postulate 2.8 Structure of functional frame graphs
There is an attribute that starts from the node representing the argument of the functional noun and ends in the central node.

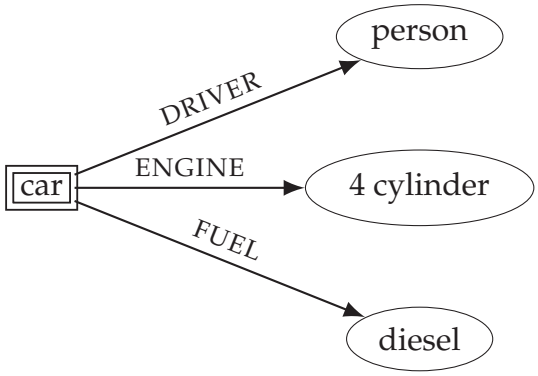
Postulate 2.9 Structure of relational frame graphs
The central node and the node representing the argument of the relational concept are not immediately related by a chain of attributes, but rather via a further node to which both, the possessor and the central node, are linked.

In the following chapters, I will critically discuss these postulates.

2.2.5.2 The approach of Petersen & Osswald (2012)

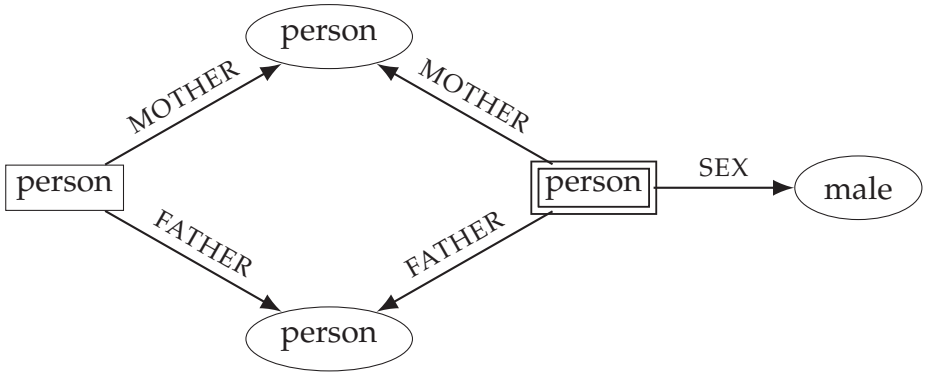
Petersen & Osswald (2012) develop a frame-based characterization of concept types that builds on the distinction between different types of nodes. Rectangular nodes are used to represent semantic arguments of concepts, whereas nodes that represent individuals are marked by an arrow pointing to them. According to Petersen & Osswald (2012), rectangular nodes correspond to λ-bound variables, as they are used in formal semantics to mark open arguments, while the uniqueness marker corresponds to ι-bound variables. Figure 2.8 translates the frames shown in Figure 2.7 into the described notation. Beyond that, Figure 2.8D exemplifies the frame of an individual concept. Frame graphs for individual concepts are not addressed in Petersen (2007), but only in Petersen & Osswald (2012).

Sortal concepts have a referential argument, but not a relational one. Thus their frame graphs contain exactly one rectangular node (see Figure 2.8A). By contrast, functional concepts have a referential and a relational argument. Consequently, their



A Sortal concept ›car‹.

B Functional concept ›mother‹.

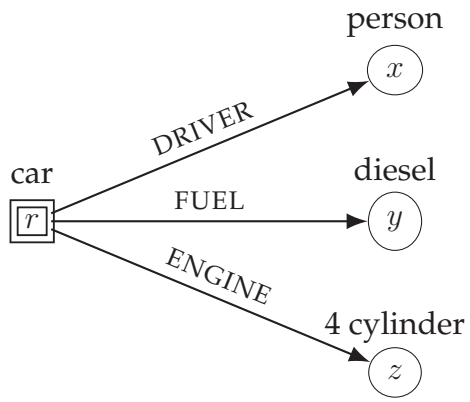


C Relational concept ›brother‹.

D Individual concept ›pope‹.

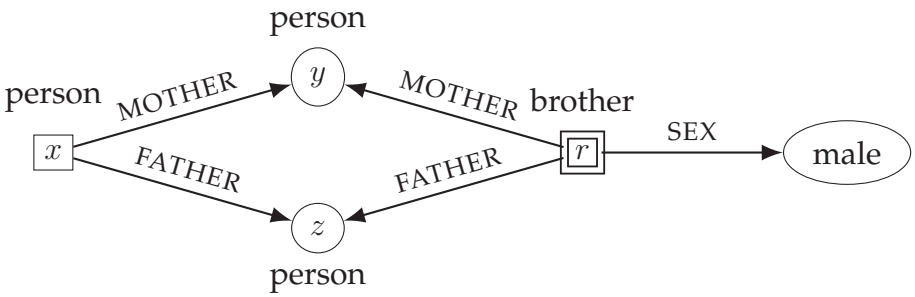
Figure 2.8 Representing sortal, individual, relational, and functional concepts in frames according to Petersen & Osswald (2012).

frame graphs have two rectangular nodes (see Figure 2.8B). This also holds for the frame graphs of relational concepts (see Figure 2.8C). However, according to Petersen & Osswald (2012: Section 3), the frame graphs of functional and relational concepts differ in that only the frame graphs of functional concepts contain an arc that links the node representing the possessor to the central node. This is motivated by the fact that attributes are functions so that the value of the possessor node determines the value of the central node uniquely. Since individual concepts represent entities that are unique in every context of utterance, the central node of their frame graphs is marked with a uniqueness marker (see Figure 2.8D).



A Frame of the sortal concept ›car‹.

B Frame of the functional concept ›mother‹.



C Frame of the relational concept ›brother‹.

D Frame of the individual concept ›pope‹.

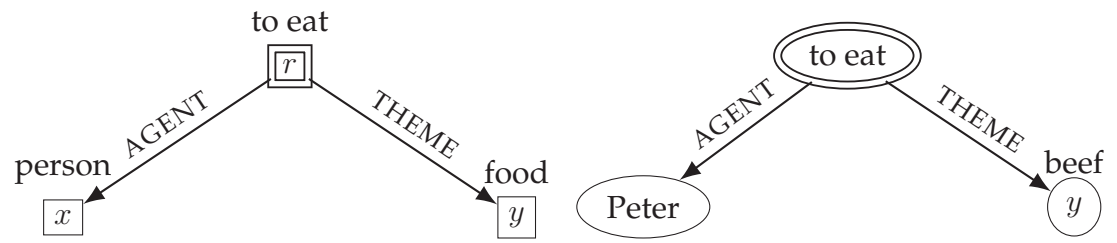
Figure 2.9 The representation of syntactically obligatory arguments. Rectangular nodes mark that the representatives have to be specified in context.

2.2.5.3 Adoption of the approaches

The frame approach developed in Section 2.2.2 to 2.2.4 distinguishes between individual labels and class labels. In line with Convention 2.5, nodes representing individuals can be separated from those carrying unspecified values. Consequently, the introduction of a uniqueness marker is not necessary.

However, the frame approach does not mark semantic arguments. Thus, the adoption of the notion of rectangular nodes in the sense of Petersen & Osswald (2012) offers additional information that is not inherent in the frame approach of Löbner (2017). Figure 2.9 translates the examples provided by Figure 2.8 into the frame model that I will use in the following analyses.

The use of rectangular nodes to mark open arguments allows, furthermore, a



A Frame with open arguments. **B** Saturation of arguments.

Figure 2.10 Rectangular nodes for marking open arguments in frames.

precise frame-theoretic description of the case frames of verbs. Figure 2.10A shows the frame graph of the verb *to eat* that requires an AGENT and a THEME argument. Since θ roles can be specified no more than once, they are partial functions and thus well-defined attributes. The central node is also rectangular because it represents the referential argument.

According to Petersen & Osswald (2012: Section 3), rectangular nodes are transformed into round nodes when the arguments they represent are saturated. For instance, Figure 2.10B represents the meaning of *Peter is eating beef* that expresses that an individual named Peter eats an entity that belongs to the class of beef.

Whether frame graphs of sortal, individual, relational, or functional concepts have characteristic structures, as postulated in Petersen (2007), is still matter of discussion. The structure that Petersen (2007) proposes as prototypical for frame graphs of functional concepts follows from the correspondence between functional nouns and frame attributes. Whether there is a characteristic structure of frame graphs representing sortal and relational concepts will be a permanent topic in the following analyses.

3 Metonymy

This chapter aims at an analysis of metonymically used nouns in terms of concept types and frames. Section 3.1 specifies which phenomena are usually considered as metonymy. I will demonstrate that although it seems to be intuitively clear what metonymy is, it is hard to explicate which necessary and sufficient conditions metonymy requires. Section 3.2 deals with Löbner's (2013) frame-based approach to metonymy. This approach provides necessary conditions for metonymy that have not been explicated in previous approaches. Finally, Section 3.3 presents a frame analysis of metonymy whose aim is threefold: First, it investigates whether the necessary conditions postulated by Löbner (2013) are valid; second, it illustrates the extent to which metonymy provides an insight into the attributes frames contain; and third, it explains some new aspects of metonymy that are revealed by modeling metonymies in frames. The investigated examples are predominantly taken from the research literature on metonymy and the Leipzig Corpora Collection (LCC), a collection of randomized sentences from German fictional texts, newspapers, and new magazines.

3.1 State of the art

The aim of this section is to provide a definition of metonymy that is as rigid as possible. The results of this section will provide the starting point for frame-based considerations on metonymy.

3.1.1 Metonymy as nonliteral meaning

According to its most general understanding, metonymy is a meaning shift that results in expressions that do not refer to their literal referents but rather to entities that are thematically related to them. Examples are given below. In (1a), the noun *university* does not refer to an educational institution but to the lectures that take place at this institution; in (1b), the proper name *USA* is not used to refer to the American states, but to their government or population; and in (1c), the noun *wheels* does not refer to certain parts of a vehicle, but rather to the vehicle as a whole.

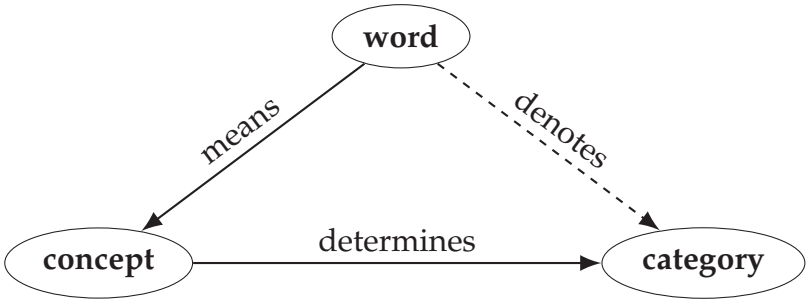


Figure 3.1 The semiotic triangle according to Löbner (2013: 24).

(1) a. The university starts early in the morning.
b. The USA is afraid of terrorism attacks.
c. Let's cruise in my new wheels.

Using the semiotic triangle depicted in Figure 3.1, it is possible to provide a more precise rendering of what metonymy actually is. The relations the triangle illustrates are these: According to Löbner (2013: Chapter 2), the meanings of lexemes are concepts. These concepts, in turn, describe a category of entities in the world. The category is the denotation of the lexeme. It determines its potential referents.

In Figure 3.1, the *denotes* relation is marked by a dashed arc to illustrate that the lexeme does not denote the category immediately. Rather, the lexeme is able to denote the category because of the concept that constitutes the meaning of the lexeme. Since metonymy allows expressions to refer to entities that do not belong to their denotation, metonymy has to be an operation that modifies, or substitutes, concepts and thus the meanings of lexemes in such a way that the denotation of the lexemes changes. These considerations lead to the distinction between the literal and the metonymic referents of lexemes. The *literal referents* belong to the denotation of a lexeme, whereas the *metonymic referents* are the entities to which the lexeme refers as a result of a metonymic shift. Based on these terms, Löbner (2013: 52) defines metonymy at the level of word meaning as follows.

Definition 3.1 Metonymy
An expression is used metonymically if it is used to refer to things that, in some sense, belong to the kind of objects to which the expression refers in its literal meaning.

In (1), it seems to be clear how the metonymic and the literal referents are related. However, to explicate more generally what do it means that the metonymic referent "belongs" to the literal referent, is a challenging task in semantics. Since Definition 3.1 postulates a thematic relation between the metonymic and the literal referent; it suggests that metonymy is subject to single members of denotations and not to denotations in general. To clarify what this means, let us consider the example in (1c),

where *wheels* is used to refer to a vehicle. Trivially, the metonymy is only possible if the wheels are part of the vehicle referred to. Certainly, the metonymy would not be possible if the wheels were not mounted on it. Thus, the knowledge that sails are usually part of boats is not sufficient for the metonymy. It is also necessary that the sail referred to is part of a boat in the context of utterance. Thus, the relation on which the metonymy is based concerns a single case of reference.

Since metonymy relates to single cases of reference, it is not surprising that the relations underlying metonymy may depend strongly on extralinguistic, or situational, knowledge. Let us consider the example below, where the name of the US newspaper *Times* is used to refer to a representative.

(2) The Times has just arrived at the press conference. (Barcelona 2002: 221)

The relationship of the metonymic referent and the literal referent depends on the situation in which (2) is uttered. For instance, *Times* may refer to the Times journalist who is awaited at the contextually determined press conference. Similarly, it would be possible that the individual noun refers to a group of people, including a journalist and a photographer. What matters is that the journalists work for the Times and officially represent it in this situation. Moreover, it may also be possible that the Times has been involved in a scandal and thus intends to talk to the public via an official representative. In this context, *Times* presumably refers to a press officer who is awaited by several journalists from other newspapers and magazines. The discussed relations between the literal referent and the metonymic referents are bound to concrete situations. This is what I mean when stating that the relation on which the metonymy is based concerns a single case of reference.

Figure 3.1 illustrated the denotational aspects of lexemes and therefore does not take reference into account. By contrast, Figure 3.2 applies to the referential use of words. According to the previous considerations, this is the level in which metonymy occurs. Metonymy is a shift that transfers concept A onto concept B. The shift is possible because the referents A and B are related via a real-world relation. The real-world relation is represented by a conceptual relation that links the concepts A and B. Using common terminology, I refer to concept A as the *source concept* and to concept B as the *target concept* of the metonymy. The conceptual relations that provide access to metonymy will be referred to as *metonymic relations*.

The examples discussed so far always contain nouns used metonymically. Beyond that, authors like Warren (2002) point out that metonymy is not restricted to this grammatical category. For instance, the main verb in (3) not only refers to the action of calling a taxi, but more generally to a sequence of related events, including the actions of calling a taxi, riding in it, and paying the taxi driver, among other things. In the following, I do not deal with the metonymic use of verbs, however, but restrict the analysis to the metonymic use of nouns.

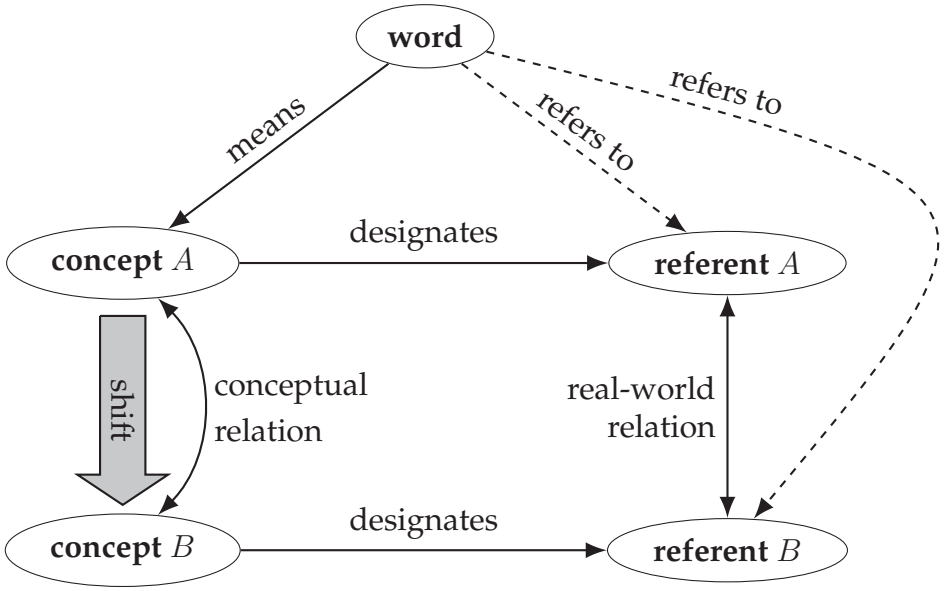


Figure 3.2 The semiotic triangle of reference for a word in metonymic use. The representation of the semiotic triangle at the top of the figure is cited from Löbner (2013: 24). Its expansion to metonymic use has been made by the author of this thesis.

(3) I'm going to call a taxi.

The notion of metonymy originated in antique rhetoric, where *metonymy* was first used as a technical term (for a detailed overview see Eggs 2000). The first known description is given in the "Rhetorica ad Herennium" (Nüßlein 1994: IV, 32, 43), written by an unknown author in the 1st century BC. According to this source, metonymy means taking from near and close objects ("rebus propinquis et finitimis") the name by which one can understand the thing whose real name is not used. The description already addresses the referential aspects of metonymy that have been discussed so far. What is missing, however, is the reference to the conceptual aspects of metonymy. These were discussed first in linguistics. At the end of the 19th century, the notion of metonymy was adopted in linguistics when Paul (1886) and Reisig (1972: first print in 1881) used the term *metonymy* to designate phenomena in semantic change that are close to what antique rhetoricians called *metonymy*. Later, in the 1950s, Jakobson (1974: first print in 1954) postulated that metonymy underlies a general principle of human thinking, namely recognizing relationships between entities in the world. Jakobson's (1974) description of metonymy seems to be similar to what has been characterized as "near and close" in metonymy, but differs in one crucial point: Whereas rhetoricians in antiquity speak of "near and close" with respect to the entities that words in their literal and their metonymic meaning designate and thus address the referential level of word meaning, Jakobson is interested

in how the recognized relationships are mentally accessed and thus addresses the conceptual level of word meaning. According to Dirven & Pörings (2002: Preface), Jakobson's work has strongly influenced the modern notion of metonymy as a conceptual shift, as described above. In this sense, I will focus on the conceptual aspects of metonymy in the following analysis that enable referential shifts.

In the literature (the antique as well as recent writings), metonymy is usually bordered by two rival types of meaning shifts, metaphor and synecdoche. Like the term *metonymy*, the terms originated in antique rhetoric and were adopted in linguistics afterwards. Metaphor is also addressed by Jakobson (1974) who assumes that, beyond recognizing relationships between entities, there is a further general principle of human thinking, namely recognizing similarity. The author postulates that similarity gives access to metaphor. Löbner (2013: 53) defines metaphor as follows.

Definition 3.2 Metaphor
An expression is used metaphorically if it is used to refer to things that are in crucial aspects similar to the kind of objects to which the expression refers in its literal meaning.

For instance, in (4a) a quiet, but also mysterious person is characterized in comparison to a book that is closed so that its content is not accessible. And in (4b), Caesar is characterized as having some characteristics that are usually attributed to the actor Chuck Norris.

(4) a. He is a closed book.
b. Caesar was the Chuck Norris of antiquity.

Moreover, it is also assumed that metaphor and metonymy may occur simultanously, as in (5). Here, expressing that the subject referent is angry by the phrase *to hit the roof*, involves metonymic as well as metaphoric aspects: The symptom of an emotion is metaphorically described, and the expressed symptom stands metonymically for the emotion as such.

(5) He hits the roof.

To capture the simultaneous occurrence of metaphor and metonymy, Goossens (2002) uses the term *metaphtonymy*. In the following, I will only deal with metonymies that do not contain metaphoric elements.

Synecdoche is assumed to be a meaning shift that is based on part-whole relations. An example was already given in (1c), where wheels, as a part of a vehicle, refers to the whole vehicle. It is also possible that the name of the whole is used to refer to a part of the whole, e.g., using *America* to refer to the USA. It is still in dispute whether synecdoche is a subtype of metonymy (Jakobson, 1974; Lakoff & Johnson,

1980; Dirven & Pörings, 2002) or a separate phenomenon (Seto, 1999). Certainly, the majority opinion seems to prefer the former. Approaches like that of Seto (1999) differentiate between synecdoche and metonymy because they come up with more specific, and not generally accepted, definitions of metonymy. Since synecdoche is subsumed by Definition 3.1, I do consider synecdoche as a subtype of metonymy.

3.1.2 The notorious examples

In the following, I will discuss some examples that are often considered as prototypical in the literature on metonymy. The examples serve to illustrate the conceptual relations that may underlie this phenomenon. Moreover, metonymy is sometimes used as a technical term for phenomena that are not in line with the properties of metonymy that were stated in the previous section. Based on examples, I will argue why I exclude such cases from my analysis. Thus, the following discussion pursues not only the goal to illustrate my object of investigation more closely, but also to delimit it more precisely.

In the literature, examples of metonymy are often grouped based on the metonymic relations underlying the different cases of metonymy. Below, I provide an overview about the metonymic relations discussed in the literature. Authors usually express metonymic relations by "A for B" paraphrases, where A describes the source and B the target concept of metonymy; e.g., *container for content* that substitutes metonymies where the name of a container is used to refer to the container's content as in *to drink a glass*. Such paraphrases also occur in modified variations. For instance, Warren (1999) uses a verbal paraphrase; e.g., "B is contained in A." What these paraphrases have in common is that they aim at defining subclasses of metonymy, based on the relations underlying it.

The paraphrases listed in the literature differ in their specifity. For instance, Warren (2002) considers only one paraphrase to capture cause-effect relations, whereas Kövecses & Radden (1998); Radden & Kövecses (1999), who come up with a very fine-grained synopsis of paraphrases, distinguish five subtypes of cause-effect relations. In the following, I will discuss the paraphrases provided by Kövecses & Radden (1998), enriched with paraphrases taken from Radden & Kövecses (1999), Radden (2002), and Löbner (2013). In the process, I focus only on those metonymies that are exemplified with noun meanings. The examples I do not consider can be divided into two types:

- Metonymies that seem to be restricted to verbs or verbal phrases

  These cases are similar to the *Taxi* example in (3) where a single event stands for a sequence of events, or to the example in (5) where an action stands for the emotion effecting it.

- Metonymies that involve derivational processes

  This class can be subdivided into two cases, namely (English) conversion where a verb is derived from a noun such that the name of an object involved in an action is used to refer to the action as such (*to blanket the bed*; example cited from Kövecses & Radden 1998: 54), and deverbal nominalization where the name of an action is used to refer to one of its arguments (*to inform >> informer*; example cited from Kövecses & Radden 1998: 54). Here, I am not sure whether the mechanisms are completely comparable to those in metonymy. In Chapter 4, I will argue that deverbal nominalization involves conceptual operations that are close to metonymy, but not identical to it.

Typical examples that occur frequently in the literature are part-whole metonymies like the ones below where the name of the whole is used to refer to one of its parts, and vice versa.

(6) Whole for part (*America* for *United States*)

(7) Part for whole (*England* for *Great Britain*)

The examples below are based on cause-effect relations. Although the examples below are listed separately by Kövecses & Radden (1998), the examples in (9) and (10) constitute subtypes of (8). This illustrates that the paraphrases do not constitute disjoint categories.

(8) State/event for the thing/person/state that caused it (*She was a success*, *he was a failure*, *she is my ruin*)

(9) Emotion for cause of emotion (*you are my joy*, *she is my hope*, *you are my pride*)

(10) Mental state for object/person causing it (*trouble* for 'thing/person causing trouble')

Moreover, producers can be used to refer to their products as in (11). Beyond that, Kövecses & Radden (1998) list examples like those in (12) where the name of a place of origin is used to refer to the products. These cases seem to be the result of the intentional naming of the products. This is why I do not include such cases in my analysis, although a referential shift is involved.

(11) Producer for product (*a Ford*)

(12) Place for product made there (*mocha, java, china*)

A special case of producer-product relation is given when the name of an author is used to refer to a piece of work the author has written.

(13) Author for his work (*We are reading Shakespeare*)

In the examples below, the source and the target concept are related via a causal relation of actions or possession.

(14) Controller for controlled (*Schwarzkopf defeated Iraq*)

(15) Controlled for controller (*The Mercedes has arrived*)

(16) Possessor for possessed (*This is Harry* for 'Harry's drink')

(17) Possessed for possessor (*He married money* for 'someone who has money')

The following example has already been mentioned: the name of a container is used to refer to its content. The opposite direction is also possible: The name of the content may be used to refer to the container.

(18) Container for content (*glass* for 'wine')

(19) Content for container (*the milk tipped over*)

In the paraphrases below, Kövecses & Radden (1998: 53) speak of *categories*.

(20) Category for defining property (*jerk* for 'stupidity')

(21) Defining property for category (*blacks* for 'black people,' *He talked to celebrities*)

Furthermore, the names of places can be used to refer to the inhabitants of these places or to the institutions located there. In both cases, the opposite direction is also possible, as the examples below suggest.

(22) Place for inhabitants (*The whole town* for the people)

(23) Inhabitants for place (*The French hosted the World Cup soccer games*)

(24) Place for institution (*Cambridge* for 'Cambridge University')

(25) Institution for place (*University* for 'campus')

In political journalism especially, but also in daily speech, the names of institutions can be used to refer to their representatives.

(26) Institution for people responsible (*The White House didn't say anything*)

Several objects are made for specific purposes, understood as actions that can be done with the object. In cognitive psychology and philosophy, such actions are captured by what is called *affordances* that will be introduced in the context of event attributes (see Section 3.3.5.2). It is possible to refer metonymically to the agent of such an action by naming the object involved in the action.

(27) Object used for user (*Please, bring the piano a glass of wine*)

Beyond that, Löbner (2013) lists the following three types of metonymic relations.

(28) Event for person involved (*His last date was in a bad temper*)

(29) Carrier for content (*The book is a history of Iraq.*)[7]

(30) Clothing for wearer (*Green Berets*)

The examples so far, illustrate the broad variety of relations that give access to metonymy. Beyond that, as initially mentioned, Kövecses & Radden (1998) also give examples that I do not consider as metonymic. In the following, I address them briefly.

Kövecses & Radden (1998); Radden & Kövecses (1999) consider cases like those in (31) and (32) as metonymic. The reason why the authors consider these cases as metonymic is that a category stands for an element of the category and vice versa. This is a class-member relation and thus a relation between the denotation and a single potential referent of a word. Hence, a referential shift is not involved. This is why I do not consider the examples in (31) and (32) as metonymic.

(31) Generic for specific (*boys don't cry*) (Radden & Kövecses 1999: 34)

(32) Specific for generic (*The/A spider has eight legs*) (Kövecses & Radden 1998: 67)

In (33), the reference of the noun underlies a count-mass shift. By contrast, a referential shift is not involved so that I exclude such examples from the following analysis. However, a referential shift seems to be involved in (34). The opposite direction is thus supposed to give access to metonymy.

(33) Object for material (*There was cat all over the street.*) (Kövecses & Radden 1998: 51)

(34) Material for object (*wood* for 'forest') (Kövecses & Radden 1998: 51)

In (35) and (36) the denotation of words is expanded and restricted, respectively. This is also an operation on denotations that do not take a single referent into account. For this reason, I do not consider them as metonymic.

(35) Member of a category for the category (*aspirin* for 'any pain-relieving tablet') (Kövecses & Radden 1998: 53)

(36) Category for member (*pill* for 'birth control pill') (Kövecses & Radden 1998: 53)

Note that there are several authors that consider category extension as metonymic (Taylor, 2002). This is supposed to underlie an inflationary use of the term *metonymy*. By contrast, I aim at a more restricted, and clearly defined, notion of metonymy.

[7] The example is taken from Croft (2002: 179). The example originally provided by Löbner (2013) is *I wrote a paper*. However, I do not assume that the reference of *paper* is shifted. Thus, a metonymy is not supposed to take place.

3.1.3 Metonymy as a repair mechanism

According to Löbner (2013: 55), the "driving force of [...] meaning modifications" in general, to which metonymy belongs, is the *principle of consistent interpretation*. Its definition builds on Löbner's distinction between *expression meaning* and *utterance meaning*. Expression meanings are "[t]he meanings of words, phrases and sentences, taken out of any particular context" (Löbner 2013: 3). The expression meaning of complex expressions is assumed to arise compositionally from the lexemes they contain and the way in which they are combined. By contrast, the utterance meaning of an expression "comes about when a sentence with its expression meaning is actually used in a concrete context and all references get fixed" (Löbner 2013: 4). Based on this, Löbner (2013: 55) defines the mentioned principle as follows.

Definition 3.3 Principle of consistent interpretation
At the level of utterance meaning, a composite expression is always interpreted in such a way that its parts fit together and that the whole fits the context.

I that case, meaning modifications like metonymy are assumed to arise if the principle of consistent interpretation would otherwise be violated: The meanings of atomic lexemes within a complex expression that prohibit a consistent interpretation are modified in such a way that the whole expression can be reinterpreted consistently. In terms of Löbner (2013: 56), "the sentential context triggers meaning shifts in order to make all parts of the sentence fit together." From this angle, metonymy is a repair mechanism that ensures the consistent interpretation of sentences that do not fit the context.

A typical case in which the sentential context triggers meaning shifts occurs when selectional restrictions in the sense of Löbner (2013: Section 5.7) are not fulfilled. As *selectional restrictions*, the author understands logical restrictions for the arguments of a predicate expression that are grounded in its lexical meaning. For instance, the verb *to answer* requires an animate subject referent. Since the subject referent in (37) is not animate, the selectional restrictions of the main verb are not fulfilled. Consequently, the parts in the sentence cannot be related consistently, and *university* is reinterpreted as 'representative of the university.'

(37) The university has answered.

Löbner (2013: Chapter 1) holds a strongly compositional view on complex expressions: Their interpretation is considered as a bottom-up process, starting with the lexical meanings of their ingredients and combining them successively to a complex meaning. In the following, I refer to the compositional interpretation of a complex meaning that is only based on the lexical meanings of the ingredients and

their grammatical marking as the *sentential meaning* of the expression. The sentential meaning can be enriched with reference or extralinguistic knowledge, like world knowledge and reference. The meaning of a sentential meaning that is enriched that way is the utterance meaning of the complex expression. Correspondingly, I refer to the construction of the sentential meaning and the utterance meaning as *sentential interpretation* and *utterance interpretation*, respectively.

Metonymy may occur when constructing the sentential as well as the utterance meaning of a complex expression. In (37), the metonymy is triggered at the level of sentential meaning because the lexical meaning of *university* describes entities that are not able to answer questions. By contrast, the sentence in (38) allows a consistent interpretation on the level of the sentential meaning, but nevertheless violations may occur at the utterance level.

(38) The newspaper has arrived.

Although sentence (38) can be interpreted literally, there are also contexts in which the meaning of the noun has to be shifted. For instance, if a group of people is waiting for a friend who works for a newspaper, the noun *newspaper* can be used to refer metonymically to this person, when this person arrives late to the group because he has worked overtime. The reinterpretation is necessary when there is no appropriate, i.e., relevant, referent that can be assigned to *newspaper*. Assigning reference is part of constructing the utterance meaning so that the metonymy is triggered on the level of utterance interpretation, but not at the level of sentential interpretation.

To sum up, metonymy is a mechanism to avoid inconsistencies that are in conflict with the principle of consistent interpretation. Such inconsistencies may occur at the level of sentential interpretation as well as at the level of utterance interpretation.

3.1.4 The problem of characterizing metonymic relations

In Definition 3.1, metonymy has been explicated as a meaning shift, where the literal and the actual referent are somehow thematically related. However, there are cases in which metonymy is not possible although the entities involved are thematically related, as Löbner (2013: 314) points out: Let us assume that Boston University was founded in 1869. Then, there is obviously a relation between Boston University and the year 1869. Nevertheless, *Boston University* cannot be used to refer to the year 1869, as the example below demonstrates. (The example is cited from Löbner 2013: 314.)

(39) ??Boston University was a year of considerable unrest.

The example leads to the question as to which relations potentially give access to

metonymy. Characterizing metonymic relations is an open problem in recent research on metonymy. In general, it is handled in three different ways.

First, which relations are metonymic is suggested by enumerating "A for B" paraphrases, each of them illustrated by examples. This, however, is not sufficient to characterize metonymic relations due to the unmanageable number of possible contexts. This is illustrated by the fact that there are examples that are supposed to be metonymic, but do not fall into one of the types discussed so far. Consider the examples below.

(40) a. Die Oper liegt auf dem Tisch. (Bierwisch, 1983)
'The opera is lying on the table.'

b. Youngster Tobias Braun brachte seine Farben in der 35. Minute erstmals mit drei Treffern (14:11) in Führung. (LCC[8] 411)
'Rookie Tobias Braun put his colors ahead in the 35th minute of play with three goals (14:11).'

In (40a), *Oper* 'opera' refers to the sheet music of the opera, and in (40b), *Farben* 'colors' refers to the handball team whose jerseys have the colors specified by the literal referent (in the following sections, I will provide frame-based analyses of the examples). These relations are not subsumed by one of the relations listed in the previous section. Although the listed paraphrases precisely define types of metonymies, characterizing metonymic relations in such a way is not sufficient because the listed paraphrases are not exhaustive, leaving it to the reader to continue adding more paraphrases to the listed ones without providing criteria for this.

Second, the metonymic relations are described as underlying *contiguity*. Thereby, the term *contiguity* is adopted from psychology, where contiguity effects are understood as "the finding that stimuli that occur close together in time become associated to each other" (Howard et al., 2008). Consequently, when describing metonymy as being based on contiguity, this expresses only that the source and the target concept are strongly associated with each other. This, however, does not explain how the relations on which the association is based can be characterized qualitatively. Thus, a characterization of the metonymic relations is still open.

Third, in cognitive semantics, metonymy is usually defined in terms of idealized cognitive models (ICMs) in the sense of Lakoff & Johnson (1980) and Lakoff (1987) or domains in the sense of Langacker (1986, 1987, 2008) who introduce metonymy as "a cognitive process in which one conceptual entity, the vehicle, provides mental access to another conceptual entity, the target, within the same domain, or ICM" (Kövecses & Radden 1998: 39). Consequently, the notion of ICMs and domains is suggested to shed light on the nature of possible metonymic relations.

[8] Leipzig Corpora Collection. The number refers to the sentence number in the corpus

Lakoff & Johnson (1980) and Lakoff (1987) explain ICMs as generalized and idealized representations of reality that are induced from everyday experiences. ICMs are assumed to organize human knowledge. However, the ingredients of ICMs are not explicitly defined. Instead, Lakoff (1987: 68) states that "[p]robably the best way to provide an idea of what ICMs are and how they work in categorization is to go through examples." He gives the example of *Tuesday*, whose meaning is explained based on the background knowledge of a week that consists of a sequence of seven days whose second element is Tuesday.[9] The example illustrates that concepts are not atomic units but related and mutually depended entities. The central aim of the theory of ICMs is to investigate the knowledge that has to be represented within an ICM and how it is related to other pieces of information. Metonymy is a frequently occurring topic in the theory of ICMs. However, neither Lakoff & Johnson (1980) nor Lakoff (1987) provide a complete characterization of metonymic relations but merely explicate some properties of metonymic relations. Concerning the source A and the target B of a metonymy, Lakoff (1987: 84) states[10]

(i) "[A] is either part of [B] or closely associated with it in that conceptual structure. Typically, a choice of B will uniquely determine [B], within that conceptual structure."

(ii) "Compared to [B], [A] is either easier to understand, easier to remember, easier to recognize, or more immediately useful for the given purpose in the given context."

Statement (ii), however, is not completely reproducible because the author does not specify how the easiness of recognizing is measured. By contrast, (i) states explicitly a characteristic property of metonymic relations: it is postulated that the source concept determines the target concept uniquely. To which extent this is correct, and what is the reason for it, is a central question of the frame analysis provided in this chapter. In Section 3.2, I will come back to it in more detail.

When developing his idea of cognitive grammar, Langacker (1987, 2008) makes several assumptions more explicit, which are merely implicit in the work of Lakoff & Johnson (1980), as Croft (2002) states. Langacker builds his definition of metonymy on the notion of *domains* which he characterizes as "any sort of conceptualization: a perceptual experience, a concept, a conceptual complex, an elaborate knowledge

[9] In this regard, Lakoff (1987: 69) speaks of *Tuesday* as the third element assuming that the week starts on Sunday. Above, I consider Monday as the start of the week.

[10] The statements are cited from Lakoff (1987: 84), whereas the enumeration is provided by the author of this thesis. Note that Lakoff's (1987) terminology differs from the recent literature on metonymy, where A denotes the source concept, where B denotes the target concept. In the quote, the notation is adapted to the recent one.

system, and so forth" (Langacker 1986: 4). With respect to linguistic expressions, Langacker (1986: 6, 2008: Section 3.3.1) relates the notion of domains to the distinction between *profiles* and *bases*. Profiles are mental representations of entities in the world, whereas bases constitute knowledge that is necessarily required to understand the lexical expression although it is not explicitly mentioned. Langacker (1986: 4f) exemplifies the distinction with the lexeme *hypotenuse*. The meaning of the lexeme requires the knowledge of what a rectangular triangle is. Thus, the mental representation of a rectangular triangle constitutes the base for the profile representing a hypotenuse. What a profile and a base is, is always assumed to be a matter of perspective. For instance, the concept ›hand‹ requires the base ›human body‹ as well as it constitutes a base for the concept ›finger‹.

Langacker (1987, 2008) assumes that in common cases, a linguistic expression not only evokes a single base, but rather a couple of bases, each of them focusing on different perspectives of the expression's profile. The example Langacker (1986: 5) gives is the concept ›knife‹ that requires a base for its shape specification, a base for its purpose specification, among others. He refers to the totality of bases that are necessarily required by a profile as a *domain matrix* (see also Langacker 2008: 47). Thus, metonymy is defined as "a shift in profile," where the new profile is a concept within the domain matrix of the original profile (Langacker 2008: 69).

Although Langacker's definition of metonymy is internally consistent, applying it to concrete examples is problematic because domains cannot be delineated accurately. The author does not give an explicit definition of domains, profiles, and domain matrices. Similar to Lakoff (1987), he only suggests examples to illustrate these terms. Like Lakoff (1987), Langacker (2008: 4) is aware of this problem, because he states explicitly that it is not feasible to list all possible domains. Nevertheless, Langacker (2008: 47) lists the following domains of which he assumes occur frequently.[11]

- Space, shape, material, and size
- Orientation in space, understood as having knowledge about movement along vertical and horizontal axes, where the vertical axis is closed and ends at the bottom.
- Function$_1$, understood as the typical orientation objects have in space and along which paths they can potentially move.
- Function$_2$, understood as the role an object can have within specific actions.

The list of domains does not provide a characterization of metonymic relations, but,

[11] The ordering of the domains does not correspond to the original.

at best, gives hints which relations metonymic relations may include. The question of characterizing metonymic relations is still open.

3.1.5 Intermediate summary

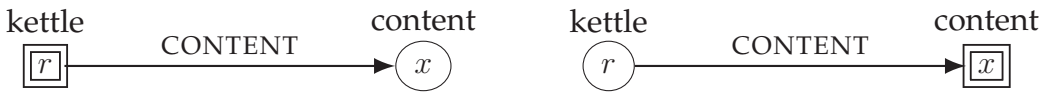
Metonymy has been introduced as a conceptual process that modifies meanings, resulting in expressions that refer to entities differently from their literal referents. The metonymic and the literal referents are linked via a relationship in the world. These relationships are represented by conceptual relations. However, not every conceptual relation gives access to metonymy, but only certain relations which I refer to as metonymic relations. A crucial statement about metonymic relations has already been made in the literature, namely that the target concept is able to identify the source concept uniquely. Of course, it is still necessary to discuss more closely the extent to which this statement is valid.

A frame-based approach to metonymy should be able to model how metonymy modifies concepts. Furthermore, it should shed further light on the characterizing properties of metonymic relations. In the following sections, Löbner's (2013) frame-based approach to metonymy is presented. I will discuss why this approach is able to investigate the properties of metonymic relations more precisely than is possible in the frameworks of ICMs or domains. Although the approach will not be able to provide a sufficient characterization of metonymic relations, it will point to some necessary conditions that have not been explicitly addressed in the literature. Partially, these necessary conditions will be motivated by Löbner's (2011) theory of concept types that has not been applied to metonymy so far.

3.2 Characterizing metonymy in terms of frames

Löbner (2013: Section 12.3.1) proposes two necessary conditions for metonymy in terms of frames. Since, by contrast to ICMs and domains, the ingredients of frames are explicitly specified, the conditions are pointed out rigidly. The starting point of Löbner's (2013: 313) considerations is the observation that metonymy has the effect that "the reference of an expression [is shifted] to something that belongs to the original kind of referent" (see also Löbner 2013: 52). The author assumes that the relation is always represented by an attribute, such that the conceptual representations of metonymic referents "are just the values of corresponding attributes" (Löbner 2013: 313) in the frame representing the literal referent.

Based on the assumption that metonymy operates on nodes that are linked via an attribute, metonymy can be frame-theoretically represented by a simple frame transformation: the central node of the frame is shifted from the source node to the



A Nonmetonymic meaning of *kettle*. **B** Metonymic meaning of *kettle*.

Figure 3.3 Representation of metonymy in frames. The central node of a frame is the source node that is shifted to the target node.

target node. For instance, in the case of the metonymy *the kettle is boiling* (the example is taken from Warren 2002: 116), the central node of the *kettle* frame is shifted to the node specifying its content; see Figure 3.3.

Understanding metonymy as a shift between frame nodes that are linked via an attribute, implies several assumptions that were made about metonymy earlier in modern linguistics. First, Jakobson (1974) proposes that metonymy is a general structuring principle of human thought. Correspondingly, attributes structure frames and thus human cognition. Second, metonymy is understood as a conceptual operation; this is also in line with the notion of metonymy as a shift between frame nodes and thus as an operation on conceptual representations. Third, metonymy is assumed to cause referential shifts in language use. In most cases, the values of attributes differ from their arguments such that the denotation of a frame changes when its central node is shifted.[12] This explains why metonymy causes referential shifts. Fourth, since attributes are functions, the source node determines the value of the target node uniquely, providing that the attribute on which the metonymy shift operates is fixed by the context in which the metonymy occurs. This is completely in line with the assumption of Lakoff & Johnson (1980) that the source concept identifies the target concept uniquely.

However, as Löbner (2013) points out that while the attribute link between the source and the target node is necessary, it is not a sufficient condition for metonymy: In several cases, a metonymy shift between two concepts is not possible, even though the corresponding frame nodes are linked by attributes. Löbner (2013: 314) gives the example of the *university* frame. Since institutions in general and universities in particular are founded exactly once, YEAR OF FOUNDATION establishes a potential attribute. Nevertheless, a metonymy shift in the direction of this attribute is not possible: The noun *university* is not able to refer to the year of foundation, as illustrated by the example in (39), which is below repeated as (41).

(41) ??Boston University was a year of considerable unrest.

[12] I speak of "most cases" here because there may be some cases in which a frame can contain circular paths of attributes. Since the composition of attributes is also assumed to be attributes, composing attributes of such a path results in an attribute that links a node to itself.

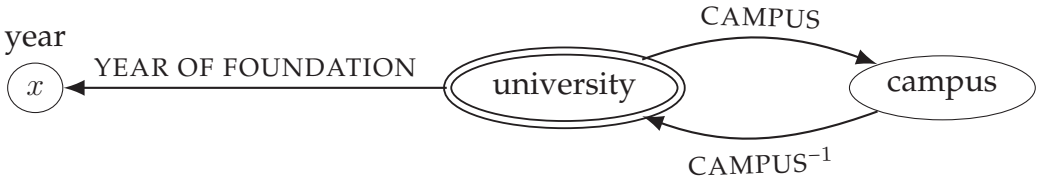


Figure 3.4 Bidirectionality and nonbidirectionality in the *university* frame.

Taking (41) as a starting point, Löbner (2013) aims at characterizing metonymy more precisely. That is, he approaches the characteristic properties of what is usually understood as metonymy. A central question which I will deal with in the following is whether his characterization is able to cover the examples I considered as metonymic in the previous section.

Löbner (2013: 314) postulates that metonymy requires not only an attribute that links the node of the literal referent to the node of the metonymic referent, but also an attribute that heads in the opposite direction. The author illustrates the necessity of such an attribute by the frame of *university* that has one and only one campus. Figure 3.4 illustrates such a frame.

In terms of the frame model developed in Chapter 2, the attribute that links the node of the literal referent to the node of the metonymic referent has to be injective and thus invertible. According to Löbner (2013: 314), the attribute only gains access to metonymy if it is injective. For instance, *university* can be used to refer to the campus, and *campus* can be used to refer to the university. Hence, the metonymy is possible. By contrast, the year of foundation cannot be linked uniquely to the *university* node because several events occurred in this year. Hence, in this case, the metonymy is not possible.

The injectiveness condition also holds for the example *the kettle is boiling* that is depicted in Figure 3.3. Since a kettle can have one and only one content at a certain point in time, the CONTENT attribute is invertible. The attribute CONTENT^{-1} links the *content* node to the *kettle* node.

In the following, I refer to the nodes that represent the literal and the metonymic referent as *source node* and *target node*, respectively. When the source and the target node can be linked by inverse attributes, there is an aspect under which the source identifies the target uniquely, and vice versa. Thus, there is a one-to-one relation between source and target. Löbner (2013) argues that the necessity of a one-to-one relation is suggested by two facts: On the one hand, a one-to-one relation reflects that source and target concept stand substitutionally for each other and, on the other hand, the metonymic relations usually cited in the literature constitute one-to-one relations. However, both arguments are disputable: On the one hand, it is ques-

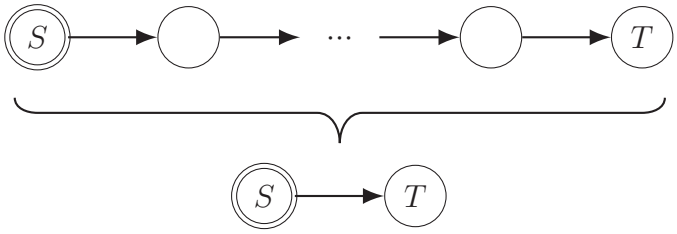


Figure 3.5 A chain of attributes that links the source node S to the target node T. The chain of attributes can be reduced to a single attribute.

tionable whether the target concept has to be able to stand for the source concept because metonymy only effects the source concept to stand for the target concept. On the other hand, authors always state that the metonymic relations they list are not exhaustive. Hence, it is not excluded that there are also many-to-one relations that provide access to metonymy. When it comes to evidence against the one-to-one correspondence, there are two possibilities, namely rejecting Löbner's (2013) hypothesis or explaining why the negative evidence constitutes exceptions from the hypothesis.

Whether Löbner's (2013) hypothesis is valid will be a permanent topic in the following section. For the sake of clarity, I will use the following terminology when speaking about the conditions postulated by the author. The terminology builds on Schulzek (2014).

Definition 3.4 Bidirectionality
*Two nodes v_1 and v_2 in a frame graph are **bidirectionally linked** if there exists a chain of attributes from v_1 to v_2 and from v_2 to v_1.*

In Chapter 2, I pointed out that two attributes can be composed to one attribute. Thus, a chain of attributes can also be composed to a single attribute (see Figure 3.5 for illustration). Seen in this light, Definition 3.4 can be considered as a slightly generalized form of Löbner's hypothesis: According to Löbner (2013), metonymy is possible if the involved nodes are bidirectionally linked. Thereby, the bidirectionality condition can be decomposed into two necessary conditions, namely that

(RU) there is an attribute from the source node to the target node,

(LU) there is an attribute from the target node to the source node.

In the following, I refer to the condition RU as *right-uniqueness condition* and to the condition LU as *left-uniqueness condition*.

3.3 Analyzing metonymy in frames

In this section, examples of metonymy are analyzed in terms of frames. The investigated examples are taken from the Leipzig Corpora Collection, contemporary research literature on metonymy, and speeches delivered at the federal parliament of Germany. Sections 3.3.1 to 3.3.3 deal with general aspects of metonymy from the perspective of concept types and frames. Afterwards, Section 3.3.4 focuses strongly on the bidirectionality condition postulated by Löbner (2013). Section 3.3.5 demonstrates that metonymic relations can be precisely described in terms of frame attributes.

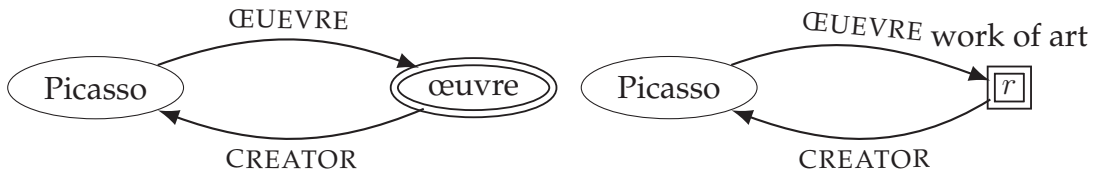
3.3.1 Metonymy and type shifts

In Section 2.1.3, it was pointed out that functional nouns transfer the concept type of their possessor: If functional nouns occur as heads of a possessive construction, the concept type of the whole NP is identical with the concept type of the possessor NP that saturates the argument of the functional noun. According to Section 2.2.4, frame attributes correspond to functional nouns. Assuming that metonymy is a shift in the direction of an attribute, the source concept is mapped to the target concept in a quite similar way that the possessors of functional nouns are mapped to a possessum. Thus, it is expected that the source concept of a metonymy determines the concept type of the target concept. In other words, the target concept inherits the concept type of the source concept. Since the concept type of a nominal concept is assumed to be reflected in the concept's frame structure, which is modified in case of metonymy, metonymy should cause some kind of restructuring processes to rebuild the original concept type of the metonymically shifted concept. In the following sections, I will illustrate these processes with several examples.

The fact that the target concept inherits its concept type from the source concept is reflected in language use when paraphrasing metonymy. Consider the sentence in (42), where the noun *USA* is used metonymically to refer to the US government.

(42) a. The USA decided to send soldiers to the Middle East.
b. The government of the USA decided to send soldiers to the Middle East.

The noun *USA* is an individual noun because, as a proper name, it is inherently unique and does not require a possessor. Thus, the source concept of the metonymy in (42a) is individual. In (42b), the metonymy is paraphrased by a possessive construction: The NP *the government of the USA* refers to the target of the metonymy. Consequently, the concept meant by the NP and the target concept of the metonymy are expected to be identical. Since every nation has one and only one government,



A Result of the metonymy. **B** Result of the type shift.

Figure 3.6 A type shift preceding a metonymy shift.

the noun *government* is functional. According to Table 2.2, the whole NP *the government of the USA* and thus the target concept is individual. Hence, the source and the target concept agree in their concept type.

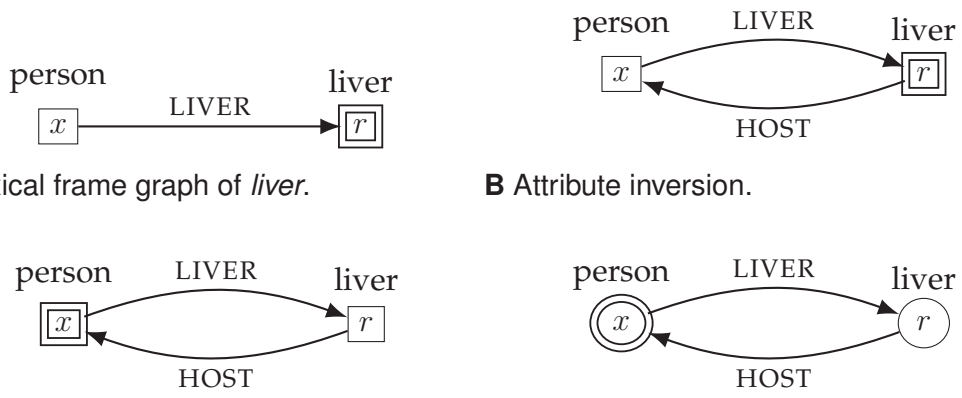
The inheritance of the concept type implies that when a metonymically used noun is used incongruently, the concept type of the target concept is not in line with the determination of the noun, and thus is in need of a type shift. Consider the example below.

(43) I've bought a Picasso.

Obviously, *Picasso* is not used to refer to the artist, but to one of his paintings, although it is not specified which one. Thus, the interpretation of (43) not only requires a metonymy shift, but also a type shift.

Figure 3.6A illustrates the metonymy as a twofold process. The first shift results in an individual concept that represents Picasso's œuvre. The second shift results in referring to an indefinite item from this œuvre. Thus, the *œuvre* node, which represents an individual, is transformed into a node representing the class of items that constitute the individual œuvre (see Figure 3.6B). The first shift is obviously metonymic because it enables the word *Picasso* to be used to refer to an entity to which the literal referent is thematically linked. What remains unclear is whether the second shift is metonymic because it results in referring to a single part of the whole œuvre, and "part for whole" has been assumed as a (very typical) metonymic pattern. In contrast to the first shift, however, the second shift includes also a type shift, since *Picasso* 'some work of art made by Picasso' is indefinite, whereas *Picasso* is an individual concept and thus refers uniquely. In considerations at the beginning of this section, I have suggested that metonymy inherits the concept type of the metonymically shifted concept. Thus, the type shift included in the second process does not belong to the metonymy, but infers it.

(44) I've talked to the liver from the second floor. (The example is similar to the one in Bartsch 2002: 71)



A Lexical frame graph of *liver*.

B Attribute inversion.

C Metonymic shift.

D Metonymic shift.

Figure 3.7 Metonymy is an operation on lexical frames. A lexical frame is shifted and restructured.

Examples like the one in (44) are often discussed in the literature. In these examples, a body part is used to refer to its possessor, typically in the context of hospitals. The expression of the medicated body part is used instead of the term for the patient to which the body part belongs. Expressions for body parts usually require a possessor and are thus [+R]. With respect to uniqueness, they can have a positive and a negative value. Since those creatures that have a liver have only one, the metonymically used noun in (44) has [+U] so that *liver* is functional. However, since it carries definite determination in (44), the feature [+R] is shifted to [−R].

Figure 3.7A shows the frame representing the meaning of *liver*. Since each liver has exactly one host, the LIVER attribute is injective and thus invertible by the attribute HOST (see Figure 3.7B). Therefore, the bidirectionality condition is fulfilled. The metonymic and type-shifted meaning ›person‹ can be explained in two ways. The first explanation builds on the unshifted meaning of *liver*. The central node is shifted to the *possessor* node (see Figure 3.7C). Since metonymy maintains the concept type, the concept is functional and thus has an open argument. The concept would describe a person that is identified in relation to his liver. Because of the definite use in (44), both rectangular nodes are transformed into round nodes (see Figure 3.7D). The result is an individual concept. Note that the determination operates on the metonymically shifted meaning and, therefore, is an operation that succeeds the metonymy. The reason for this is that metonymy operates at the lexical level, i.e., on noun meanings, and not the sentential level, as I will argue in Section 3.3.2.

The type shift of the metonymically used noun in (43) is said to occur frequently in the context of metonymy, in particular when the names of artists, authors or producers are used to refer to items of their work. Consider the examples below.

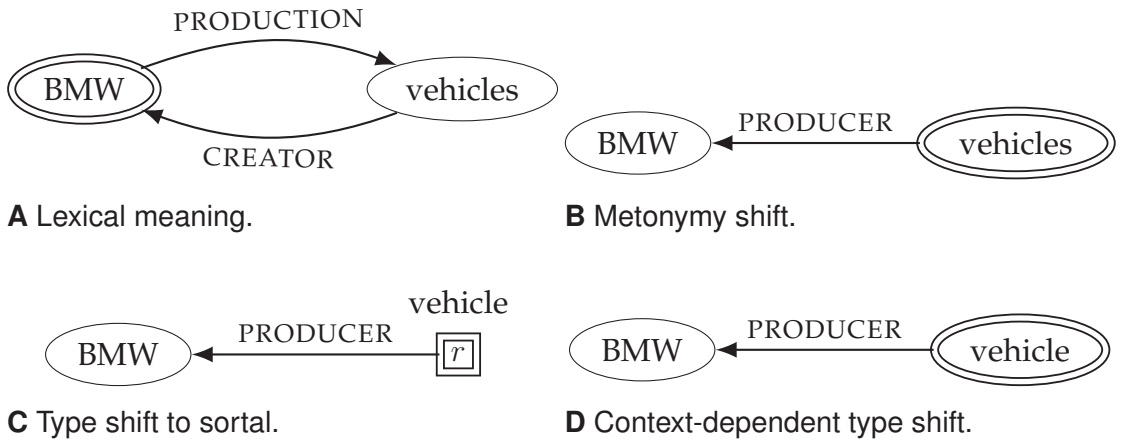


Figure 3.8 Modifying a metonymically modified noun by multiple type shifts.

(45) a. At the moment, I'm reading Shakespeare.
b. A BMW turned around the corner.
c. I like Mozart. (Warren 2002: 125)

The examples in (45a), (45b), and (45c) can be explained analogously to the *Picasso* example. The metonymically used nouns stand for ›literature written by Shakespeare‹, ›a vehicle made by BMW‹, and ›music composed by Mozart‹, respectively.

In (46), the proper name *BMW* is used to refer to a product that is uniquely determined due to the context. This case differs from the metonymies above that either refer to the totality of products or pieces of work or to single, but undetermined instances of these totalities, as in (43) and (45).

(46) The BMW in the parking lot is black-colored.

The reference to a specific entity out of BMW's products, can be explained by a twofold type shift, as in Figure 3.8. Figure 3.8A shows the lexical meaning of *BMW*, which is, as already mentioned, analogous to the meaning of the *Picasso* example illustrated in Figure 3.6A. The concept is metonymically shifted and restructured (compare Figures 3.8A and 3.8B) and shifted to sortal-much like to the previous cases (Figure 3.8C). Due to its definite determination, the sortal concept is shifted to individual (Figure 3.8D). The example illustrates that the metonymy is close to the former examples but requires an additional step. Note that the type shifts that operate on the metonymically shifted frame, are not restricted to metonymy, but rather operations that also occur with nonmetonymically modified concepts.

Example (46) illustrates that the interaction of concept types and metonymy may be complex. However, in this case too, metonymy and type shifts are separated pro-

cesses. They differ in that metonymy modifies the denotation of concepts and type shifts the [±R, ±U] features.

3.3.2 Types of attributes involved in metonymy

In this section, I categorize the attributes that are potentially involved in metonymy. I will distinguish three types of attributes that can be related to lexical knowledge, the sentential interpretation, and the utterance interpretation.

Core attributes. The term *core attribute* originates from Barsalou (1992b) and was already introduced in Section 2.2.1. According to Barsalou (1992b: 34), core attributes are those attributes that occur frequently when the frame of a certain concept is evoked because, in most contexts, these attributes are relevant (see also Section 2.2.1). Core attributes seem to be subject to the lexical knowledge. Although the characterization of core attributes seems to be plausible from a cognitive point of view, from a purely semantic angle, it is hard to specify whether an attribute is a core attribute, however. I let the problem rest for the moment. Rather, I introduce two further types of attributes in contrast to which core attributes will be specified.

Sentential-differentiation attributes. Differentiation is a very general semantic process. According to Löbner (2013), when verbs are used in context, their contextual meaning can slightly vary depending on contextual information. Consider the examples below that are cited from Löbner (2013: 54).

(47) a. John lost his friend in the overcrowded subway station.
b. John lost his friend in a tragic car accident.
c. John lost his friend, as he could never suppress bad jokes about him.

In every sentence in (47), *to lose* has the same core meaning, namely ›stop having, due to some event‹. Beyond that, *to lose* has additional, but nonoverlapping meaning components that specify exactly what John has stopped having: In (47a), it is the knowledge of where his friend is, in (47b), it is his friend as such due to his death, and in (47c), it is the friendship to his former friend. Löbner (2013: 54) refers to the process of enriching lexical meaning as *differentiation* which he defines as follows.

Definition 3.5 Differentiation
Differentiation adds content to a given concept.

Differentiation applies to concepts in general and is thus not restricted to verbal concepts. Rather, nominal concepts may also be subject to differentiation. Consider the following example where *part* designates the population of a region.

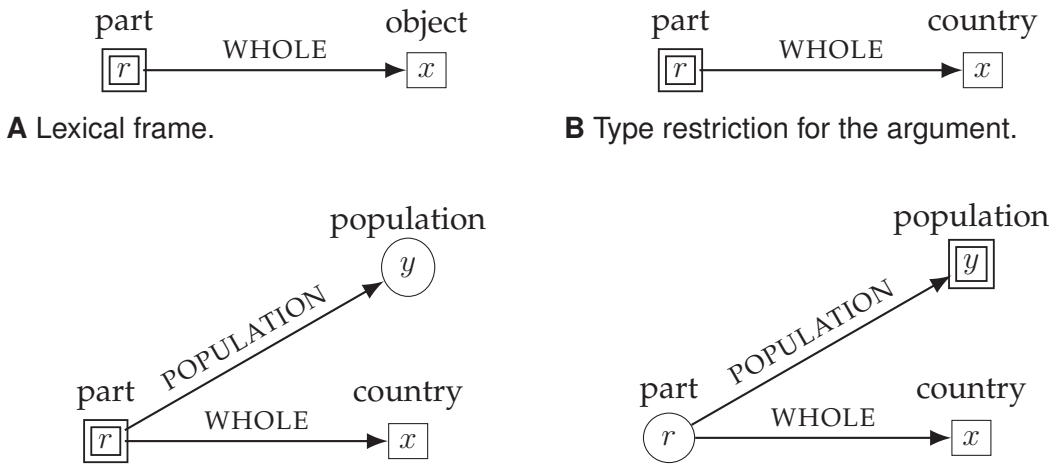


Figure 3.9 Frame of a metonymically shifted noun that occurs in a complex NP.

(48) Different parts of the country use 'tea' differently. (Dirven & Pörings 2002: 107)

In (48), the metonymically used noun *part* is part of a complex NP. Nevertheless, the only element that is metonymically modified is the meaning of *part*. The meaning of *country*, by contrast, is maintained. The noun *part* is relational because it describes an entity as a member of a set of entities that constitute a whole. The set usually contains more than one element so that there is a one-to-many relation between a part and the corresponding whole. Since every part belongs to exactly one whole, WHOLE is a potential attribute. Figure 3.9A shows the frame of the lexical meaning of *part*. Obviously, the structure of the frame is not in line with the structure Petersen (2007) proposes for relational concepts (see Section 2.2.5.1). However, I do not know how to convert the frame to the structure assumed by Petersen (2007). Nevertheless, the frame in Figure 3.9A represents a relational concept in the sense of Petersen & Osswald (2012) because it contains a possessor argument whose value does not determine the value of the central node uniquely because there is no attribute that links the possessor node to the central node. The relationality is, moreover, reflected by the fact that the WHOLE attribute is not invertible.

Since in (48), the possessor of *part* is specified by *country*, the argument of the relational noun is restricted to the class *country* (see Figure 3.9B). Based on this, further content is added to the concept. For instance, we know that regions are inhabitable. Figure 3.9C shows how this knowledge is added into the frame. Adding this knowledge is subject to differentiation because parts, in the most general sense, are not

inhabitable. The knowledge is derived from the sentential meaning of the sentence. Extralinguistic knowledge is not required.

The metonymy shifts the central node to the value of the INHABITANTS attribute (see Figure 3.9). The result is a concept that can be paraphrased as 'inhabitants of a part of a country' where ›country‹ is the possessor. Hence, the metonymical meaning of *part* is 'inhabitants of a region in a country' based on which sentence (48) can be reinterpreted consistently.

The attribute on which the metonymy operates, results from differentiating the meaning of the metonymically used noun during the sentential interpretation. When concepts are differentiated, their denotation is restricted. For instance, *part* in the most general sense is able to refer to more entities than *part* in the regional meaning above. Since differentiated concepts are more specific than the original concepts underlying them, frames representing differentiated concepts may contain attributes that are not necessarily part of the original concepts.[13] With respect to the example, INHABITANTS is not an appropriate attribute in the frame representation of *part* in its general meaning because there are a lot of parts that do not have inhabitants, like *parts of cars*, *parts of argumentation*, and so on. In the following, I refer to attributes resulting from differentiation as *sentential-differentiation attributes*. Their characterization is this: Such attributes describe aspects that do not regard the whole denotation of a concept, but an appropriate subset. Since individual concepts have exactly one referent per context, their denotations cannot be reduced any further. This is why attributes resulting from differentiation should not be possible if the metonymically used noun is individual.

Contextual attributes. Barsalou (1992b: 31) assumes that "people are highly creative in their construction of attributes, often producing new ones relevant to specific contexts" (see also Section 2.2.1). Thus, attributes may arise that are dependent on context. Consider the example below.

(49) The university won the race.

In (49), *university* refers to the participant of a race who represents the university. The participant may be a single runner or a team of oarsmen, depending on the kind of race to which it is referred. The only prerequisite is that there is no more than one official participant (which may be a team) that represents the university. Since there is one and only one participant from the university, the relation is right-unique and thus a potential attribute. Figure 3.10A shows the frame containing such

[13] Note that it is not possible that *part of the country* is metonymically shifted because – as we have already found out – metonymy operates at the level of words and not at the level of word phrases.

A Nonshifted meaning.

B Shifted and restructured meaning.

Figure 3.10 Metonymy shift operating on a contextual attribute.

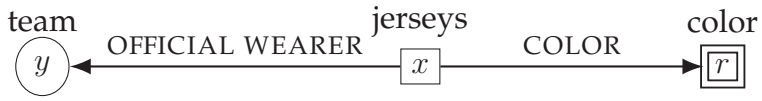
an attribute. In the frame, the central node is rectangular because *university* is a sortal concept.

The metonymically modified frame provides a description of an individual that takes part in the race. The metonymically modified concept is nevertheless sortal because it inherits the underlying concept type of the original concept ›university‹, which is sortal. However, the metonymically shifted frame in Figure 3.10A is not in line with Postulate 2.7 on the structural properties of sortal concepts. However, since the university has exactly one participant, the *participant* node is linked to the *university* via an INSTITUTION attribute based on which the metonymically shifted frame is restructured in such a way that it is in line with the prototypical structure of sortal frame graphs (see Figure 3.10B). Thus, bidirectionality guarantees that the modified concept can be restructured to the frame of a well-defined sortal concept. Since *university* carries definite determination in (49), the metonymically modified concept is shifted to individual on the sentential level.

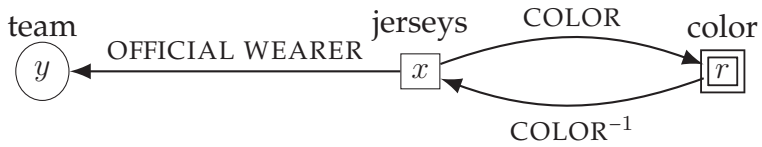
The PARTICIPANT OF THE RACE attribute is only defined for the context of (49): In other contexts, it might be impossible to assign a value to the attribute. I refer to those attributes that are established context-dependently as *contextual attributes*. Contextual attributes differ from sentential-differentiation attributes because they are established by world-linguistic knowledge. By contrast, differentiation attributes are based on linguistic knowledge. Very briefly, differentiation attributes occur during the utterance interpretation, whereas sentential-differentiation attributes occur within the sentential interpretation.

Although example (49) suggests the importance of uniqueness of shifts, there are examples that seem to contradict the uniqueness at first glance. Consider the example in (50).

(50) Deutschland gewinnt Gold und Bronze.
Germany won Gold and Bronze.



A Frame of *color* in the context of (52).



B Attribute inversion.

Figure 3.11 Attribute inversion enabled by a special context.

The sentence in (50) is equivalent to (51).

(51) Deutschland gewinnt Gold, und Deutschland gewinnt Bronze.
Germany won Gold and Germany won Bronze.

Thus, (50) is the conjunction of propositions that constitute separate contexts in which the metonymy also occurs separately. Consequently, example (50) does not contradict the argumentation so far.

In (49), the contextual attribute introduces a completely new aspect in the *university* frame. Beyond that, contextual attributes may also introduce inversions of already established attributes, as the analysis of the following example demonstrates.

(52) Youngster Tobias Braun brachte seine Farben in der 35. Minute erstmals mit drei Treffern (14:11) in Führung. (LCC 411)
'Rookie Tobias Braun put his colors ahead in the 35th minute of play with three goals (14:11).'

Tobias Braun is a German handball player. He is the possessor of *Farben* 'colors.' The noun *Farbe* 'color' is functional because it specifies the color of physical objects. However, humans have one and only one color, namely the color of their skin. This is in conflict with the plural the noun carries. Thus, the relation induced by the personal pronoun *seine* 'his' is reinterpreted. The reinterpretation is based on the knowledge that professional sportsmen wear jerseys during their matches. This is why *seine Farben* 'his colors' is interpreted as 'the colors of the jerseys of Tobias Braun's team.'

Figure 3.11A shows the frame representing the color of jerseys that constitute the official uniform of a sport team. Objects can have the same color so that the COLOR attribute is usually not invertible. However, when competing in a match,

opposing sport teams are not allowed to wear jerseys of the same colors. Thus, the JERSEY COLOR attribute is injective and can thus be inverted (Figure 3.11B) so that the reference can be shifted via the COLOR^{-1} and the OFFICIAL WEARER attributes. Thereby, the attribute is injective due to the special context. Its inversion is therefore a contextual attribute.

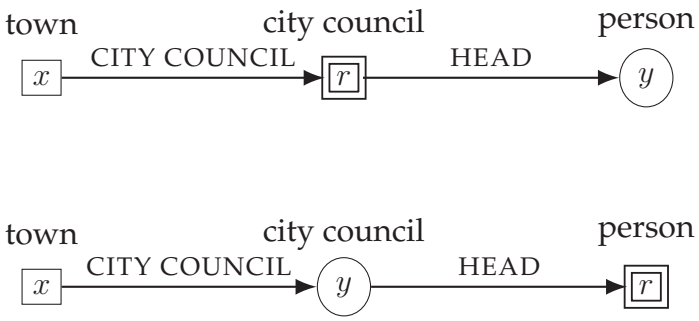
After introducing sentential-differentiation attributes and contextual attributes, the notion of core attributes in the context of metonymy can be rendered more precisely. Metonymy is based on conceptual relations between the source and the target concept. These conceptual relations are part of the knowledge about the source concept. This knowledge is represented by attributes and the values they take. If an attribute results neither from a differentiation of the source concept nor from the context, it has to be assumed that the attribute is already contained in the frame of the source concept before it is embedded into both, the sentential context and the context of utterance. Thus, such attributes have to be core attributes. Hence, in the context of metonymy, I consider those attributes to be core attributes that are neither sentential-differentiation attributes nor contextual attributes. Note that the argumentation presupposes metonymy and thus may not hold for further phenomena. From a purely semantic point of view, I suppose that a more concrete characterization of what core attributes are, is not possible. Nevertheless, the provided characterization is precise enough to deal with it when investigating metonymy.

3.3.3 Inheritance of uniqueness: Another example

Let us, once again, consider the *part* metonymy in (48) that was frame-theoretically analyzed in Figure 3.9. In (48), the relational noun *part* is metoynmically shifted, where the metonymy maintains its [+R] (and also its [+U]) feature: Based on the metonymic meaning, the NP *parts of the country* is regularly interpreted such that the possessor specifies the open argument of the metonymically modified ›part‹ concept. The following examples illustrate the inheritance of the [+R] and [+U] features with a metonymically shifted functional noun.

(53) Die Stadtverwaltung von Hanau ist eingetroffen.
'The city council of Hanau has arrived.'

Imagine that the noun *Stadtverwaltung* 'city council' is used to refer to the mayor of a town, who is, in Germany, the official head of the city council. From the perspective of concept types, *Stadtverwaltung* 'city council' is a functional noun since each town has exactly one city council. Figure 3.12A shows the frame of the noun. Since each city council has exactly one head, HEAD specifies a potential attribute that links the *city council* node to the representation of the city council's head. Note



A Original frame

B Metonymically modified frame.

Figure 3.12 Frame of *Stadtverwaltung* 'city council.'

that the attribute is injective so that the bidirectionality condition is fulfilled. The metonymy results in that the reference is shifted to the value of the HEAD (see Figure 3.12B). Since there is a chain of attributes that links the possessor node to the value of the HEAD attribute, this value is determined uniquely by the value of the possessor node. Consequently, the metonymically shifted frame represents a functional concept that identifies the head of a city council depending on the possessor of the city council. In (53), the possessor of the functional noun is specified by the town named Hanau. Analogously to the *part* example in (48), it is only the meaning of the functional noun *Stadtverwaltung* 'city council' that is metonymically shifted, but not the meaning of the whole NP.

3.3.4 Right-uniqueness and left-uniqueness

The bidirectionality condition is constituted by two subconditions I referred to as right-uniqueness and left-uniqueness at the end of Section 3.2. In this section, I comment on these conditions in isolation, starting with the right-uniqueness condition that can be motivated from the perspective of pragmatics. It allows the unique identification of the target concept in dependence of the source concept, including the fact that the elements to which the speaker refers can be identified uniquely. This ensures clarity of communication, as postulated by Grice (1975: 46). Ex negativo, right-uniqueness avoids obscurities in communication. This explains also why Lakoff (1987: 84) postulates the unique identification of the target concept by the source concept (see also page 40 of this dissertation). The examples investigated so far support the right-uniqueness conditions since the investigated metonymies were explained as shifts in the direction of attributes, understood as functions mapping concepts right-uniquely.

Now, let us raise the question whether it is also necessary for the target concept

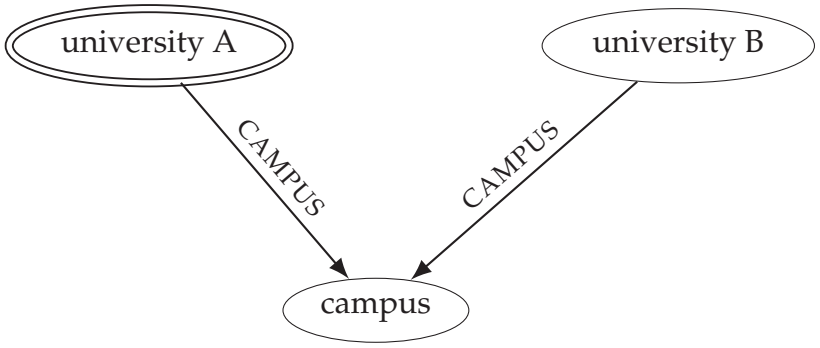


Figure 3.13 Frame of a university that shares its campus with a different one. I assume that the node representing the first university is the central node.

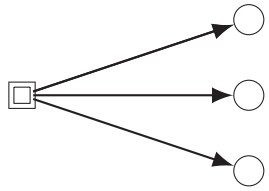
to be uniquely related to the source concept. To this end, let us construct an example in which the left-uniqueness condition is not fulfilled, taking the example below as a starting point.[14]

(54) The university is situated in the center of the city.

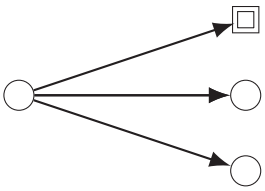
Let us imagine that the individual university to which the NP *the university* refers, shares its campus with another university (see Figure 3.13). Therefore, both universities identify the campus uniquely, whereas the opposite direction does not hold. Nevertheless, the metonymy in (54) is still possible: The sentence is obviously still interpreted as 'the campus of the university is situated in the center of the city.' One might object that the campus is apportioned among the universities. Then, both universities would possess their own part of the campus, ensuring a right-unique relation between the universities and their part of the campus, respectively. However, even if this is not the case (e.g., the universities share the whole campus) example (54) would work. Thus, the example suggests that right-uniqueness may already be sufficient, whereas left-uniqueness is not necessary.

In Löbner (2013), it is argued that the left-uniqueness condition ensures the well-formedness of sortal frame graphs. The idea is this: According to Postulate 2.7, the central node of sortal frame graphs do not have ingoing arcs. Figure 3.14A exemplifies such a frame. If a sortal frame is metonymically modified, the central node is shifted in the direction of an attribute. Consequently, the new central node has an incoming arc (see Figure 3.14B). Since metonymy does not change the concept type, the metonymically shifted frame would violate the postulated structure of sortal concepts according to Postulate 2.7. Under these conditions, the bidirectionality condition ensures that the frame can be restructured by substituting the original attribute based on which the reference has been shifted by its inverse attribute

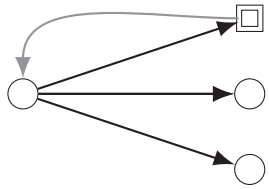
[14] This example was inspired by Anselm Terhalle.



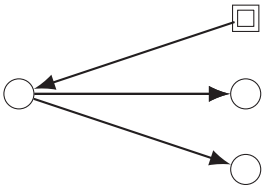
A Sortal frame graph.



B Shift of the central node.



C Bidirectionality condition.



D Restructuring the frame graph.

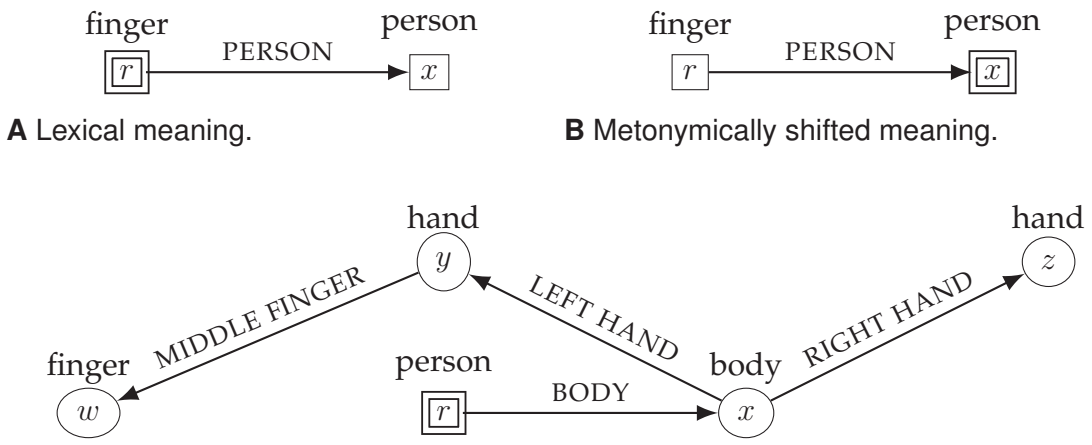
Figure 3.14 Bidirectionality for restructuring sortal frame graphs.

whose existence is guaranteed by the bidirectionality condition (see Figure 3.14C and 3.14D).

However, the explanation lacks explanatory value for two reasons. On the one hand, it does not hold for nonsortal nouns. For instance, consider the metonymy of the *part* example and the *Stadtverwaltung* example in (48) and (53), respectively. In the analysis of these examples, it was argued that the metonymically modified frames are relational or sortal, without making use of re-structuring processes. On the other hand, the explanation builds on Petersen's (2007) assumption that the frames of sortal concepts have characteristic structures. Certainly, in the coming chapters I will provide evidence that the structural condition for sortal frame graphs is not valid. Thus, a motivation for the left-uniqueness condition of metonymy is still open.

3.3.5 Describing metonymic relations in terms of attributes

Löbner (2013: 309) distinguishes four categories of attributes, namely *part*, *event*, *correlate*, and *dimension* attributes. In the following subsections, I will discuss the extent to which these attribute types gain access to metonymy on the basis of several examples. The analysis will provide an insight into the attributes frames potentially contain.



A Lexical meaning.

B Metonymically shifted meaning.

C Construction of a left-unique link.

Figure 3.15 Metonymy shift in the *finger* frame. The central node is shifted.

3.3.5.1 Part-whole metonymy

As parts, Löbner (2013: 309) assumes constitutive elements of the mereology of physical objects. Metonymies that operate on attributes for parts are expected to underlie part-whole relationships. Such metonymies are usually referred to as *pars pro toto* or *totum pro parte*. That is, the source concept of the metonymy represents the part of an entity, whereas its target concept represents the whole entity, or vice versa.

One example of such a metonymy has already been considered in (44) where *liver* is used to refer to the possessor of a liver. In this case, an organ stands for the person who possesses it. Thus, the metonymy is of the type pars pro toto. Equally in (1c), *wheels* was used to designate a vehicle. The metonymy is also of the type pars pro toto because a lexeme designating a constitutive part of an object literally is used to refer to the whole object.

The example in (55) is also of the type pars pro toto. Here, a body-part expression is used to refer to the possessor of the body part.

(55) I've talked to the finger from the second floor.

The metonymy is triggered in a similar way to the *liver* example. Figure 3.15A shows the lexical frame of the relational noun *finger*. The frame graph has two open arguments that are linked in such a way that the value of the possessor node does not specify the value of the central node uniquely. Figure 3.15B shows the metonymy shift to the *person* node.

It remains open whether there is a bidirectional link between the source and the target concept. In order to construct a left-unique link between source and target,

Figure 3.15C shows the relation between a finger and the possessor in a different light. Here, the *finger* node is integrated in such a way that it can be reached from the central node by a chain of attributes, as postulated in Petersen (2007). The frame representation takes use of a MIDDLE FINGER attribute. Of course, it is also possible that the *hand* is linked to the *finger* node by the rival attributes RING FINGER, TRIGGER FINGER, or LITTLE FINGER. Moreover, it is also possible that the *finger* node is linked to the right hand of the possessor instead of his left hand. This emphasizes that *finger* is nonunique. How the *finger* is linked to the *person* node depends on the situation in which sentence (55) is uttered. Here, the *person* node is linked to the *finger* node via the composition of the attributes LEFT HAND and MIDDLE FINGER.

So far, the part-whole metonymies discussed operate on relational concepts. However, they can also be subject to nonrelational ones. In (56), *Kinoleinwand* 'cinema screen' is used to refer to the cinema in which the big screen is placed. The noun *Kinoleinwand* 'cinema screen' is sortal because it describes its potential referents in terms of properties without reference to a possessor. Thus, the metonymically used noun has [–R, –U].

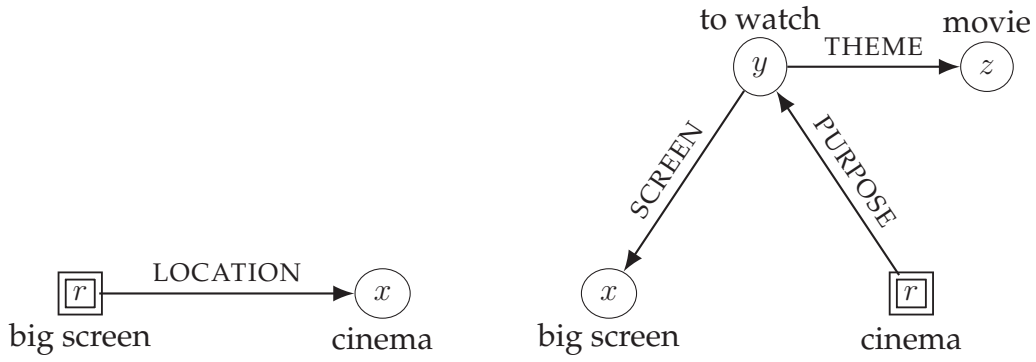
(56) Geschickt nutzte der Mann aus Denver diverse Pleiten, bis er über mehr Kinoleinwände in den USA gebot als jeder andere. (LCC 1004)
'The man from Denver cleverly exploited several bankruptcies until he owned more big screens than everyone else.'[15]

The sentence in (56) is taken from a newspaper article about the American investor Phil Anschutz who has made millions of dollars with oil and who owns, among other things, several German hockey clubs. The metonymy is triggered because the selectional restrictions of the verb *gebieten über* 'to reign over sth.' are violated: As object argument, the verb requires an institution, a people, or a region.[16] Cinema screens, however, are not of this type. Thus, the metonymy is triggered by a codomain violation of the PATIENT attribute in the *reigning* frame. The meaning of *Kinoleinwand* 'big screen' is shifted to ›cinema‹ because cinemas contain big screens as obligatory parts. Furthermore, a cinema is an institution with a leadership that can potentially be reigned by advising its employees.

After explicating why the metonymy is triggered, let us now discuss how the metonymy operates at the lexical level. In (56), the metonymically used noun occurs in the plural. Figure 3.16A shows the lexical frame of the metonymically used noun. It contains a LOCATION attribute specifying that the cinema screen is placed in a cinema. Of course, cinema screens might also be placed in further locations; e.g.,

[15] Except as noted otherwise, the examples were translated by the author of this thesis.

[16] It could be argued that *gebieten über* is used here in the meaning 'to have sth. available.' However, this meaning does not fit the general context of example (56) that centers on the rise of Phil Anschutz' empire, understood as an economic institution.



A Lexical frame of *Leinwand* 'big screen.' **B** Shifted and re-structured frame.

Figure 3.16 Metonymy shift of *Leinwand* 'big screen.'

in a living room or a garage in which home cinemas are installed. These concepts, however, are represented by other frames. The metonymy shift follows the direction of the LOCATION attribute. Since there is no one-to-one relation between a cinema screen and a cinema, the criterion of bidirectionality is in question. Nevertheless, a bidirectional link can be constructed, as shown in Figure 3.16B. Note that all nodes carry type labels and thus do not specify individuals but classes. Hence, the frame expresses that cinemas are made for special purposes, namely performing several watching events.

If Postulate 2.7 is valid, the metonymically shifted frame can be restructured based on the bidirectional link in order to transform the shifted frame into a well-formed sortal frame: The LOCATION attribute in Figure 3.16A can be substituted by an inverse attribute. The inverse link is ensured by a verbal frame to which the *cinema* node is linked via a PURPOSE attribute. Thus, the LOCATION attribute can be inverted by an attribute that results from composing the PURPOSE and the SCREEN attribute in Figure 3.16B.

The examples so far belong to the *pars pro toto* phenomenon. Literature on metonymy usually assumes that there are also examples where a whole stands for one of its parts, like the example below.

(57) I painted the window while she was standing in it. (Barcelona 2002: 229)

However, I do not agree with the analysis that those examples are metonymic. In several cases, if an entity is involved in an action, the action is not performed with the object as a whole, but only with appropriate parts of the object. For instance, to open a door does not mean that the whole door – including its frame, its leaf, and so on – is involved in the opening action, but rather its latch with which the door is moved and, if necessary, its lock that has been opened before. Analogously,

appropriate parts of the object referent are addressed in (57). In (57), the meaning of *to paint* is understood in that the painting action is only applied to those entities of a door that are usually paintable. Thus, considering the example in (57), would result in an inflationary application of the term *metonymy*.

This also holds for the examples below. In each case, the verb meaning does not address the whole argument, but rather its parts with which the action designated by the verb is characteristically performed.

(58) She came in through the bathroom window.

(59) a. I ate grilled rattlesnake for dinner. (Croft 2002: 186)
b. I ate roast tapir for dinner. (Croft 2002: 186)
c. I ate pan-fried armadillo for dinner. (Croft 2002: 186)

(60) a. to wash a car (Taylor 2002: 325)
b. to vacuum-clean the car (Taylor 2002: 325)
c. to service a car (Taylor 2002: 325)
d. I filled up the car with sand. (Croft 2002: 182)

In (58), the subject referent came through the opening of the window because this part of a window is where someone may come through. In (59), the meaning of *to eat* is differentiated, depending on which parts of the designated animals are potentially edible. In (60), single parts of a car are singled out by the meaning of the verb: Usually, the car body of a car is washed, its interior is vacuum-cleaned, and its motor is serviced. (60d) is ambiguous because there are several parts of a car which can be filled up with sand: Which part of the car is filled up, depends on extralinguistic information.

The crucial difference to the previous examples of metonymy of the type pars pro toto is this: In these cases, no part of the referents of the source concepts is said to be part of the action described by the main verb. Consider the *liver* example in (44). It is not the liver that is involved in the talking action, but rather its possessor because only human beings – but not organs – can be involved in communication processes. This is why such examples are subject to metonymy: The source concept is metonymically modified, and the referent of the target concept is involved in the action described by the main verb. By contrast, in (57), it is still the literal referent that is involved in the action described by the main verb.

Nevertheless, there are some cases of totum-pro-parte metonymies. For instance, when *America* is used to refer to the United States. These cases seem to underlie salience conditions because the source concept represents a very prominent part of the object represented by the target concept. So far, it is not clear, however, how such salience conditions can be represented in frames.

A PURPOSE attribute in the frame of *pen*. **B** Referential shift and attribute inversion.

Figure 3.17 Metonymic use of *pen* for ›to write‹.

3.3.5.2 Event metonymy

As event attributes, Löbner (2013: 310) considers those attributes that "link the possessor [i.e., the argument of the attribute] to events and activities." Representations of events can be the target of metonymy, as I will point out in the following: I focus on those metonymies where nouns are used to refer to events.

Artifacts are objects that are intentionally created, mostly for special purposes. Expressions for artifacts can be used metonymically to refer to the purposes for which they have been created. Consider the examples in (61), where the meaning of *pen*, *sword*, *Film* 'movie,' and *Flasche* 'bottle' is shifted to ›to write‹, ›to fight‹, ›to watch‹, and ›to drink‹, respectively.

(61) a. The pen is mightier than the sword. (Warren 2002: 125)

b. Bevor ich mit der Analyse begann, waren meine Filme sehr schwierig. (LCC 225)
'Before I started analyzing, my movies were very challenging.'

c. Dem Mittelfeldspieler des Fußball-Bundesligisten Hertha BSC half auch eine Flasche Löwenbräu nicht, eine Urinprobe für den Dopingtest zu produzieren. (LCC 1317)
'Even a bottle of Löwenbräu did not help the midfielder of the Bundesliga team Hertha BSC to produce a urine sample for the doping test.'

Let us consider the triggers of the metonymies. In (61a), the adjective *mighty* is in the comparative form and thus compares the referents of the subjects with respect to their efficiency. However, the objects cannot be compared with respect to the aspect induced by the adjective *mighty*. To repair this violation, the meanings of *pen* and *sword* are shifted to the actions for which they are made because actions are supposed to have effects and thus can be compared with respect to their efficiency. Both objects are created by one and only one object so that PURPOSE is a potential object in their frames. Hence, the central node is shifted from the central node to the event node in direction of the PURPOSE attribute. Figure 3.17 shows the metonymy for *pen*. The metonymic shift of *sword* can be represented analogously.

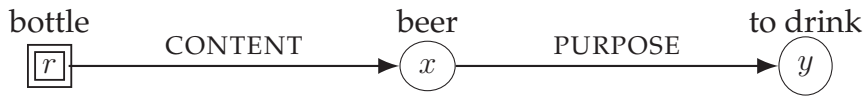
Since ›write‹ represents an action, its frame has θ roles. The INSTRUMENT attribute links the *writing* node to the *pen* node to restructure the frame of *to write* in such a way that it is in line with prototypical frames for verbs. Thus, in contrast to the counterexamples discussed before, this example confirms the bidirectionality hypothesis due to the opposite direction of the PURPOSE and the INSTRUMENT attribute. The left-uniqueness can be used to restructure the event frame in such a way that the frame has the characteristic structure of verb frames: The substitution of the PURPOSE attribute by the INSTRUMENT attribute ensures that the metonymically shifted meaning represents an event in which arguments are involved, similar to verb meanings.

Example (61b) can be explained in a similar way to the previous example. The metonymically used noun refers to an object that is made for one and only one purpose: Movies are made for watching. Thus, the metonymy can be analyzed similar to Figure (3.17). The meaning of *Film* 'movie' is metonymically shifted because movies as such cannot be difficult, but only their reception. This is why the meaning of *Filme* 'movies' violates the selectional restrictions of the adjective *schwierig* 'difficult' that specifies tasks or actions.

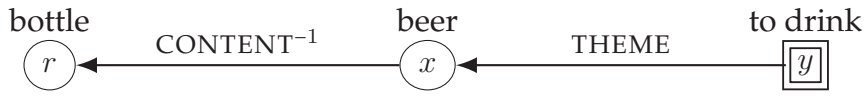
In (61c), the meaning of *Flasche* 'bottle' is in conflict with the verb *produzieren* 'to produce' because bottles cannot be used for generating urine samples as such. To interpret the sentential meaning consistently, *Flasche* 'bottle' is used to refer to an action of drinking its contents. In contrast to the former examples, bottles cannot be reduced to exactly one purpose: They are made for storing, drinking, or transporting liquids. The reason why the reference is shifted to ›drinking‹ is this: The contents of the bottle is specified as *Löwenbräu* which is a Bavarian brewery. It is part of our world knowledge that drinking beer stimulates the urge to urinate which is necessary to produce urine samples. Therefore, the meaning of *Flasche* 'bottle' is shifted to the act of ›drinking‹. The analysis raises the question how the *drinking* event is linked to the *bottle* frame. Beer, which is the contents of the bottle in (61c), has a unique purpose, namely for drinking. The metonymy can be analyzed according to Figure 3.18A: The reference is shifted from the central node to the *drinking* node by crossing the *beer* node. The attributes that are involved in the metonymy can be inverted, as in Figure 3.18B. Thus, the frame can be restructured to a verbal frame, and the hypothesis of bidirectionality is confirmed once again.

Expressions for objects can also be used to refer metonymically to the event by which the original referents have been created. In (62), the noun *Tiefwasserhafen* 'deep water harbor' is used metonymically to refer to the origin of the designated object.

(62) Gelassen sieht man in Wilhelmshaven den jüngsten Vorstoß von der Elbmündung: Man werde weiterhin an einem Tiefwasserhafen festhalten

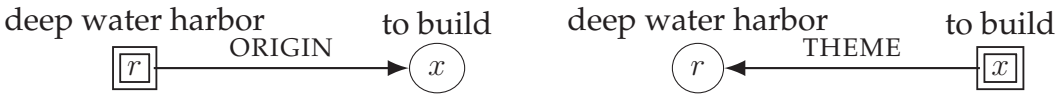


A Lexical frame of *beer bottle*.



B Restructured frame.

Figure 3.18 Two-step metonymy of *Flasche* 'bottle.'



A Lexical frame. **B** Metonymically shifted frame.

Figure 3.19 Metonymy based on ORIGIN attributes.

> und diesen notfalls im Alleingang bauen, hieß es in der vergangenen Woche aus Cuxhaven. (LCC 354)
> 'In Wilhelmshaven, the latest venture from the Elbe estuary is being viewed with equanimity: the deep water harbor is being retained and will even be realized unilaterally if necessary, sources in Cuxhaven reported last week.'

The metonymy is triggered because an existential quantification is violated: First, it is suggested that a deep water harbor exists to which some unspecified person or institution adheres. However, afterwards it is stated that such a deep water harbor has yet to be built. To reestablish a consistent interpretation, the meaning of *Tiefwasserhafen* 'deep water harbor' is shifted to its construction. The violation is dissolved as follows: For each object, there is one and only one event through which it has been generated. Thus, the relation between an object and its generating event is right-unique and thus specifies a well-defined attribute. I refer to such an attribute as ORIGIN. Such attributes are very close to what (Pustejovsky, 1995) calls *telic roles*. Figure 3.19A shows the frame containing the *origin* attribute based on which the meaning of the noun is shifted. Similar to the foregoing examples, the verbal frame can be restructured in such a way that it is in line with frames for verbs (see Figure 3.19B).

Initially, we considered artifacts that stand for their purposes. Beyond that, objects can stand for nonpurposed actions. Consider the examples below where

Lösemittel 'solvent' and *Alt- und Neubauten* 'old and new buildings' mean ›breathing in solvents‹ and ›buying/building old and new buildings‹. Neither action would be considered as the purpose of the objects.

(63) a. Lösemittel verursachen Unwohlsein, Schlafstörungen und Kopfschmerzen. (LCC 181)
'Solvents cause malaise, insomnia and headaches.'

b. Die Förderung von Alt- und Neubauten wird gleichgestellt. (LCC 257)
'The government aid for old and new buildings will be balanced.'

In cognitive psychology, the totality of actions to which an object "invites", is referred to as *affordances*. The term was originated by Gibson (1977).[17] The purpose for which an object is made is a special type of its affordances. Beyond that, its affordances contain much more actions, especially those for which the object is not purposed. Consequently, affordances do not constitute functional relations because each object usually has more than one affordance. Just think of a lighter that can be used to light a cigarette as well as to open a bottle of beer. Nevertheless, the source concepts of the metonymies in (63) are usually determined due to context. Thus, let us consider the examples more deeply. In (63a), the main verb *verursachen* 'to cause' requires a causee. However, solvents as such are not possible causees so that the metonymy is triggered. It is part of our world knowledge that solvents emit unhealthy vapors that may cause illness, insomnia, and headaches when inhaled. These symptoms identify the action of ›breathing in solvents‹ fairly surely. Rival actions like drinking solvents, by contrast, are supposed to have much worse effects.[18]

The example in (63b) is taken from an announcement that deals with the German "Eigenheimzulage," a government aid to support house purchases. The deverbal noun *Förderung* 'to support' >> 'support' refers to the support by this government aid. The metonymy is triggered because houses as such cannot be subject to the government aid, but only their purchase.

The examples demonstrate that the affordances that underlie the metonymy depend strongly on the context. These attributes are contextual attributes: The metonymy shift in (63a) can be modeled via a contextual CAUSE attribute, whereas the metonymy in (63b) can be explained on the basis of a contextual PURPOSE at-

[17] My understanding of *affordances* is more general than the one proposed in Löbner (2013). The way in which I use the term is close to Gibson's (1977) notion, whereas Löbner (2013: 315f) uses the term for purposes and origins of objects.

[18] Note that inhaling the vapors from solvents can be a side effect of their standard use during which the vapors originate. Consequently, one might argue that the inhalation is triggered by the standard use of solvents. However, the inhalation can be avoided and thus persists independently of it.

tribute. Neither the English nor the German language provides functional nouns for these relations. Thus, the attribute labels are subject to lexical gaps.

In the literature on metonymy, there are two further cases in which the metonymic reference to events is assumed. However, I do not consider these cases as metonymical, as I will argue in the following.

With respect to examples like those in (64), it is argued that the actions *to be on the playground*, *to be in bed*, and *to be in the bathroom* are metonymically used because they denote the activities usually performed at this place, like playing, sleeping, and washing.

(64) a. The children are on the playground. (Radden 2002: 424)
b. The children are in bed. (Radden 2002: 424)
c. I am in the bathroom. (Radden 2002: 424)

However, these examples are on the borderline of metonymy. One the one hand, they do not clearly involve a referential shift because the people referred to are still on the playground, in bed, or in the bathroom, respectively. On the other hand, it could be argued that the main focus is on the actions performed there. I think, the performance of these actions is a simple implicature. For instance, (64a) proposes that the children are on the playground, and implies that they are playing there. A referential shift, however, is not involved. The examples (64b) and (64c) behave similarly. As a referential shift is not clearly involved, I do not consider them as metonymies in the following.

The examples in (65) are sometimes argued to be metonymical because body parts are said to be used to refer to the activities they enable, as *legs*, *eyes*, and *head* enable walking, seeing, and thinking. The metonymy is assumed to be triggered by the adjectives.

(65) a. John has good legs. (Barcelona 2002: 265)
b. John has good eyes.
c. He really has a (good) head for maths. (de Mendoza Ibáñez & Velasco 2002: 514)

I do not consider those examples as metonymic because no referential shift is involved in the examples. In particular, the adjectives do not trigger metonymy shifts because they evaluate properties of the body parts that are measured in the activities the body parts enable: John's legs are good because they enable him to run fast; he has good eyes, because he has a good visual perception; and he has a good head for math because he is able to think quickly and correctly about mathematical problems.

3.3.5.3 Correlate metonymy

According to Löbner (2013: 309), "[c]orrelate attributes specify things of independent existence to which the referent of the concept is uniquely related." Examples are attributes for PRODUCER or OWNER in the case of artifacts as well as MOTHER in the case of human beings. There is a broad variety of correlates. Accordingly, attributes for correlates provide a presumably infinite range for possible types of metonymy. Thus, it is more or less impossible to provide a complete overview. The infinity of possible metonymic relations has already been noted by Bierwisch (1983). Moreover, this seems to be the reason why research on metonymy always points out that it is impossible to provide a complete overview about the relationships underlying metonymy (compare Radden & Kövecses 1999, among others, who note explicitly that the overview they present about metonymic relations is incomplete). Equally, this section does not aim at a complete overview of the correlate relations that gain access to metonymy. It pursues two goals: On the one hand, it exemplifies the diversity of correlate metonymy, especially focusing on the attributes involved in it; and on the other hand, it discusses some aspects that shed further light on bidirectionality.

Examples for correlate metonymy have already been discussed. For instance, when the container stands for its content (see Figure 3.3), this is a correlate metonymy because the container exists independently from the substance with which the container is filled at a given point in time. In the context of metonymy and type shifts (Section 3.3.1), I have already discussed examples where an artist stands for (an instance of) his œuvre, or where a producer or a factory stands for a product. Those examples are already cases for correlate metonymy because both an œuvre and a product exist independently from their creator. These types of correlate metonymy are very close to examples like (66) in which *newspaper* is used to refer to the publisher producing it.

(66) The newspaper went under. (Croft 2002: 199)

The noun *newspaper* is sortal. In the context of (66), the meaning of the noun is modified by several processes in order to refer to newspaper publishers as institution. Let us consider the metonymy first. Each newspaper has one and only one publisher. Figure 3.20 shows the frame that represents this knowledge. The central node is metonymically shifted to the *publisher* node.

Whether the examples confirm the bidirectionality hypothesis is in question. The attribute cannot be inverted because publishers usually publish more than one newspaper; this is in conflict with the structure of sortal frame graphs according to Postulate 2.7. Thus, it is debatable whether Postulate 2.7 is valid at all.

Figure 3.20 Metonymical modification of the sortal noun *newspaper*.

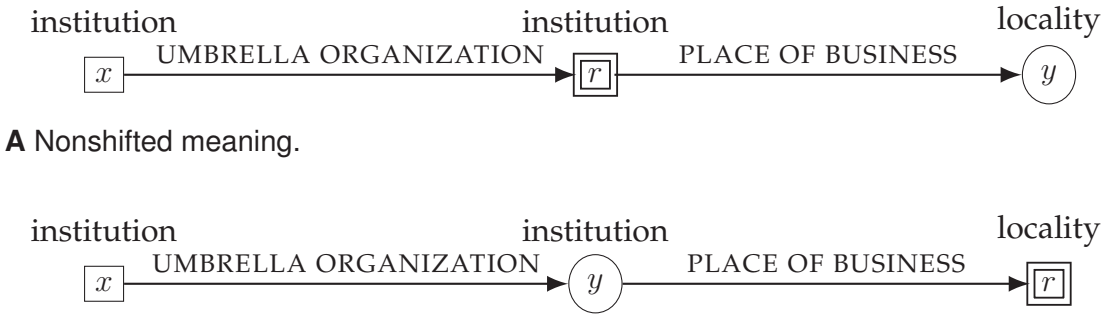
Source concepts that represent institutions occur frequently in correlate metonymy. In (49), I discussed an example in which the name of an institution is used to refer to a representative. Moreover, names of institutions can be used to refer to the locality where the institutions are situated, or, in the context of economics, to the institutions' share prices, as suggested by (67a) and (67b).

(67) a. Thüringische BausparerInnen beispielsweise kommen schneller zur Häuslefinanzierung, wenn der Dachverband ihrer Sparkasse in ostdeutschen Landen bleibt. (LCC 1498)
'Thuringian building society savers, for example, receive home loan financing more quickly when their savings bank's umbrella organization remains in Eastern Germany.'

b. Zudem verloren Thyssen, Karstadt Quelle und MAN mehr als drei Prozent. (LCC 666)
'Moreover, Thyssen, Karstadt Quelle, and MAN lost more than 3 percent.'

In both cases, the metonymy is triggered because selectional restrictions are violated. The noun *Dachverband* 'umbrella organization' is a functional noun that can be applied to associated institutions that are organized within such an organization. In (67a), the argument of the noun is satisfied by *Sparkasse*, which is a regionally organized cooperative bank in Germany, and thereby refers to an individual institution. The metonymy is triggered because only physical objects can be located, whereas what is called *Dachverband* 'umbrella organization' constitutes an abstract, nonmaterial entity. To interpret the sentence consistently, the meaning of *Dachverband* 'umbrella organization' is metonymically shifted. Umbrella organizations have a uniquely determined place of business. Figure 3.21A shows the frame representation of this relation. The central node is shifted to the *locality* node; see Figure 3.21B. The result is a well-formed functional frame graph according to Postulate 2.8 that represents the meaning 'locality of an institution's umbrella organization' based on which (67a) can be interpreted, as the noun *Sparkasse* specifies the argument of the shifted functional noun.

Since the frame in Figure 3.21B is a well-formed functional frame, it does not have to be restructured. Note, however, that each institution has one and only one



A Nonshifted meaning.

B Shifted meaning.

Figure 3.21 Metonymy shift of the functional noun *Dachverband* 'umbrella organization.'

place of business so that the corresponding attribute can be inverted. Thus, there is also a one-to-one correspondence between the source and the target concept, but it does not have to be used for restructuring processes.

The metonymy in (67b) is also triggered by a violation of selectional restrictions. The individual nouns *Karstadt* and *MAN* refer to German companies. The proposition that something increases by three percent can only apply to objects whose frames have properties that are changeable as well as measurable. Institutions like companies, however, do not offer such properties. Thus, the reference is shifted to the institution's share price because share prices have such properties. Since institutions have exactly one price of shares, PRICE OF SHARE is a potential attribute based on which the reference is shifted. The meaning shift as such is very similar to several of the examples that have already been discussed.

In the examples below, the name of a state or nation is used to refer to a representative. Such examples are typically investigated in the literature on metonymy. In (68a), *United States* refers to the US government, and in (68b), *Myanmar* refers to the government's executioners.

(68) a. The United States banned tuna imports from countries using driftnets.
b. Myanmar executed twenty Muslim activists. (Croft 2002: 184)

What is usually not noted in the literature on metonymy, is the following: In (68a), the metonymy is based on a core attribute because it is an integral part of the knowledge about nations that they have one and only one government. Thus, GOVERNMENT can be assumed to be a core attribute in the *USA* frame. By contrast, the metonymy in (68b) depends on a contextual attribute, depending on the execution to which the sentence refers. Figure 3.22 shows the frame representing the proposition that the government of Myanmar orders an execution. The sentence addresses a single execution, which has one and only one responsible person. Thus, the AGENT

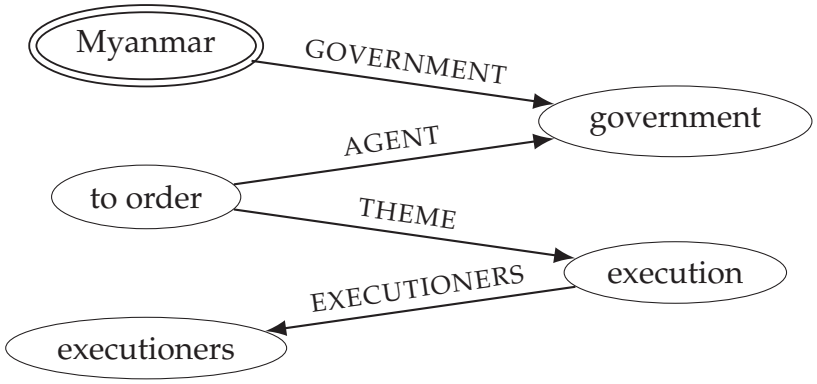


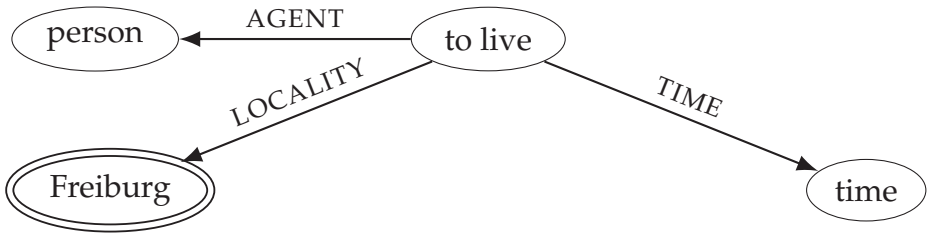
Figure 3.22 Frame representation of (68b).

attribute can be inverted to create a chain of attributes that leads from the *Myanmar* node to the *executioners* node along to which the central node is metonymically shifted. In this case, the AGENT attribute is injective due to the context in which a single event is designated.

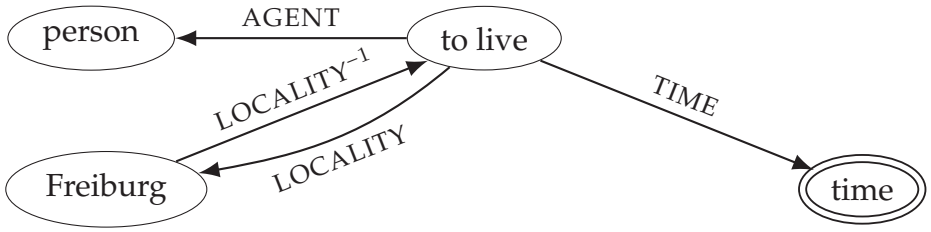
In (48), I discussed an example in which a locality stands for its inhabitants. Beyond that, localities are also able to refer to periods of time.

(69) In Freiburg waren meine Kinder noch jung.
'In Freiburg, my children were still young.'

In (69), the speaker is referring to a period of time during which he still thought of his children as young. Since *Freiburg* does not refer to a period of time but to a German town, the meaning of the expression is metonymically shifted. Thereby, the metonymy shift is based on nonlinguistic information, namely on the knowledge how the speaker has a connection to Freiburg. The speaker is connected to ›Freiburg‹ by a contextual attribute because the relation strongly depends on extralinguistic knowledge. Let us assume that the speaker lived there once. Alternative relations can be analyzed similarly; e.g., when the speaker worked in Freiburg. Living at a certain location is a state and thus related uniquely to a time, as represented by the frame in Figure 3.23A. The *person* value in the frame represents the speaker and therefore an individual. The noun *Freiburg* is also individual. These individuals uniquely determine the living event that, in turn, has a unique time. Hence, each node represents an individual, and the frame does not contain rectangular nodes. Since people usually live in one and only one place at a given point in time, the LOCALITY attribute can be inverted. Afterwards, the central node is shifted via that attribute and the TIME attribute to the *time* node. The result is shown in Figure 3.23B. The example illustrates once again that correlate metonymy may be based on single events.



A Frame representing a single *living* event.



B Metonymically shifted meaning.

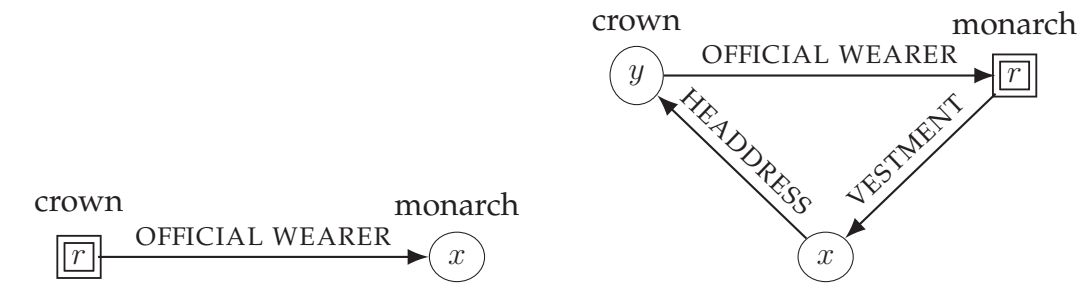
Figure 3.23 Metonymic reference to a period of time, depending on a *living* event.

A further prominent case of metonymy is referring to people by using terms for salient items of their clothing. Consider the examples below where UN soldiers and the queen are named by *the crown* and *Blauhelm* 'blue helmet,' respectively.

(70) a. The crown has knighted two professors of economics.
b. Niederländische Blauhelme töten Rebellen in Mali.
'Dutch Blue Helmets killed insurgents in Mali.'

Both metonymies operate on the knowledge that official items of clothing have uniquely determined subjects, or groups of subjects, that are formally allowed to wear them. I refer to the attribute describing such a relation as OFFICIAL WEARER. The noun *crown* in (70a) is a sortal concept. Since metonymy operates on the lexical meaning of nouns, it operates on the sortal concept depicted in Figure 3.24A. Possible values of the OFFICIAL WEARER attribute are majesties, marked by the corresponding type label. The central node is shifted to the *monarch* node.

The modified frame represents a monarch and thus also a sortal concept. Assuming that Postulate 2.7 is valid, the metonymically modified frame has to be restructured. This is possible because the *monarch* frame contains information about the official vestment of a monarch whose headdress is specified by a *crown* node; see Figure 3.24B. Since every node in the frame can be reached from the central node, the sortal frame is well-structured. When sentence (70a) is reinterpreted, the frame is forced to assign one and only one referent because the noun *crown* carries definite determination. The referent is specified context-dependently.



A Lexical sortal frame. **B** Metonymically shifted frame.

Figure 3.24 Metonymy shift of *crown*.

The example in (70b) can be explained analogously if we treat *Blauhelm* 'blue helmet' as a sortal concept. Indeed, *Blauhelm* is a compound whose meaning is the topic of Chapter 5. However, explaining the *Blauhelm* metonymy analogously to the *crown* metonymy is possible if we assume that the compositional derivation of the meaning of *Blauhelm* precedes the metonymy shift. This is plausible, because compounding provides complex meanings that are embedded compositionally into the sentence meaning, similar to the meanings of noncomplex nouns, as I will argue in Chapter 5.

3.3.5.4 Property metonymy

As property attributes, Löbner (2013: 310) considers those attributes that specify inherent dimensions of individuals; e.g., NATIONALITY or SEX. Antique rhetoricians sometimes considered expressions in which the material is used to refer to the object that is made out of this material to be metonymic (Nüßlein, 1994).

(71) He held the steel in his hand.

Examples 71 are sometimes considered as metonymic because *steel* is assumed to refer to ›sword‹. Certainly, I do not consider the example as metonymic. As already pointed out, metonymy shifts of referentially used expressions cause a referential shift. In the example, the reference of *steel* is not shifted, but still refers to the original referent.

Metonymies based on property attributes seem to occur very rarely. An example was considered in (40b), which has been frame-theoretically analyzed in Figure 3.11. However, in the examples investigated for this thesis, I did not find further examples for metonymy shifts based on property attributes.

In German, there are several nouns derived from adjectives referring to an entity with the property designated by the base adjective. Examples are the following:

(72) a. *flüssig* '(state of being) liquid' >> *Flüssigkeit* 'liquid'
b. *berühmt* 'famous' >> *Berühmheit* 'celebrity'

The examples, however, are derived adjectives and thus differ from the examples investigated in this chapter, in which the metonymy does not have a morphological reflex. Nevertheless, the examples raise the question as to whether there are similar examples that belong to the scope of metonymy as it has been investigated in this chapter. Although, I have not found any examples of this type, I do not want to exclude them in principle.

3.4 Summary

In this chapter, I have analyzed metonymy as a simple frame operation, resulting in a shift of the central node in the direction of an attribute to the value. The direction of the shift ensures that the source concept identifies the target concept uniquely, viewed from a certain angle usually determined by the sentential or the utterance context. The necessity of such a right-unique relation between source and target concept was motivated from the perspective of pragmatics: The right-uniqueness avoids inaccuracy in daily communication. Lakoff (1987) already noted the necessity of right-uniqueness but does not motivate it.

The fact that metonymy operates on attributes makes it possible to describe metonymic relations in terms of attribute labels, which correspond to functional nouns. In this regard, I introduced Löbner's (2013) attribute distinction. He distinguishes between part-whole, event, correlate, and property attributes. Figure 3.25 illustrates to which metonymic relations the four types of attributes gain access. The figure depicts those relations for which examples have been discussed in this chapter. Since there is always an unmanageable number of possible contexts and thus of potential attributes, the synopsis is definitely not exhaustive.

The following list shows the attributes with which we came up when analyzing the metonymies investigated in this thesis.

- Properties: COLOR
- Correlates: INHABITANTS, PARTICIPANT OF THE RACE, INSTITUTION, CITY COUNCIL, OFFICIAL WEARER, CONTAINER for CONTENT, CREATOR, PRODUCTS, PUBLISHER, PUBLISHED MEDIUM, UMBRELLA ORGANIZATION, PLACE OF BUSINESS, THEME, LOCALITY, AGENT, VESTMENT, HEADNESS, ŒUVRE, CREATOR, COMPOSER
- Part: HOST, BODY, LIVER, BODY, MIDDLE FINGER, WHOLE,

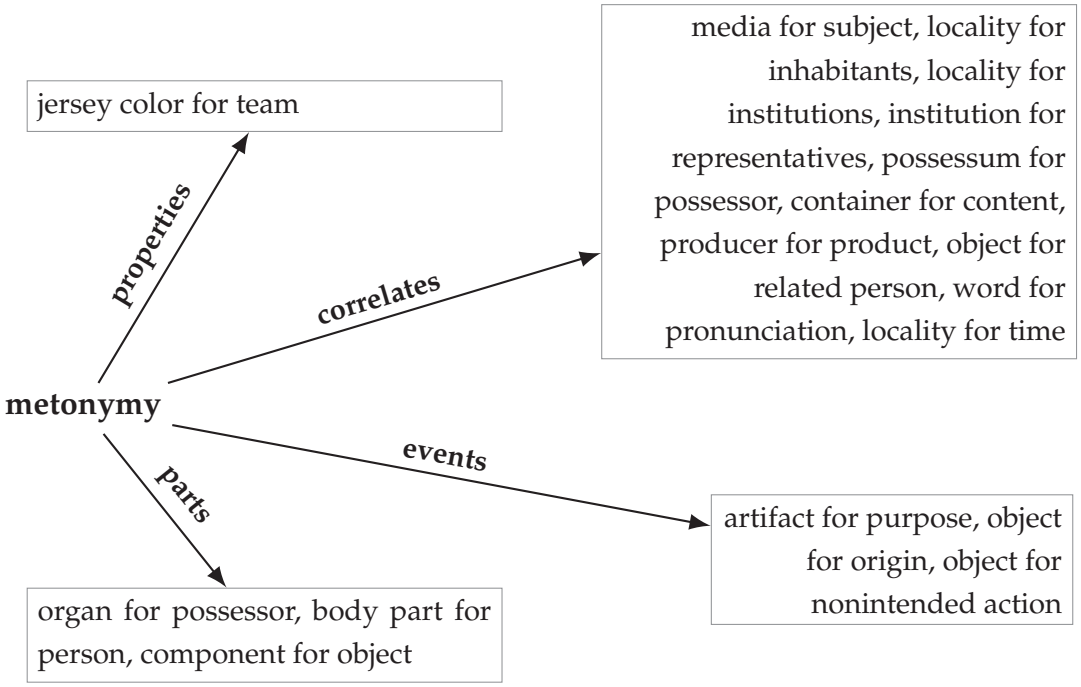


Figure 3.25 Synopsis of metonymic relations.

- Event: PURPOSE, INSTRUMENT, ORIGIN, CAUSE, ORIGIN

This comprehensive overview shows that attributes potentially cover a broad range of relations.

Furthermore, it has been explicated that the attributes occurring in metonymy can be divided into core attributes, sentential-differentiation attributes and contextual attributes. The distinction depends on the status of the knowledge represented by the attributes. Core attributes belong to the lexical knowledge. By contrast, sentential-differentiation attributes arise during sentential interpretation. At the least, contextual attributes are established by extralinguistic knowledge.

Beyond that, I argued that metonymy can co-occur with type shifts. However, these shifts can be explicitly separated from metonymy shifts. The frame analysis allows to be precise about the effect of the metonymy and was able to border it result from the effects of rival shifts.

Furthermore, we discussed Löbner's (2013) hypothesis according to which metonymy not only requires a right-unique, but also a left-unique relation between source and target concept. I referred to this hypothesis as *bidirectionality*. Although many examples confirm the hypothesis, a plausible motivation for the necessity of bidirectionality has not been found. Löbner's (2013) argument that bidirectionality is required to restructuring metonymically modified frames is in dispute: First of all, the arguments hold only for shifts of sortal concepts, but not for functional concepts,

as the examples in (53) demonstrate. Beyond that, the argument builds on Postulate 2.7 for which evidence is still missing.

4

German *-er* and *-ung* nominalization

Deverbal nominalization is one of the most productive types of derivational word formation in German. In this chapter, I develop a frame-theoretic decomposition of the meanings of German deverbal nouns generated with the suffixes *-er* and *-ung*. Section 4.1 summarizes general results of research on deverbal *-er* and *-ung* nominalization in order to explicate which phenomena have to be captured by a frame-based approach. Section 4.2 comments on the interpretation of deverbal nouns in general and thereby clarifies the assumptions on which a conceptual approach to nominalization is usually built. Finally, 4.3 presents a frame-based analysis of deverbal *-er* and *-ung* nouns that also takes Löbner's (2011) theory of concept types into account.

4.1 Semantic properties of *-er* and *-ung* nominals

Semantic research on deverbal *-er* and *-ung* nouns usually centers around three topics, namely (i) the relationship between their meanings and the meanings of their base verbs, (ii) the phenomenon called *eventivity*, and (iii) the argument structure of these nouns. However, in recent semantic classifications, these topics are, if at all, only partially, related to each other. The analysis developed in Section 4.3 will reflect on each of these topics, and combine them in a conceptually coherent way. The current section aims at summarizing the most important results on the mentioned topics.

4.1.1 The relationship between deverbal nouns and their base verbs

Deverbal *-er* and *-ung* nominalization derives nouns from verbs. The affixation of these suffixes has a grammatical as well as a semantic effect: Grammatically, *-er* and *-ung* generate masculine and feminine nouns, respectively, whereas semantically, a new meaning is derived from the meaning of the base verb. In this regard, I distinguish between *compositional* and *noncompositional* meanings of deverbal nouns: I consider an *-er* or *-ung* nominal as compositional, if its meaning can be expressed

in terms of its base verb following a general rule of composition. For instance, the meaning 'someone who drives' of the *-er* nominal *driver* can be paraphrased with regard to the base verb. Furthermore, the meaning is said to be derived regularly since there are *-er* nouns that are built analogously; e.g., *baker* 'someone who bakes,' *teacher* 'someone who teaches.' Thus, the meaning is compositional.

By contrast, the meaning of the nominal *Schläfer* 'sleeper agent' cannot be expressed by the base verb because the base verb does not imply the semantic component ›being an agent or a terrorist‹. Moreover, there are no analogously interpreted *-er* nouns. Hence, its meaning is noncompositional. In the following, I only focus on the meaning of compositional nominals because I am predominantly interested in the conceptual mechanisms underlying the productive use of word formation.

In most cases, deverbal nouns do not have a unique meaning, but rather are potentially ambiguous. For instance, the noun *berichtigen* 'to correct' >> *Berichtigung* 'correction' refers to the process of correcting in (1a) and to the result evoked by this process in (1b).

(1) a. Die Berichtigung der Klassenarbeit dauerte Stunden.
'The correction of the test took hours.'

b. Die Berichtigung liegt auf dem Tisch.
'The correction is on the table.'

Thus, the investigations of the meanings that deverbal *-er* and *-ung* nouns can have usually do not center solely around the question which meanings these nouns enable in general, but also aim at providing explanations which verb classes allow which meanings and which not. However, analyzing the semantic constraints underlying deverbal *-er* and *-ung* nominalization would require a deeper decomposition of verb meanings in terms of frames than is possible so far.[19] Hence, the results developed in Section 4.3 must be understood as existential statements: For each meaning variant, there are verbs enabling it systematically. In the following, I summarize which meanings can be generated by the compositional interpretation of deverbal *-er* and *-ung* nouns.

Deverbal *-er* nouns. For German, Fleischer & Barz (2012: 121ff) investigate deverbal *-er* nominalization in terms of traditional grammar, like *nomina agentis*, *nomina instrumenti*, and *nomina acti*. Although Osswald (2005: 257f) points out that these terms are not consistently used in the literature, the way in which the terms are used by Fleischer & Barz (2012) suggests that deverbal *-er* nouns can refer to the arguments of their base verbs, including the agent, the experiencer, the instrument, the theme, or the locality, as in (2), (3), (4), (5), or (6), respectively, as well as to the event designated by the base verb as such, as in (7).

[19] Such a decompositional account is currently being pursued by the project B02 of CRC 991.

(2) Agents
   a. *laufen* 'to run' >> *Läufer* 'runner'
   b. *fahren* 'to drive' >> *Fahrer* 'driver'

(3) Experiencer
   a. *betrachten* 'to observe' >> *Betrachter* 'observer'
   b. *hören* 'to hear' >> *Hörer* 'hearer'

(4) Instruments
   a. *drucken* 'to print' >> *Drucker* 'printer'
   b. *wischen* 'to wipe' >> *Wischer* 'wiper'

(5) Themes
   a. *aufkleben* 'to stick' >> *Aufkleber* 'sticker'
   b. *anhängen* 'to attach' >> *Anhänger* 'tag'

(6) Locality
   a. *anlegen* 'to land' >> *Anleger* 'jetty'
   b. *laufen* 'to walk' >> *Läufer* 'carpet'

(7) Events
   a. *lachen* 'to laugh' >> *Lacher* 'laugh'
   b. *jauchzen* 'to whoop' >> *Jauchzer* 'whoop'

Furthermore, there are *-er* nouns that refer to results of the action described by the base verb; e.g., *kratzen* 'to scratch' >> *Kratzer* 'scratch.' However, these cases are very rare and do not seem to occur regularly. This is why I exclude them from the following analysis.

Although deverbal *-er* nominals in German have properties similar to their English equivalents (Taute, 2000), they differ insofar as only German nominals allow the reference to events. In English, by contrast, such readings arise from conversion, as the comparison of the sentences in (8) demonstrates. According to Schäfer (2008), the reference to events is restricted to *-er* nominals built with semelfactive verbs.

(8) a. Ich habe einen lauten Lacher vernommen.
   b. I heard a loud laugh.

Moreover, Fleischer & Barz (2012) distinguish the category of *terms for persons or objects* ("Personen- und Sachbezeichnungen"). Although the authors do not mention it explicitly, this category seems to be orthogonal to the classification in terms of θ roles, as illustrated in (2) to (7). The category covers nominals that refer to entities that are generically involved in the events designated by the base verb, e.g., for job-related or purpose-based reasons; e.g., *backen* 'to bake' >> *Bäcker* 'baker' or

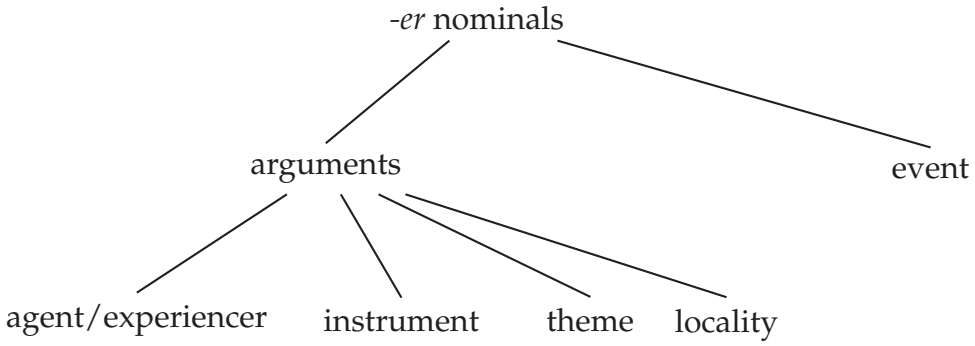


Figure 4.1 Readings of *-er* nominals.

wischen 'to wipe' >> *Wischer* 'wiper.' Obviously, such deverbal nouns include extralinguistic knowledge, e.g., the action a *Bäcker* 'baker' performs in his job is baking. The examples provided by Fleischer & Barz suggest that this category is restricted to the reference to the agents of the base verb, whereas denominations of objects are supposed to refer to instruments.

Beyond that, Taute (2000) proposes categories for terms for animals and plants that occur mostly as compounds; e.g., *Nachtfalter* 'moth' or *Flachwurzler* 'shallow root tree.' However, I do not consider these categories because they do not seem to be the result of compositional meaning derivations, but rather of the intentional naming of animals and plants, where the relation to the meaning of the base verb is notoriously veiled. Thus, these meanings are based on conventions, but do not underlie compositional rules. By contrast, meanings of denominations of persons or objects in the sense of Fleischer & Barz (2012) are mostly derived by compositional mechanisms, although they involve extralinguistic knowledge, as I will argue in 4.3. Figure 4.1 summarizes which meanings have been verified for deverbal *-er* nouns so far. It has been demonstrated that deverbal *-er* nominals in German can refer to the agent, the experiencer, the theme, the instrument, or to the event. Correspondingly, I refer to those nominals as having *agent*, *experiencer*, *theme*, *instrument*, or *event* reading. Agents and experiencers are considered as one category because their θ-roles are distributed complementarily. Denominations for people or objects are possible for nominals that have either an agent or instrument reading.

Deverbal *-ung* nouns. According to Osswald (2005), traditional semantic classifications differentiate between two general readings of *-ung* nominals, namely *nomina actionis* and *nomina acti*. In case of the former, the event described by the base verb is denoted, either seen as a punctual or as a continuous process; e.g., (9a) and (9b), respectively. By contrast, nomina acti refer to persons or objects that are involved in the event designated by the base verb, as in (10a), or to its results, as in (10b).

(9) a. Eine kurze Schwankung war bemerkbar.
'A short deviation was noticeable.'
b. Die Kinder beobachteten die Landung des Flugzeugs.
'The children observed the landing of the airplane.'

(10) a. seine Begleitung
'his companion'
b. die stabile Absperrung
'the strong blockade'

The term *nomina acti*, however, covers a broad variety of readings. Hence, it is not clear whether the traditional classification is precise enough to capture the semantics of the suffix adequately (Osswald, 2005). Research on *-ung* nominalization suggests that the readings referred to as *nomina acti* can be subdivided into those referring to entities that are involved in the events described by the base verb and those referring to results that come into being by these events (Ehrich & Rapp, 2000; Fleischer & Barz, 2012). The arguments to which deverbal *-ung* nouns may refer include the agent, theme, instrument, and locality. Consider the examples below.

(11) Agents
a. *begleiten* 'to accompany someone' >> *Begleitung* 'companion'
b. *vertreten* 'to represent someone' >> *Vertretung* 'representative'

(12) Themes
a. *liefern* 'to deliver' >> *Lieferung* 'deliver'
b. *senden* 'to broadcast something' >> *Sendung* 'broadcast'

(13) Instruments
a. *heizen* 'to heat' >> *Heizung* 'heater'
b. *lüften* 'to aerate' >> *Lüftung* 'airing'

(14) Localities
a. *wohnen* 'to live' >> *Wohnung* 'apartment'
b. *reinigen* 'to clean' >> *Reinigung* 'cleaning'

The results to which *-ung* nominals may refer can be distinguished into those that are contained in the argument structure of their bases verbs, as in (15a), and those that are not represented in the argument structure, as in (15b), where *Absperrung* 'blocking' refers to what comes into being by the action described by the base verb.

(15) a. *erfinden* 'to invent' >> *Erfindung* 'invention'
b. *absperren* 'to blockade' >> *Absperrung* 'blockade'

With respect to result readings that are not established by the argument structure of the base verb, Ehrich & Rapp (2000) distinguish between result objects and result states. An example for the former class was already given in (15b). Deverbal *-ung* nouns of the latter class are always generated with change of state verbs, as in (16). The state refers to results from the event designated by the base verb.

(16) *verwirren* 'to confuse' >> *Verwirrung* 'confusion'

Result-state readings differ from event readings of psych verbs. The former refers to the state evoked by the event designated with the base verb, whereas the latter refer to the event expressed by the base verb as such. Compare the example in (16) with the one in (17) below.

(17) *bewundern* 'to admire' >> *Bewunderung* 'admiration'

In (16), the confusion state to which the nominal refers results from an event of confusing someone to which the base verb refers. Consequently, *Verwirrung* 'confusion' is a result-state nominal. By contrast, the nominal (17) refers a psych state of admiring somone. Since the base verb refers also to this state, the nominal *Bewunderung* 'admiration' has event reading.

The class of result objects can be further subdivided: With reference to Brandtner (2011) and Roßdeutscher (2010), Dölling (2013) distinguishes between concrete and abstract result objects. Examples of concrete result objects are material objects, such as *Abgrenzung* in (15b). As abstract result objects, Dölling (2013) considers deverbal nouns like *entscheiden* 'to decide' >> *Entscheidung* 'decision' that have mental results. Nominals like the one in (15a), however, seem to be on the border of these classes because inventions can be material (e.g., the steam engine) as well as immaterial (e.g., patented procedure like Karmarkar's algorithm).

In addition to the readings discussed, deverbal *-ung* nominals can be interpreted in a way that has not been investigated in the literature so far. I refer to them as *property readings*.[20] In property readings, deverbal *-ung* nominals refer to the quality of a result object. For instance, in (18a), *Zusammensetzung* 'composition' refers to the quality of how an object has been composed. In this case, it is excluded that *Zusammensetzung* refers to the object resulting from a construction process because the object itself can be specified within a genitive construction, as (18b) shows.

(18) a. Die Zusammensetzung ist gut gelungen.
'The construction is well done.'
b. Die Zusammensetzung des Objekts ist gut gelungen.
'The construction of the object is well done.'

[20] The class of *properties* was uncovered by Anselm Terhalle in Terhalle (2017).

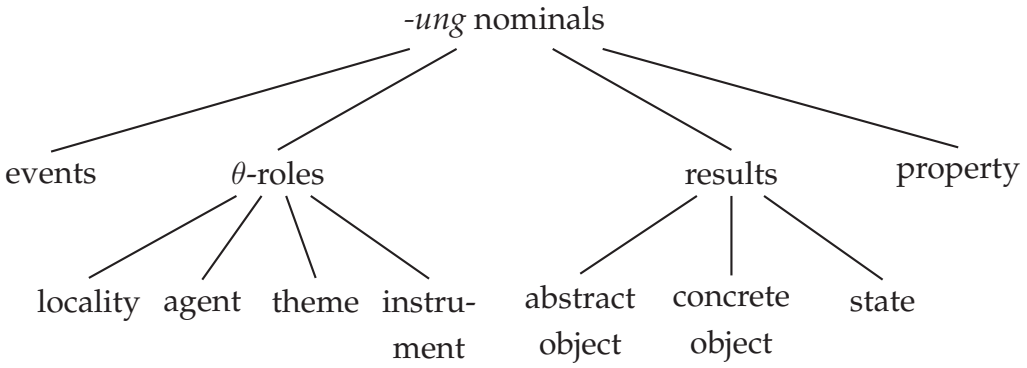


Figure 4.2 Readings of *-ung* nominals.

The discussion illustrated the semantic variety of deverbal *-ung* nouns. Figure 4.2 summarizes the readings distinguished so far. The category of results has to be understood as capturing result objects that are not represented in the θ structure of the base verbs. By contrast, result objects like *Erfindung* 'invention' are understood as themes.

4.1.2 Eventivity

The deverbal *-er* nouns in (19) seem to differ in a crucial point: A person can be denoted as *Lehrer* 'teacher,' although he has never taught, whereas a person cannot be designated as *Retter* 'saver' without having saved anyone. This difference motivates the distinction between event vs. nonevent or, equivalently, between eventive vs. noneventive, which is usually used in research on deverbal *-er* nominalization. As far as I know, it is not mentioned in the literal discussion of deverbal *-ung* nominals.

(19) a. *lehren* 'to teach' >> *Lehrer* 'teacher'
b. *retten* 'to save' >> *Retter* 'saver'

A deverbal noun is eventive if its referent is determined by participating in a given event of the type specified by the base verb. By contrast, if the referent does not have to be involved in a particular event necessarily, the deverbal noun is noneventive. In these cases, the events occur dispositionally or habitually. Despite this intuitive notion, the distinction of eventive and noneventive nominals has evoked some confusion, especially concerning the ontological status of the event underlying eventive nominals. Before going into these problems, let us consider some additional examples in order to illustrate which phenomena the notion of eventivity addresses.

According to Alexiadou & Schäfer (2010: Section 2.1), nonevent nominals either occur in agent or instrument reading. Examples for the former refer to subjects performing the action designated by the base verb habitually or for job-related reasons; e.g., *Lehrer* 'teacher' or *Lügner* 'liar.' Examples for the latter refer to artifacts that are made for special purposes: The instruments can be designated by these deverbal nouns, even if they have not and never will be involved in the respective events. Instead, it is only mandatory that they are made for typically being involved in these events as instruments.

One example for an eventive nominal in agent reading was introduced in (19b). Beyond that, there are also eventive nominals in instrument reading, as the example below suggests (the example is cited from Alexiadou & Schäfer 2010: Section 4).

(20) Woks have always been conservers of cooking oil as well as fuel.

Semantically, the distinction between eventive vs. noneventive is problematical for the following reason: When the notion of eventivity is introduced, authors usually build on a referential criterion. For instance, according to Roy & Soare (2014: 139) who investigate *-er* nominalization in English, eventive *-er* nominals entail the occurrence of an actual event.

This assumption, however, seems to be too strong when considering the example in (21). Trivially, it is also possible to designate the referent of *Markus* as *Fahrer* 'driver,' even if an actual driving event in which he is involved does not exist yet. Consider a situation in which a group of people have planned a road trip that does not take place in the end because the car will not start because of an engine failure. In this case, a driving event does not occur. Nevertheless, the deverbal noun applies to the subject referent because he was scheduled to be the driver of an actually planned event.

(21) Markus ist unser Fahrer.
'Markus is our driver.'

The example shows that the notion of eventivity has to be separated from the level of reference and only related to the conceptual level instead. Authors like Alexiadou & Schäfer (2008) postulate that eventive nominals presuppose an event but leave open whether presupposing means the existence or the disposition of a single event. Thus, the notion of eventivity is in need for clarification. In Section 4.3.1, I will propose a terminology that does not take the level of reference into account.

As mentioned before, eventivity is not used in the analysis of deverbal *-ung* nouns. However, there are obviously cases in which *-ung* nominals are related to actual events (*Bedrohung* 'threat') and those that are not (*Heizung* 'heating'). After rendering the eventive vs. noneventive distinction more precisely in Section 4.3, I will apply it to German *-ung* nominalization.

4.1.3 Argument structure of deverbal nouns

In general, deverbal *-er* and *-ung* nominals can occur without arguments. It is also possible that they take arguments inherited from their base verbs. The question as to which arguments can be specified, and why has been extensively discussed in the literature on deverbal nominalization. In the following, I will not provide a complete overview, but rather summarize the discussion to such an extent as is relevant for the frame approach developed in this chapter. That is, I focus on those claims that will be either supported or revised by the frame approach.

Deverbal *-er* nouns. The occurrence of arguments in the genitive position is usually linked to eventivity (Roy & Soare, 2014). As already mentioned, the definition of eventivity is in need for clarification. For the moment, however, let us consider eventive nominals as those nominals whose referents are involved in a single event expressed by the base verb. Roy & Soare (2014: 140f) assume that only eventive *-er* nominals occur with arguments, whereas noneventive ones prototypically occur in isolation.

As Hovav & Levin (1992) point out, an eventive interpretation of typical noneventive nominals can be forced by the occurrence of arguments, if the referent of the nominal is animated. For instance, *backen* 'to bake' >> *Bäcker* 'baker' is usually used as a jobtitle and thus may refer to people doing such a job, even if they are not actually involved in a baking event. However, in (22a), the referent of the phrase is related to an actual event. Thus, the argument specification forces the eventive interpretation of a noneventive nominal. This also explains why the person referred to in (22a) need not be a professional baker.

The enforcement of an eventive reading is not allowed for nonanimated nominals in noneventive interpretation, as the *wiper* example in (22b) demonstrates: the craftsman is not interpreted as a person that is actually involved in a wiping event. Rather, the phrase is interpreted based on a possessive relation in that the wiper is possessed by the craftsman, where *possessed* has to be understood in a general sense, including relations where, for instance, the craftsman holds a wiper in its hand.

(22) a. der Bäcker des Brotes 'the baker of the bread'
b. der Wischer des Handwerkers 'the wiper of the craftsman'

Although Hovav & Levin (1992) provide convincing data for their thesis why animacity is a necessary condition for forcing eventive interpretations of noneventive *-er* nominals, they do not motivate it semantically.

Moreover, the claim only holds for arguments in the genitive position, but does not hold for arguments specified by prepositional phrases. For instance, *Lehrer*

teacher in (23) is not interpreted eventively, although the theme argument of a teaching event is specified.

(23) Markus ist Lehrer für Englisch.
'Markus is an English teacher'

Furthermore, there are also noneventive *-er* nominals that are open for argument specification. Imagine a person who has recently been employed as the chauffeur of the German chancellor Angela Merkel. The person can be referred to as *der Fahrer Merkels* 'Merkel's Driver' even if he has not chauffeured Merkel once. In this case, *Fahrer* 'driver' is noneventive and occurs with an argument.

Kaufmann (2005) investigated the argument specification of nominalized infinitives in German. She makes a case for these nominals that I will relate to deverbal *-er* and *-ung* nominals in Section 4.3. In German, nominalized infinitives always designate the event to which the base verb may refer. Kaufmann (2005) distinguishes between nominalized infinitives in referential and generic use and demonstrated that both may occur with arguments. If arguments are specified, the function of the argument specification, however, differs in both cases: In referential use, the arguments enable or facilitate the identification of the event designated by the nominalized infinitive, whereas in generic use, the arguments enable the differentiation of the event. For instance, in (24a), the event is identified by the specification of the theme argument, whereas in (24b), the meaning of *Schießen* 'shooting' is differentiated by the argument: shooting in general is not forbidden, but only the shooting of rabbits and thus a subtype of the event type designated by the nominalized infinitive.

(24) a. Das Schießen des zweiten Tores war entscheidend.
'Scoring the second goal decided the game.'
b. Das Schießen von Hasen ist verboten.
'The shooting of hares is forbidden.'

Deverbal *-ung* nouns. Similar to deverbal *-er* nouns, deverbal *-ung* nouns also allow argument specification in the genitive position and by prepositional phrases. For instance, in (25) the theme argument of the base verb is specified in genitive position, whereas in (26) the agent is specified by a PP with the preposition *durch*.

(25) die Berichtigung des Diktats 'the correction of the dictation'

(26) die Absperrung durch die Polizei 'the police blockade'

In the context of deverbal *-ung* nouns, the genitive position is of common interest. In most cases, it is ambiguous whether the genitive has to be interpreted as agent or theme. In (27), for instance, the argument specified in the genitive position may

be either the agent or the theme of the interrogation event. Speaking more syntactically, the genitive may be interpreted as the argument occurring in subject or object position of the base verb. In the German literature, the different interpretations of the genitive are referred to as *genitivus subiectivus* or *genitivus obiectivus*, respectively. The former means interpreting the genitive as agent and the latter as theme.

(27) die Befragung des Kanzlers 'the interrogation of/by the chancellor'

In contrast to the example above, there are also examples in which the genitive phrase does not allow both readings, but only the genitivus obiectivus interpretation. Compare the examples below.

(28) a. die Fertigstellung des Hauses
'the completion of the house'
b. ??die Fertigstellung des Architekten
??'the architect's completion'

Ehrich & Rapp (2000) investigated under which conditions the genitive position offers both the genitivus-subiectivus as well as the genitivus-obiectivus interpretation and when it is restricted to the genitivus-obiectivus interpretation. To this end, they approach the meaning of deverbal *-ung* nouns in terms of Davidsonian semantics. The authors assume that the arguments of verbs underlie a prominence scale according to which the agent is more prominent than the theme or patient. The explanation the authors provide is this: If the semantic form, understood as the representation of the lexical meaning in terms of Davidsonian semantics, entails a BECOME predicate and is thus telic in the sense of Vendler, only the argument of minor prominence can be specified in genitive position. Since the theme or patient argument are less prominent than the agent argument, telic verbs only allow the genitivus obiectivus reading. By contrast, in case of atelic base verbs, the genitive can be interpreted as agent as well as theme or patient.

However, this explanation lacks explanatory value for two reasons: First, it is not syntactically motivated, and second, there are some exceptions. The genitive in (29), for instance, is supposed to be preferably interpreted as agent, although the base verb *hinrichten* 'to execute' is telic. Ehrich & Rapp (2000: 277f) debilitate the counterexample by arguing that the verb *hinrichten* 'to execute' is strongly associated with Henker 'hangman' so that the interpretation of the genitive as agent is strongly guided by world knowledge.

(29) Keiner entging der Hinrichtung des Henkers. (Ehrich & Rapp 2000: 277)
'No one escaped the hangman's execution.'

Moreover, Ehrich & Rapp (2000: 288ff) discuss the meaning of *Bemalung* 'painting' based on several examples and reach the conclusion that there are cases in which

it allows both the genitivus-subiectivus and the genitivus-obiectivus interpretation and those cases in which the genitive is restricted to the latter interpretation. Consider the examples below. The authors explain this phenomenon by postulating that *bemalen* 'to paint' has two lexical entries specifying a telic and an atelic meaning, respectively.

(30) a. Die Bemalung der Wand dauerte Stunden.
'Painting the wall took hours.'
b. ??Die Bemalung des Malers$_{[agent]}$ dauerte Stunden.
?¿'The painting by the painter took hours.'

(31) a. Die Bemalung des Malers$_{[agent]}$ ist sehr fachmännisch.
'The painting by the painter is very professional.'
b. Die Bemalung der Wand$_{[theme]}$ ist sehr fachmännisch.
'The painting of the wall is very professional.'

In Section 4.3, I will present an explanation for the example above without postulating different lexical entries for the base verb. This explanation will moreover be conceptually motivated.

4.2 The interpretation of deverbal nouns

In the previous section, it was demonstrated that the readings of deverbal *-er* and *-ung* nouns are not infinite, but constitute a small and restricted set. Since the number of possible contexts is disproportionate to the set of meanings that deverbal *-er* and *-ung* potentially provide, it is implausible to assume that the interpretation of deverbal nouns is guided by the context (this is different for compounds, as I will argue in Chapter 5). Rather, it is always assumed in research on nominalization that there is a finite set of derivational rules based upon which certain meanings of deverbal nouns are provided that are similar to lexical meanings of nonderived nouns. That is, the derivational rules operate independently from the sentential or the utterance context.

The assumption is not in conflict with the ambiguity of deverbal *-er* and *-ung* nouns: Their ambiguity behaves equally to those of polysemous underived nouns, whose polysemy is eliminated before the sentential meaning is composed. The elimination of ambiguity, however, is not subject to derivational rules but to the context. The derivational rules only provide a range of meanings the deverbal nouns are supposed to take. Which meaning is selected in the given context, is subject to the elimination of polysemy. Moreover, it is not excluded that the meaning of deverbal nouns can be context-dependently modified by post-lexical processes like metaphor

and metonymy. Certainly, these modifications do not influence the derivational rules, but rather operate on the results of these derivational rules. Consequently, the derivational rules have to be independent from the context and only apply to the meaning of the base verbs.

Furthermore, since deverbal *-er* and *-ung* nouns are potentially ambiguous, the derivational rules proposed for *-er* and *-ung* have to be flexible enough to capture productive meanings of these nominals and rigid enough to exclude impossible interpretations. This leads to the questions how many derivational rules have to be stored for *-er* and *-ung* and how flexible they should be. In principle, there are two explanations. I refer to them as the *underspecification approach* and the *polysemy approach*. Note that the approaches are not mutually exclusive but may also occur in combination.

Underspecification. The underspecification approach traces back different readings to the same derivational rule: The derivational rules are considered as offering a scope of flexibility that is fixed, or specified, based on the base verbs' meanings. Different readings can be explained as underlying the same derivational rule, when assuming that the differences result from the different inputs different verbs provide. At the same time, it has to be noted that the content used for specification is provided only by the base verb and not by the context in which the deverbal noun is used. Thus, the underspecification approach is not in conflict with the initial considerations according to which the context does not guide the interpretation of nominals, but, if at all, indicates reinterpretations of nominals like metonymy or metaphor that operate independently from the derivational rules. Roßdeutscher (2010), Dölling (2013), von Heusinger & Schwarze (2005) and Lieber (2004) proposed that the derivational rules for nominalization are underspecified in most cases because the meaning of nominals often depends on the argument structure of the base verbs, which provides potential referents of nominals. However, the approaches do not specify under which conditions the arguments are selected, although this has to be the crucial point of an underspecification approach: explicating which meaning components are underspecified and based on which mechanisms they are enriched with content. Otherwise, the approach lacks explanatory value.

Polysemy. In the polysemy approach, it is assumed that there is a separate lexical entry for each derivational rule. For instance, Bierwisch (1983) assumes that there are completely independent derivational rules underlying the interpretation of deverbal *-ung* nominals.

With respect to the German suffixes *-er* and *-ung*, researchers tend to avoid the polysemy approach. In this regard, the objection is usually that the assumption of multiple derivational rules is not in line with the assumption that the mental lexi-

con should be as economic as possible (Dölling, 2013). However, arguing this way disregards the fact that the underspecification approach requires more complex interpretational processes than the polysemy approach in order to add content to the derivational rule or to modify the assumed basic meaning, respectively. With this in mind, it is questionable whether it requires a higher cognitive effort to store multiple derivational rules in favor of avoiding complex interpretations or realizing complex interpretations in favor of reducing the number of derivational rules. Thus, polysemy could only be rejected if we find a motivation as to why complex interpretations are more economic than the storage of multiple derivational rules. On the other hand, the polysemy approach is only justified if it motivates the opposite fact, or if it is demonstrated that there are productive readings that cannot be explained by the underspecification approach.

The synopsis of the approaches suggests what a semantic theory of *-er* and *-ung* needs to supply. First, it is necessary to explicate derivational rules in order to explain how the different readings of the nominals arise. Afterwards, it has to be explicated the extent to which the readings are interrelated. This is where the approaches discussed above become relevant: There is a need for a clarification if the semantics of the suffixes is subject to underspecification or polysemy.

4.3 Approaching deverbal nouns in terms of frames

The frame approach to nominalization that will be developed in the following builds on the distinction between single-event and event-type nominals that was introduced in Section 4.3.1. The distinction motivates several subtypes of readings that deverbal *-er* and *-ung* nominals may have. Each of the subtypes subsumes a variety of derivational patterns that are explicated in the subsequent sections.

4.3.1 Single-event vs. event-type nominals

In the following, I clarify the notion of eventivity. Building on the episodic vs. generic distinction in the sense of Carlson (2011), I will introduce the distinction of single-event vs. event-type nominals. The former correspond to what is commonly understood as eventive nominals whereas the latter correspond to noneventive nominals. Despite this correspondence, I introduce the terms single event and event type in order to highlight that my definition slightly differs from how eventivity is usually defined in the context of deverbal nouns.

According to Carlson (2011: 1154), genericity "is a phenomenon whereby generalizations are expressed by sentences that typically abstract over events, situa-

tions, etc." For instance, (32) states that bears are assumed to like honey. By contrast, episodic sentences refer to single events or situations, as in (33).

(32) Bears eat honey. (Carlson 2011: 1154)

(33) This morning, a bear ate some honey. (Carlson 2011: 1154)

Carlson (2011) assumes that episodic statements predicate about single events, as in (33). By contrast, generic statements express "regularities, laws, generalizations, habits, and dispositions" (Carlson 2011: 1153), like the following examples taken from Carlson (2011).

(34) a. You shall not kill.
b. Adults have to pay the full price.
c. John smokes.

Deverbal nominals behave analogously in that their potential referents can be related episodically or generically to the event designated by the base verb. In the following, I refer to the former as *single-event nominals* and to the latter as *event-type nominals*. The referents of single-event nominals are usually involved in a particular event of the type expressed by the base verb. For instance, *Fahrer* 'driver' in (35) is a single-event nominal because it identifies the referent depending on a single situation.

Deverbal nominals can be usually paraphrased by either an episodic or a generic statement. Consider the examples below. In (35), the referent of the nominal has to be paraphrased by an episodic sentence; e.g., 'someone drove a vehicle and thereby caused an accident.' In (36), however, the meaning of the nominal has to be paraphrased by a generic statement; e.g., 'someone teaches (professionally and regularly).'

(35) Der Fahrer des Unfallwagens flüchtete.
'The driver of the involved car (or: of the car involved in the accident) fled.'

By contrast, the referents of event-type nominals are involved in the event described by the base verb habitually or dispositionally. Examples are nominals that refer to objects that are made for special purposes (*Heizung* 'heater'), people that have characteristic habits (*Lügner* 'liar'), or jobholders (*Lehrer* 'teacher'). Presumably, event-type nominals only allow generic meaning paraphrases, as in (36).

(36) Lehrer 'teacher' >> 'someone who regularly gives lessons (for money)'

4.3.2 Specifying derivational rules in terms of frames

According to Section 4.2, the aim of a semantic theory of nominalization has to be the specification of derivational rules. In the following, I describe how the derivational rules underlying deverbal *-er* and *-ung* nouns can be specified within a frame-based approach. The central statement is that such a derivational rule is determined by specifying

- how the potential referent of the deverbal noun is conceptually related to the event designated by the base verb,
- whether the meaning of the deverbal noun is based on a single event or on an event type in the sense of the foregoing section,
- which arguments the deverbal noun requires and how they are conceptually related to the potential referent of the deverbal noun.

The specifications above correspond to frame-theoretic modifications that operate on the frame of the base verb. I refer to these modifications as follows (in this order):

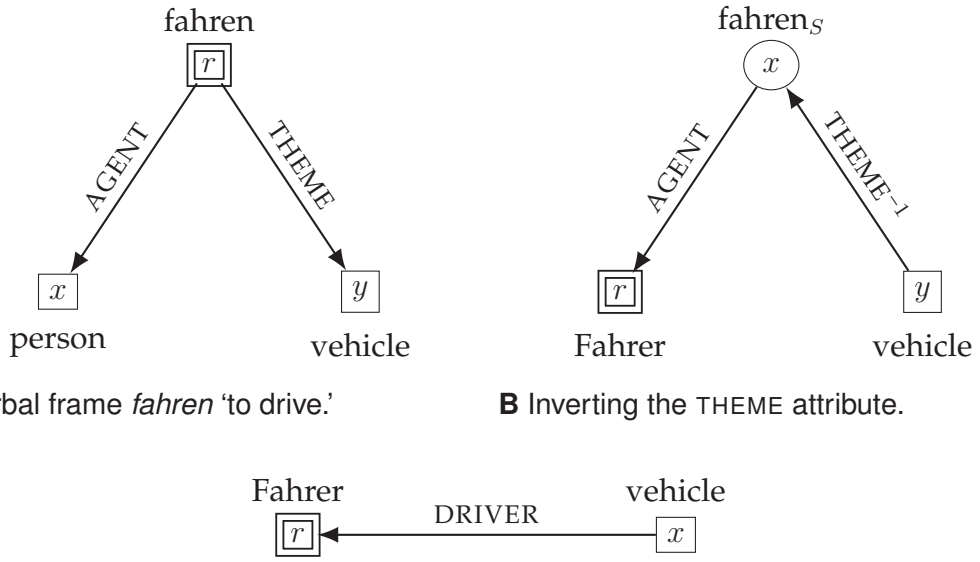
- central-node fixation
- event-node fixation
- concept-type fixation

The overall aim of this section is to explicate these frame operations, to exemplify them, and to motivate why their explication describes derivational rules sufficiently.

Let us consider one transitive meaning of *fahren* 'to drive' >> *Fahrer* 'driver' in the sense 'driver of a vehicle.' This meaning underlies the interpretation of the *-er* nominal in (37) where the vehicle is specified via a genitive construction. Of course, the verb allows additional readings; e.g., the intransitive one 'someone drives' and the transitive reading 'someone drives somebody or something.' However, these readings are not considered in the following remarks.

(37) Der Fahrer des Unfallwagens flüchtete.
'The driver of the involved car (or: of the car involved in the accident) fled.'

Figure 4.3A shows the verbal frame 'to drive' from which the meaning of the nominal is derived. Figure 4.3B represents the result of the meaning derivation. This representation is frame-theoretically motivated as follows: Since the potential referents of frames are determined by their central nodes, the potential referent of *Fahrer* is explained by a shift of the frame's central node to the *agent* node. This is what I



A Verbal frame *fahren* 'to drive.'

B Inverting the THEME attribute.

C Composition of attributes.

Figure 4.3 Frame analysis for the single-event nominal *fahren* 'to drive' >> *Fahrer* 'driver.'

understand as *central node fixation*. The AGENT attribute in whose direction the central node is shifted captures the conceptual relation between the potential referent of the nominal and the event designated by the base verb.

The shift of the central node is semantically of the same kind as metonymic shifts. Note, however, that the shift involved in the interpretation of the deverbal noun is not triggered by a sentential or an utterance context, as it has been pointed out as typical for productive metonymy in Chapter 3, but rather by a morphological operation, which also changes the grammatical category of the lexeme.

In (37), the reference of *Fahrer* is based on a single event. Formally speaking, the original central node of the verb frame specifies a single instance of a driving event. By contrast, in case of event types, it has to allow multiple instantiations. This, however, cannot be represented in our frame model so far. This is why I use a provisional notation and assign a type value to the node that is indexed with S. The indexation expresses that the node represents a concrete driving event. In Section 4.3.4, I will introduce a corresponding notation for event types. The notation allows to represent the single-event vs. event-type distinction in frames immediately. In the following, the marking of the verb node as a single event or event type is referred to as *event-node fixation*.

Semantically, deverbal nominalization produces noun meanings. According to Löbner (2011), noun meanings cannot be specified, leaving open their concept types. Thus, in order to investigate the arguments *Fahrer* requires, let us consider which concept type *Fahrer* is. In (37), the theme argument of the base verb is specified in

the genitive position. Since each vehicle can be involved in one and only one driving event at a given point in time, the vehicle identifies its driver and thus the referent of *Fahrer* uniquely. Thus, *driver* is a functional noun. The functionality is reflected in the frame in that the THEME attribute is invertible in a single-event frame. Substituting the attribute by its inverse, as seen in Figure (4.3B), ensures the functionality of the deverbal noun: The value of the *vehicle* node identifies the value of the *fahren* node at a given point in time that, in turn, determines the value of the *Fahrer* node. Thus, the concept-type analysis of *Fahrer* and the investigation of its frame-theoretic implementation sheds light on both: which arguments the deverbal noun requires and how they are conceptually integrated in the concept that specifies the meaning of the deverbal noun.

Due to the inversion of the THEME attribute, the specification of the theme argument allows the unique identification of a contextually determined event based on which the referent of the nominal is uniquely determined. Nevertheless, the driving event as such is not an argument of the nominal. It is only a conceptual link that establishes a relation between the theme argument and the referential argument of the nominal. Furthermore, the uniqueness is ensured by the fact that vehicles can be driven by one and only one agent at a given point in time. Note that the inversion of the attribute is only partially defined; i.e., only in those contexts in which the vehicle is driven and thus involved in a driving event. I refer to the modification of the frame in order to derive a concept of a certain concept type as *concept-type fixation*. By composing the attributes THEME^{-1} and AGENT, the frame can be transformed to the structure of functional nouns that is claimed in Postulate 2.8 (see Figure 4.3C).

The discussion of the example exemplifies how the initially introduced parameters of derivational rules are reflected in frames. The analysis explains the reading of deverbal nominals and also sheds light on their eventivity in terms of the single-event vs. event-type distinction as well as their argument structure in terms of concept types. In the following sections, I will present further derivational rules for generating the meanings of deverbal nouns. I propose those derivational rules as regular if they apply systematically to broad classes of verbs.

Note that the three types of fixations, i.e., regarding the central node, the event node, and the concept type, differ in their range of variation. The central-node fixation is flexible to a certain extent because, usually, several argument nodes in the frame of the base verb are available as the central node for the frame of the nominal. Just consider the ambiguity of the deverbal noun *Berichtigung* 'correction' that can refer to a correction event as well as to the result of this event. The different denotations correspond to different nodes in the frame of the base verb. The fixation of the event-node is subject to different kinds of patterns that I will point out in the following analysis. For instance, *Lehrer* 'teacher' allows an event-type reading,

whereas *Retter* 'saver' does not. At least, the concept-type fixation is more inflexible because it is restricted by the meaning of the base verb. For instance, in the case of the discussed *Fahrer* 'driver' example, the [*+U*] feature is determined by the fact that vehicles can be driven by only one driver at a given point in time.

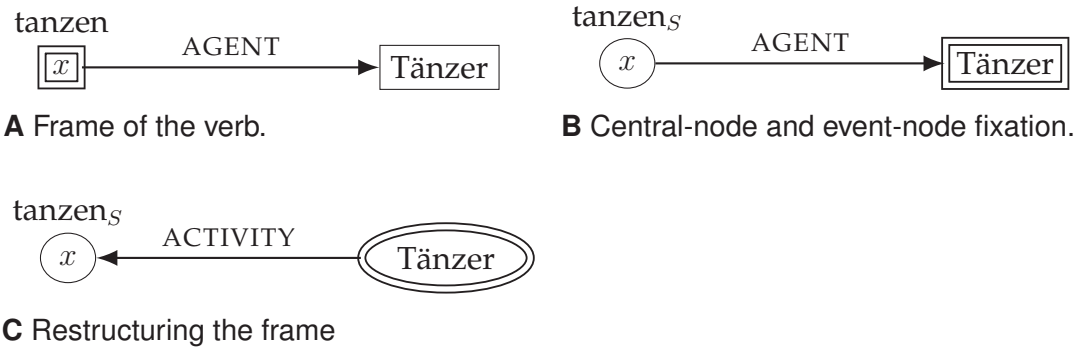
4.3.3 Single-event nominals

The aim of this section is the explication of several derivation patterns for generating single-event nominals. Each pattern will be illustrated by an example. Thereby, the section is subdivided into the analysis of event-related and result-related ones. It has to be noted that each derivational rule generates a uniquely determined meaning. The potential ambiguity of deverbal *-er* and *-ung* nouns is explained by the fact that different derivational rules can be applied to the same verb.

4.3.3.1 Event-related nominals

Since this section addresses single-event nominals, the event-node is specified by a token value. I understand deverbal nouns that refer to arguments of the base verb or to the event designated by it to be event-related. The derivational rules discussed in the following are classified by their central-node fixation, which determines the potential referents of the concepts they generate. Thus, the question as to the central-node and the event-node fixation is settled. In the following, I will point out which concept-type fixations are possible.

Agents. The reference of these nominals results from shifting the central node to the the AGENT attribute of the base verb. In the previous section, the *Fahrer* 'driver' example was discussed in which a functional noun was derived from the base verb. Furthermore, there are a lot of intransitive verbs that allow sortal meanings, like *tanzen* 'to dance.' Figure 4.4A shows the frame of the base verb. In a single-event reading, the nominal *Tänzer* 'dancer' refers to someone who performs a dancing activity. Figure 4.4B shows the reference shift of the central node and the marking of the central node of the original verb frame as single-event node. The situational argument of the base verb is absorbed during the nominalization. The resulting frame, however, is in conflict with Postulate 2.7 according to which the central node of sortal concepts does not have ingoing arcs. To avoid this inconsistency, the frame can be restructured, based on the assumption that each individual is conceptualized as being able to perform one and only one activity of the same type at a given point in time. Based on this assumption, the AGENT attribute is injective and hence invertible. The resulting frame in Figure 4.4C is a well-formed sortal frame in the sense of



A Frame of the verb.

B Central-node and event-node fixation.

C Restructuring the frame

Figure 4.4 Frame of *tanzen* 'to dance' >> *Tänzer* 'dancer.'

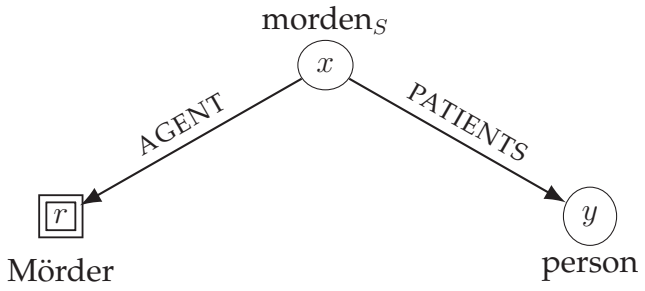


Figure 4.5 Frame of *morden* 'murder' >> *Mörder* 'murderer.'

Postulate 2.7. It characterizes a person dancing in a single situation. Thus, the frame is in line with the characterization of sortal frames in the sense of Petersen (2007).

The deverbal noun *Mörder* 'murderer' allows two interpretations. The first reading is sortal. It characterizes a person as having killed someone. This reading is represented in Figure 4.5. The AGENT attribute can be inverted to restructure the frame since a single murder event has one and only one agent. Even if a murder has committed collaboratively, one murder event per perpetrator can be assumed.

The second reading of *Mörder* 'murderer' is functional. It identifies a person uniquely depending on a murder victim. Thus, the referent of the functional nominal *Mörder* 'murderer' is identified depending on the murdered person. The nominal has $[+U]$ because of the trivial fact that murder victims can be killed exactly once. Consequently, the $[+U]$ feature is motivated by the semantics of the base verb. Figure 4.6 shows the frame of the nominal. The functionality is incorporated by inverting the PATIENT attribute in the frame of the base verb.

Relational nouns can be generated if the base verb requires a theme argument whose referent can be involved in multiple events of the type determined by the base verb at the same time. One example is the deverbal noun *betrachten* 'to observe'

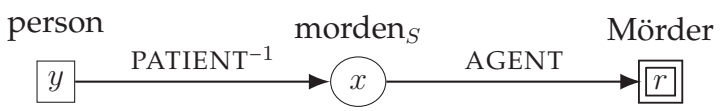


Figure 4.6 Frame of *Mörder* 'murderer' in a functional reading.

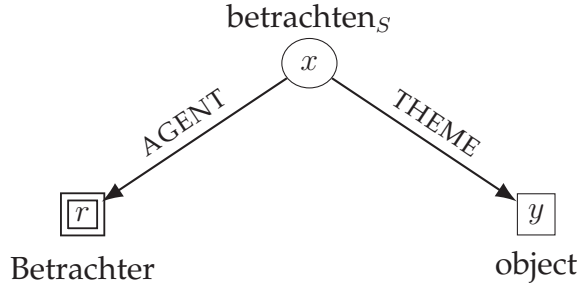


Figure 4.7 Frame of *betrachten* 'to oberseve' >> *Betrachter* 'observer.'

>> *Betrachter* 'observer.' The theme of the base verb specifies the observed entity. Such an entity can be observed by multiple individuals at the same time. Consequently, the meaning of the deverbal noun is a relational concept whose possessor is specified as the theme argument of the base verb. The frame of the deverbal noun is depicted in Figure 4.7. In contrast to the *Fahrer* frame in Figure 4.3, the theme argument of the *betrachten* 'observing' frame can be involved in more than one event simultaneously. This is why the THEME attribute cannot be inverted. In other words, the referent of the deverbal noun is not uniquely determined, depending on the theme argument. Thus, the noun is not functional, but relational.

Note that the frame in Figure 4.7 does not fit Postulate 2.9 for relational frame graph. Nevertheless, the relationality of the noun follows from the frame structure since the saturation of the argument node would not determine the value of the central node uniquely but only restricts the range possible values the central node can take. Hence, it is debatable whether Postulate 2.9 is valid. The analysis in Figure 4.7 can be frame-theoretically motivated in that the event node whose value determines the value of the AGENT attribute uniquely is a member of the preimage of the THEME attribute. Since the preimage can have more than one member, there is a one-to-many relation between the referent of the deverbal noun *Betrachter* 'observer' and its argument.

There are verbs expressing actions that are performed constantly over a period of time. For instance, *regieren* 'to govern' >> *Regierung* 'government.' Each governable object is repeatedly governed by the same agent, understood as either a single

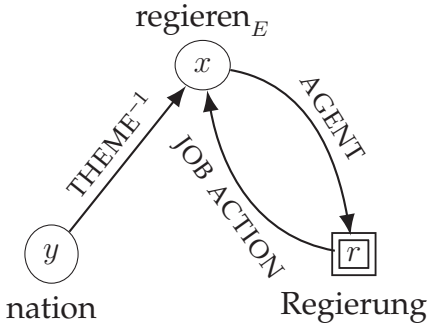


Figure 4.8 Frame of *regieren* 'to govern' >> *Regierung* 'government.'

person or, more commonly, as a group of people. Thus, the THEME argument of the base verb is injective and can be inverted. The frame of the nominal is shown in Figure 4.8. Note that the central node and the verb node are linked via the JOB ACTION attribute. Certainly, the functionality is not the subject of this attribute, but rather results from the inversion of the THEME attribute.

Individual concepts seem to be very rare, if at all. In any case, I have not found clear examples for them.

Themes. Functional deverbal nouns in theme reading seem also to occur rarely. One example could be *Sendung* 'sending' in the sense 'an object a certain person has sent' which is functional since a sending usually has one and only one sender.[21] Another example would be *lagern* 'to store sth.' >> *Lagerung* 'stored object' whose referent is uniquely determined by the location since objects can be placed at only one place at any given point in time. Figure 4.9 shows the frame of *Sendung*. The analysis of *Lagerung* is analogous. Similar to the *Mörder* example above, the THEME attribute is invertible because the potential referent is assumed to be involved in one and only one sending event. Note that it is not necessary that the sending event exists, but only that its existence is assumed at a given point in time. This confirms that the notion of single events is separated from the referential level and only takes the conceptual level into account.

Deverbal nouns like *voraussetzen* 'to assume' >> *Voraussetzung* 'assumption' and *fordern* 'to demand sth.' >> *Forderung* 'demand' require a specification of the theme argument. Since the specification of the argument does not identify the potential referent of the deverbal nouns uniquely, these nouns are relational. Their frame analysis is similar to 4.7 and only differs from the *Betrachter* frame insofar as the theme occurs as referential argument and the agent as possessor argument.

[21] I was pointed to the functional reading of *Sendung* 'sending' by my second supervisor Wiebke Petersen.

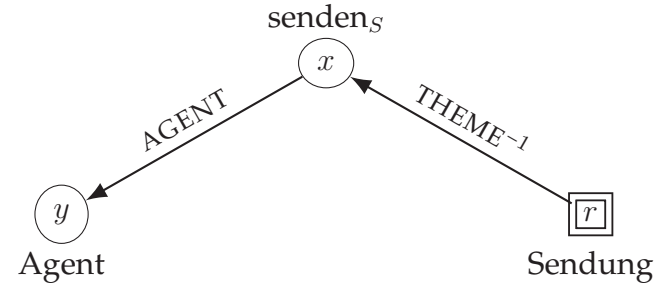


Figure 4.9 Frame of *senden* 'to send' >> *Sendung* 'sending.'

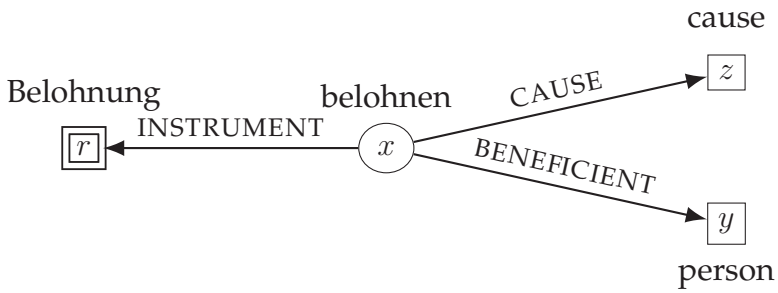


Figure 4.10 Frame of the nominal *belohnen* 'to reward' >> *Belohnung* 'reward.'

I am not sure whether there are individual nouns in the theme reading. The examples investigated for this thesis do not provide such a case. Nevertheless, I do not want to exclude such deverbal nouns in principle.

Instruments. Nominals of these types are [+R] in most cases because their reference is related to a single event that is usually determined by the arguments of the base verb designating the event. The concept type of these nouns is determined by complex patterns that build on the relation between the verb's arguments. Let us consider the example *belohnen* 'to reward' >> *Belohnung*. The deverbal noun designates the reward someone gets for having done something. The former argument is specified by the beneficient argument of the base verb. The latter argument is hard to specify in terms of θ roles. I refer to it as *cause*. Figure 4.10 shows the frame of the nominal.

It is hard to decide whether the nominal is [+U]. Assuming that *belohnen* 'to reward' is conceptualized in that a reward for a certain occasion can be submitted to a person only once, the deverbal noun is functional. To be more precise, the nominal is a two-place functional noun whose arguments are summarized to a tuple that determines the event uniquely. The event node, in turn, allows the unique identification

of the referential argument. Thus, the event as such has an implicit argument that is determined by the argument nodes. However, assuming that *belohnen* 'to reward' is conceptualized in such a way that rewards can be submitted more than once for a given occasion, the deverbal noun would be relational: Saturating the arguments of the nominal does not determine an event uniquely, but only restricts the set of possible values whose cardinality can be greater than one. Each of these possible values determines another referential argument. What the different considerations have in common is that the interaction of the arguments determines the [±U] feature of the nominal.

A very clear case in which the nominal is [−U] is the deverbal noun *mitteilen* 'to convey sth.' >> *Mitteilung* 'message.' A message has always an addressee and a sender. However, since a sender can send more than one message to the same addressee, the nominal is relational. An example for a unique single-event nominal in instrument reading is *verwarnen* 'to caution someone' >> *Verwarnung* 'reprimand' since usually one gets a reprimand due to a certain event only once. Hence, the addressee of a reprimand and the cause for which the addressee is cautioned determine the caution event and, thus, the instrument of the event the nominal designates.

I am not sure whether the generation of individual concepts is possible; I am not able to think of a qualitative reason why single-event instrument readings should always occur with arguments.

Locations. As we are going to see in Section 4.3.4, deverbal nominals in a location reading are preferably based on event types. However, there is also a single-event interpretation that is always functional. A typical example is *wohnen* 'to live' >> *Wohnung* 'apartment,' understood as the apartment where somebody actually lives. The single event is considered as continuing for a continuous period of time. The agent of the time period identifies the event that, in turn, identifies the referent of the deverbal noun. The frame of *Wohnung* 'apartment' is shown in Figure 4.11.

Events. There are some deverbal *-ung* nouns in an event reading that preferably occur in functional or individual use; e.g., *Globalisierung* 'globalization' or *Entnazifizierung* 'denazification' (understood as a policy implemented during the allied occupation after the Second World War). They denote historic events or cultural phenomena uniquely. However, their meanings do not seem to be the result of compositional meaning derivations, but rather of intentional naming that is strongly based on world knowledge. These meanings are compositionally derived and afterwards fixed to the reference of one and only one entity.

Most deverbal *-ung* nominals characterize their referents as events of a certain type. They inherit the arguments of their base verbs. With respect to their argument

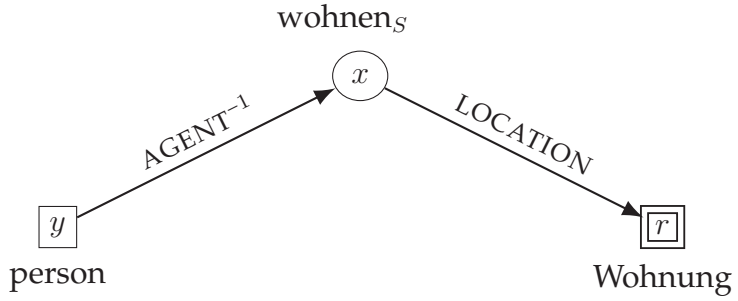
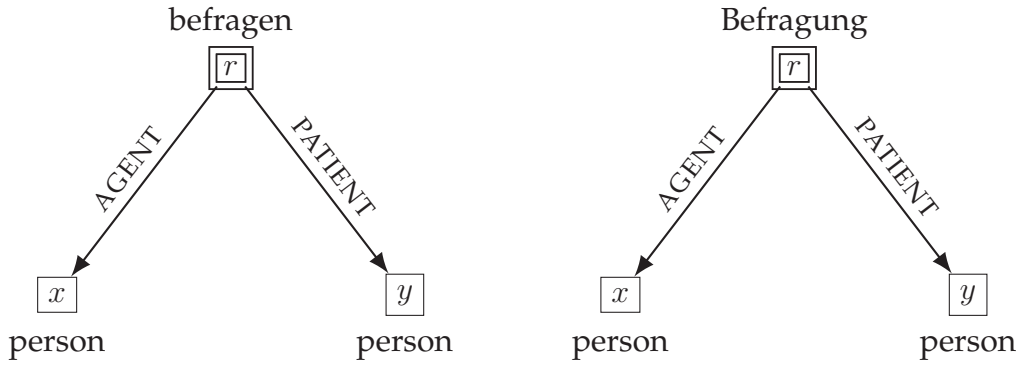


Figure 4.11 Frame of *wohnen* 'to live' >> *Wohnung* 'flat' in functional use.



A Verb frame of *befragen*.

B Nominal frame of *Befragung*.

Figure 4.12 Frame of an event *-ung* nominal in event reading compared to the frame of its base verb.

structure, the frame representations of these nouns are structurally identical to the frames of their base verbs. Figure 4.12 compares the frames of the verb *befragen* 'to interrogate' and the nominal *Befragung* 'interrogation.'[22] The central node of the deverbal nominal represents a single event. When saturating the argument nodes, the set of potential events is restricted but not uniquely determined. The reason for this is that the same agents and patients can be involved in multiple interrogation events at different points in time. Thus, the concept ›Befragung‹ as such is relational. There are several examples in which the arguments of the nominals are left implicit, as in (38). In these cases, the arguments of the nominal are contextually determined. Thus, examples like the one in (38) do not disprove the relationality of the nominal.

(38) Die Befragung dauerte Stunden.

[22] Note that the frames of the nominal and the verb presumably differ because only the frame of the verb should incorporate a time attribute that is specified by tenses. How temporality can be formally represented in frames, however, is subject to future research.

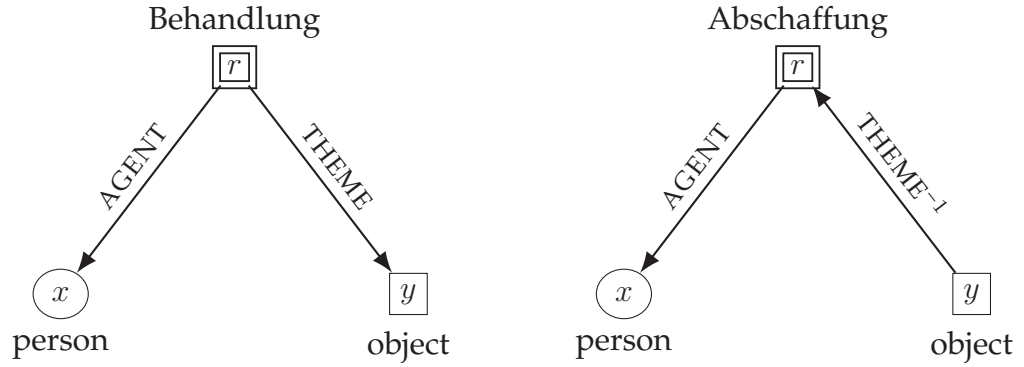


Figure 4.13 Frames

'The interrogation lasted for hours.'

Beyond that, there are also relational nominals in event reading. Relational deverbal nouns are based on verbs whose arguments can be involved in the actions designated by the base verb for several times; e.g., *behandeln* 'to treat' >> *Behandlung* 'treatment,' *umsetzen* 'to implement' >> *Umsetzung* 'implementation.' Functional nouns are generated with base verbs whose arguments can be involved in the respective events only once; e.g., *abschaffen* 'to abolish' >> *Abschaffung* 'abolition.' Examples are depicted in Figure 4.13. Since an entity can be abolished only once, the specification of the abolished entity determines the event by which the entity has been abolished. Thus, in terms of frames, the THEME argument is invertible. The inversion guarantees the well-formedness of the functional frame graph.

4.3.3.2 Result-related nominals

In the following, I focus on deverbal nouns that refer to results of the event that is designated by the base verb. I distinguish between four types of result nominals. First, there are results that are specified as themes in the argument structure of the base verb. Second and third, there are result objects and result states that are not specified in the argument structure, but rather originate from the event designated by the base verb. Fourth, there are result-related property readings that evaluate the quality of result objects originated by the event designating by the base verb.

Themes. When occurring in result reading, themes like *erfinden* 'to invent' >> *Erfindung* 'invention' or *ausgraben* 'to excavate' >> *Ausgrabung* 'excavation' usually require the agent argument as possessor. Since the agent does not uniquely determine the referent of the deverbal noun, the deverbal nouns are relational. The frame of the nominal *Erfindung* 'invention' is shown in Figure 4.14. The frame analysis of *Aus-*

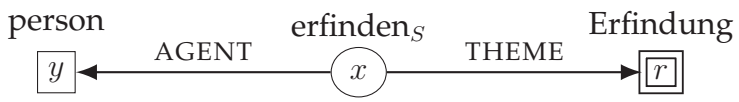


Figure 4.14 Frame of the deverbal noun *Erfindung* 'invention.'

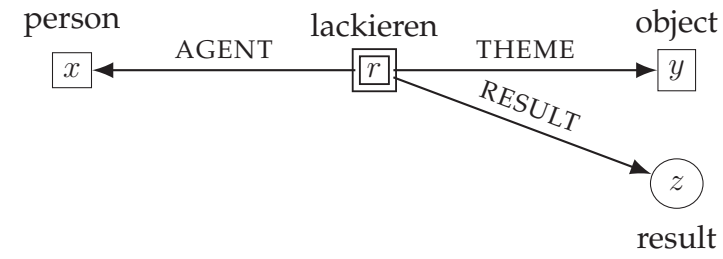
grabung 'excatation' in the sense 'dug out object' is analogous. Since a person can invent more than one entity, the AGENT attribute is not invertible. Consequently, the value of the AGENT attribute does not determine the inventing event uniquely. Thus, the value of the argument node does not determine the value of the central node. This confirms that the concept is relational. In principle, the meaning of the nominal is derived similarly to the event-related examples because the central node is shifted to one of the base verb's argument nodes, whereas another argument node is established as possessor.

Note furthermore, that the structure of the frame in Figure 4.14 is not in line with Postulate 2.9. Nevertheless, the $[+\text{R}, -\text{U}]$ features of the represented concept has been frame-theoretically motivated.

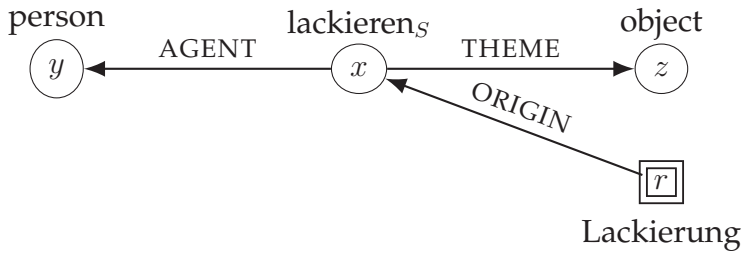
Result objects. Deverbal nouns denoting result objects characterize their potential referents as being created by the type of event designated by the base verb. To model such nominals in frames, I assume that the frames of their base verbs contain a RESULT attribute that specifies the expected outcome of the event designated by the base verb. The assumption of such an attribute is in line with the basic assumptions of the frame approach used here because events that have results usually have exactly one expected result (where the result is not represented in the argument structure of the base verb). Based on this, the reference of such nominals results from a shift to the value of the RESULT attribute.

Figure 4.15A shows the frame of the verb *lackieren* 'to varnish' that contains a RESULT attribute. In the frame of the nominal, the central node is shifted to the *result* node (see Figure 4.15B).

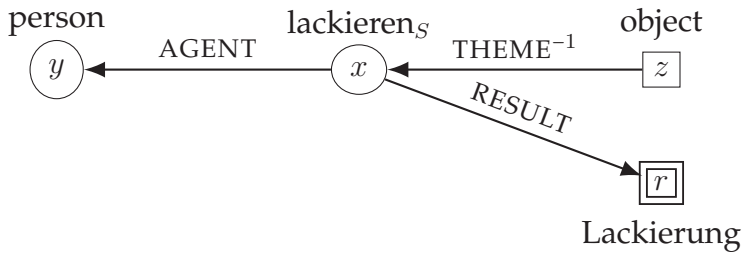
The noun *Lackierung* 'varnishing' is functional, requiring the varnished object as possessor argument. The functionality can easily be motivated: The actual varnishing of an object results from exactly one event. Thereby, *actual varnishing* has to be understood as the visible varnishing that is unique at a given point in time. Since the actual varnishing is unique, the THEME attribute in the *lackieren* 'to varnish' frame can be inverted (see Figure 4.15C). Thus, the value of the original *theme* node uniquely determines the value of the RESULT attribute. The composition of the THEME^{-1} and the RESULT attribute lead to a frame structure that is in line with the one claimed in Postulate 2.8 for functional frame graphs.



A Verbal frame.



B Restructured frame of the nominal.



C Functional interpretation.

Figure 4.15 Frame of the deverbal noun *Lackierung* 'varnishing.'

There are comparable verbs in whose frames the THEME attribute is not injective because the process designated by the verb can be applied to the same themes repeatedly, even at a given point in time. Such verbs build the basis for relational result nominals; e.g., *deuten* 'to interpret' >> *Deutung* 'interpretation,' *klassifizieren* 'to classify' >> *Klassifizierung* 'classification,' or *vertonen* 'to set sth. to music' >> *Vertonung* 'sound recording,' *übersetzen* 'to translate' >> *Übersetzung* '(written down) translation.' The frame analyses of these deverbal nouns are very similar to the analysis of *Lackierung* 'varnishing' and only differs insofar as the THEME attribute is not inverted. This difference causes the relationality of these deverbal nouns. An example is given in Figure 4.16. Note that the structure of the frame is not in line with Postulate 2.9. Nevertheless, the relationality of the concept is motivated, as argued before.

Result objects may also refer to the material recordings of abstract results. Ex-

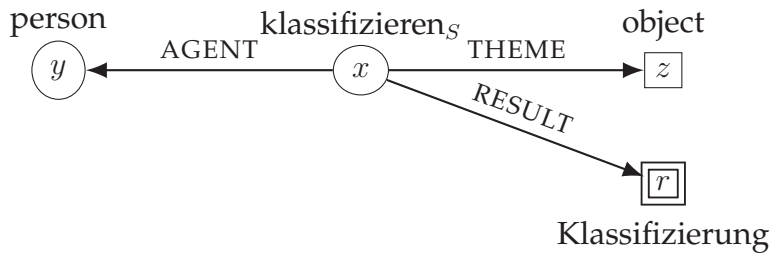


Figure 4.16 Frame of the deverbal noun *Klassifizierung* 'classification.'

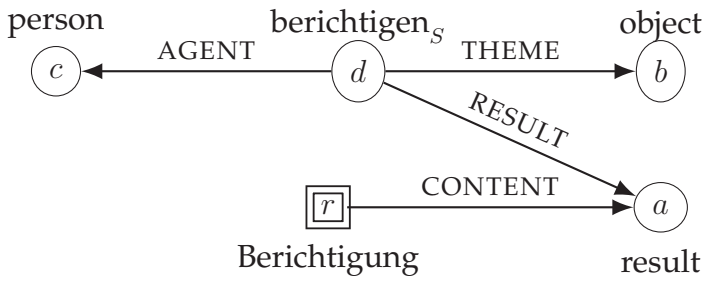


Figure 4.17 Frame of the deverbal noun *Berichtigung* '(written down) correction.'

amples are deverbal nouns like *abrechnen* 'to discount' >> *Abrechnung* 'payoff' or *berichtigen* 'to correct' >> *Berichtigung* '(written down) correction.' The primary result of the events designated by their base verbs is an immaterial result that is written down afterwards. This can be modeled by a CONTENT attribute, as illustrated in Figure 4.17. Note that the central node is shifted from the verb node to a nonargument node, without following the direction of a chain of attributes.[23] This is not possible in case of metonymy shifts, as argued in Chapter 3.

In (30) and (31), I cited the *bemalen* 'to paint' >> *Bemalung* 'painting' example discussed by Ehrich & Rapp (2000). The authors assume that the different readings of the deverbal noun underlie different meaning variants of the polysemous base verb. In contrast to Ehrich & Rapp (2000), I assume that different readings do not result from different meaning variants of the base verb, but rather from applying different derivational rules to the same basic meaning of the base verb. How event readings arise has already been discussed in the foregoing sections. This explains the meanings in (30). Thus, let us consider how the different result meanings in

[23] One may argue that the nodes labeled with *a* and *r* in Figure 4.17 can be linked via an attributed expressing that *a* is the literalization of *r*. However, thoughts can be literalized multiple times so that LITERALIZATION is not a valid attribute.

(31) arise. Ehrich & Rapp (2000) distinguish between two meanings that require a specification of the agent and of the theme argument of the base verb, respectively.

Figure 4.18A shows the frame of the base verb *bemalen* 'to paint.' What both meanings have in common is that the reference of the deverbal noun results from a shift in the direction of the RESULT attribute. They differ because they maintain different arguments of the base verb, namely either the agent or the theme argument (see Figure 4.18B and 4.18C). Depending on which argument is contained, the meanings differ in their concept type. Since agents may paint several paintings, the AGENT attribute is not injective. Thus, the concept in Figure 4.18B is relational. By contrast, each surface can have one and only one visible painting at every given point in time (the argumentation is similar to the one regarding the *Lackierung* 'varnishing' example). Thus, the THEME attribute is injective (see Figure4.18D). Inverting the attribute leads to a functional concept.

Consequently, the result readings of the deverbal noun *Bemalung* 'painting' do not differ because they are derived from different meaning variants of the base verb. They rather differ because the inheritance of different arguments of the base verb lead to different concept types.

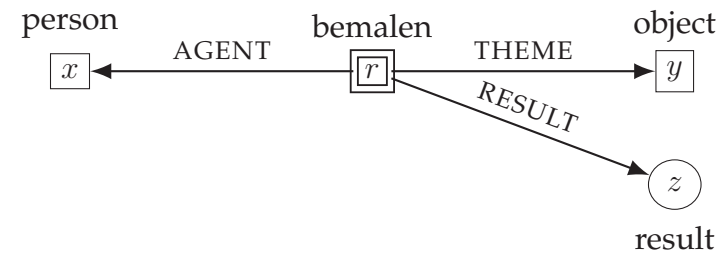
Deverbal nouns can also designate objects that result from single events occurring iteratively. One example is *sammeln* 'to collect' >> *Sammlung* 'collection' that refers to the set of objects resulting from iteratively occurring collecting events. The noun is sortal. The frame representing its meaning is depicted in Figure 4.19. If Postulate 2.7 is valid, the well-formedness of the frame is ensured by inverting the original THEME attribute of the base verb by an ORIGIN attribute. The inversion is possible because what is designated as *Sammlung* 'collection' is bijectively linked to the set of events by which it is generated.

One may argue that what is designated by *Sammlung* 'collection' changes during the collecting events labeled with x in Figure 4.19: After a single collecting event, the collection is not the same as before the collecting event since new objects are added to it. Nevertheless, it is plausible that what is designated by *Sammlung* 'collection' is conceptually represented as one and only one entity, as the following sentences suggest.

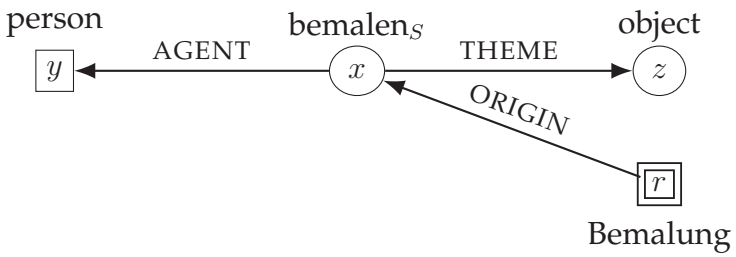
(39) a. Er hat seine Sammlung erweitert, weil er mehrere Sammlerstücke gekauft hat.
He expanded his collection by buying several new collector's items.

b. Er hat seine Sammlung erheblich reduziert, weil er mehrere Sammlerstücke verkauft hat.
He made his collection smaller by selling several collector's items.

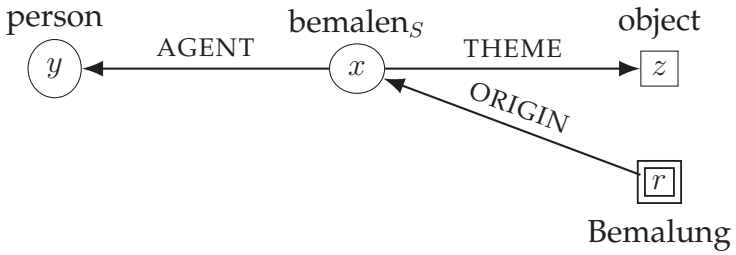
In the examples, events are described during which the collections referred to un-



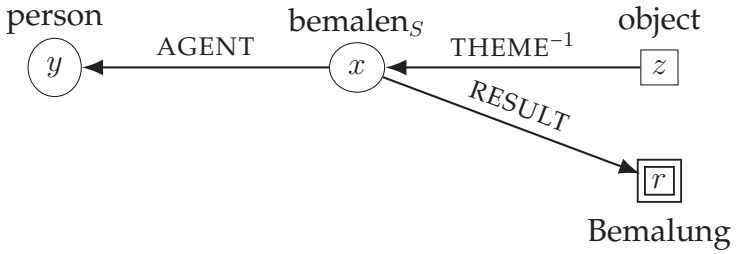
A Verbal frame.



B The agent as an argument.



C The theme as an argument.



D Functionality by attribute inversion.

Figure 4.18 Different readings of the deverbal noun *Bemalung* 'paiting.'

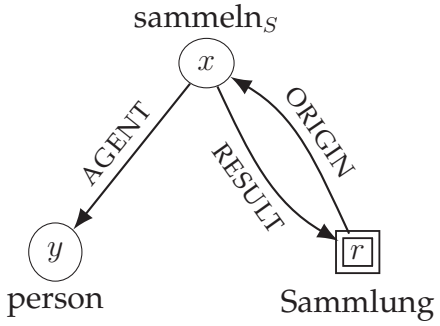


Figure 4.19 Frame of *sammeln* 'to collect' >> *Sammlung* 'collection.'

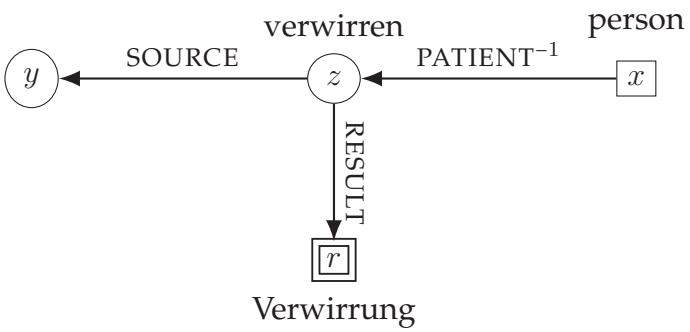


Figure 4.20 Frame of the deverbal noun *Verwirrung* 'confusion.'

dergo changes. Nevertheless, the nominal *Sammlung* 'collection' is used to refer to the same collection before and after these changes.

Result states. Result states usually occur with arguments specifying the entity that is subject to the state referred to. Thus, result state nominals are preferably relational. Examples include the deverbal nouns *verunsichern* 'to make so. insecure' >> *Verunsicherung* 'uncertainty,' *verwirren* 'to confuse' >> *Verwirrung* 'confusion,' or *ausformen* 'to shape sth.' >> *Ausformung* 'molding.' These nominals take the theme argument of the base verb as possessor. The states described by the deverbal nouns are unique in that an entity cannot be in multiple states of the same type at the same time. Thus, the single-event nominals referring to result states are [+U]. Figure 4.20 shows the frame of the example *Verwirrung*. Since people may undergo one and only one confusion process at a given point in time, the PATIENT attribute is injective. Its inversion ensures that the value of the *person* node uniquely determines the value of the *Verwirrung* node. Thus, the functionality of the result-state nominal *Verwirrung* 'confusion' is adequately represented. Note that uniqueness is only guaranteed depending on a fixed point in time immediately after the event.

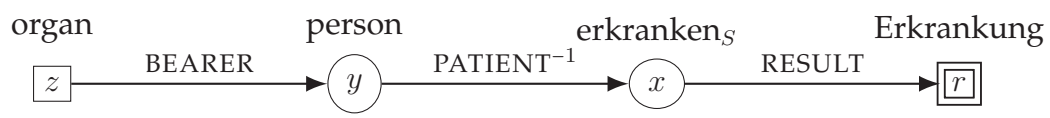


Figure 4.21 Frame of the deverbal noun *Erkrankung* 'sickness.'

In (40), the theme argument occurs as argument of result-state nominals. However, some nominals also allow agent specifications. Consider the deverbal noun *Erkrankung* 'sickness,' which is derived from the intransitive verb *erkranken* 'to sicken.' The sick person occurs in subject position; as in (40a). In the derived nominal meaning, the agent of the base verb can be specified in genitive position; as in (40b).

(40) a. Er ist erkrankt.
'He has fallen ill.'

b. Seine Erkrankung dauert schon sehr lange.
'His illness has lasted a long time.'

Beyond that the agent's organ which is attacked by a disease can also be specified, although the specification is impossible in case of the verb. Consider the examples below.

(41) a. ??Die Leber erkrankt.
??'The liver is diseased.'

b. Die Erkrankung seiner Leber 'the disease of his liver'

Figure 4.21 shows the frame of the meaning that underlies the nominal in this reading. Note that the argument of the deverbal noun is not inherent in the argument structure of the base verb but accessed based on world knowledge. The functionality is ensured by the inversion of the PATIENT attribute.

Properties. In the property reading, result-related deverbal *-ung* nouns refer to the quality of objects that is determined by the way in which the objects have been created. The creation process is designated by the base verb. Examples are *gestalten* 'to design' >> *Gestaltung* 'design' in the sense 'quality of the design,' *zusammensetzen* 'to compose' >> *Zusammensetzung* 'the composed object' in the sense 'quality of the composed objects,' *zusammenstellen* 'to compose' >> *Zusammenstellung* 'composition' in the sense 'quality of the composition,' or *anordnen* 'to arrange' >> *Anordnung* 'arrangement' in the sense 'quality of the arrangement.' These qualities are always [+U]. Additionally, these readings are also [+R] because they specify properties of result objects, where the result objects occur as arguments.

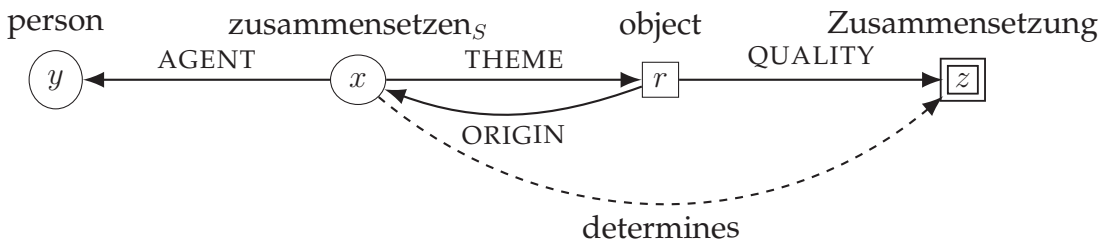


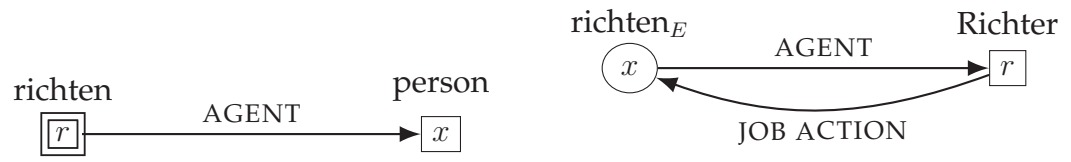
Figure 4.22 Frame of the deverbal noun *Zusammensetzung* '(quality of) the created object.'

Figure 4.22 shows the frame analysis of *Zusammensetzung* '(quality of) the composed object.' The reference is shifted from the central node of the base verb to the value of the QUALITY attribute. Its value is determined by the base verb, as illustrated by the dashed arrow. The assumption of such an attribute is plausible since it describes a unique relation, as already argued. The structure in the frame is in line with Postulate 2.8 since the central node can be reached from the argument node.

4.3.4 Event-type nominals

There are no event-type nominals in result reading since results come into being only once and not repeatedly. Thus, there are only event-related event-type nominals. They characterize their potential referents as being related to a certain type of event. That is, the event can be instantiated multiply. To this extent, they are very close to the semantics of generic expressions in the sense of Carlson (1989). In the following analysis, deverbal nouns are, once again, ordered by the semantic role of their potential referents. The analysis focuses primarily on the concept types of the deverbal nouns.

Agents. These nominals occur frequently as sortal nouns. They characterize their referents as performing actions regularly for job-related reasons (*richten* 'to judge' >> *Richter* 'judge'), for dispositional reasons (*lügen* 'to lie' >> *Lügner* 'liar'), or for habitual reasons (*pendeln* 'to commute' >> *Pendler* 'commuter'). What they have in common is that they concern jobs, habits, or dispositions and therefore those domains that Carlson (2011: 1153) assumes as underlying generic expressions. Instead of modeling the regular performance of the actions described by the base verb frame-theoretically, I index the verb node with T. The node carrying the indexed label has to be understood as a representation of types of events that may occur multiply including zero, in contrast to the index S that marks nodes that stand for



A Verbal frame. **B** Frame of the nominal.

Figure 4.23 Frame analysis of the event-type nominal *richten* 'to judge' >> *Richter* 'judge.'

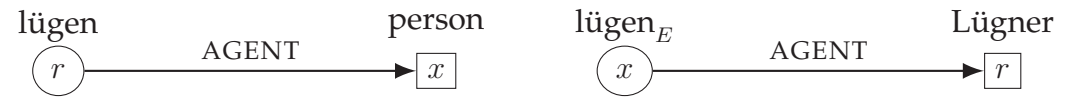
single events. Figure 4.23 shows how the meaning of *Richter* 'judge' is derived from the base verb *richten* 'to judge.'

Assuming that Postulate 2.7 is valid, the frame can be restructured to fit the well-formedness conditions of sortal frames. To this end, the AGENT attribute is inverted by a JOB ACTION attribute. The relation described by the attribute is unique because subjects usually have exactly one job. Concepts that describe subjects having multiple jobs have to be represented differently.

It is hard to answer how to express dispositional or habitual behavior in frames. The assumption of the attributes DISPOSITIONAL ACTION or CHARACTERISTIC HABIT could be used correspondingly to the *Richter* 'judge' example in the frame of *Lügner* 'liar.' However, subjects usually have more than one dispositional or habitual behavior. Possibly, the assumption of these attributes could be motivated based on salience. One alternative representation of deverbal nouns like *Lügner* 'liar' would be to reject Postulate 2.7. In that case, the mentioned deverbal nouns could simply be represented as in Figure 4.24, which shows the frame of *Lügner* 'liar.'

Sortal event-type nominals in which the AGENT attribute cannot be inverted cast doubt on Postulate 2.7. It could be argued that the frame represents a sortal concept because the value of the verbal node does not determine the value of the AGENT attribute unique: The verbal node stands for an event type and thus for multiply occurring events (including zero). Different single events might involve different agents. Consequently, an event-type node is not able to uniquely determine an agent. Note that the [–U] feature has been motivated independently from the structure of the frame.

With regard to Figure 4.23, the attribute JOB ACTION is not only used for restructuring reasons but adds conceptual content to the frame by specifying how the frame's referent is linked to the event type based on which it is characterized. The attribute is based on world knowledge and cannot be derived from the lexical meaning of the verb. In this regard, event-type nominals differ from single-event



A Verbal frame. **B** Frame of the nominal.

Figure 4.24 Frame analysis of the event-type nominal *lügen* 'to lie' >> *Lügner* 'liar.'

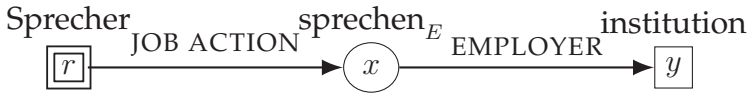


Figure 4.25 Frame of *sprechen* 'to speak' >> *Sprecher* '(official) speaker.'

nominals, whose meaning is, in most cases, consistently derived by taking the lexical meaning of the base verb into account.

Event-type nominals in agent reading can also be relational or functional. For instance, *sprechen* 'to speak' >> *Sprecher* 'speaker' in event-type interpretation designates a press officer of an institution whose specification is required as argument. Since institutions usually have more than one press officer, the deverbal noun is relational. Frame-theoretically, the relationality is motivated in that the INSTITUTION attribute in the frame of *Sprecher* 'speaker' cannot be inverted (see Figure 4.25). The example also shows that the argument of the event-type nominal is not reflected in the argument structure of the base verb.

Themes. Event-type nominals in theme reading only occur rarely. One example is *überziehen* 'to overdraw sth.' >> *Überzieher* 'overcoat.' The noun is sortal. The frame representing its meaning is depicted in Figure 4.26. If Postulate 2.7 is valid, the well-formedness of the frame is ensured by inverting the original THEME attribute of the base verb by adding a PURPOSE attribute. The inversion is possible because what is designated as *Überzieher* 'overcoat' is made for one and only one purpose.

Instruments. Event-type nominals referring to instruments are usually sortal. They describe artifacts that are made for special purposes; e.g., *bohren* 'to drill' >> *Bohrer* 'drill,' *wischen* 'to wipe' >> *Wischer* 'wiper' or *drucken* 'to print' >> *Drucker* 'printer.' Figure 4.27 shows the frame of *Drucker* 'printer.' Assuming that Postulate 2.7 is valid, the well-formedness of the sortal frame graph is ensured by linking the central node to the verb node via the PURPOSE attribute. It expresses that the referent of the frame has been created for performing an action of a certain type. Events of this type may

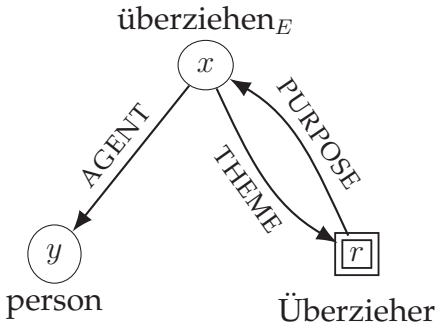


Figure 4.26 Frame of *überziehen* 'to overdraw sth.' >> *Überzieher* 'overcoat.'

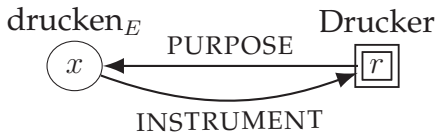


Figure 4.27 Frame of *drucken* 'to print' >> *Drucker* 'printer.'

occur never, one time, or several times. This is completely in line with the common notion of so-called noneventive nominals that refer to events (see Section 4.1.2).

Relational nouns occur very rarely. One example is the deverbal noun *abdecken* 'to cover' >> *Abdeckung* 'cover,' understood as a cover for specific objects, like covers for cars. The frame of the noun is shown in Figure 4.28. Functional nouns do not seem to be possible because instruments are usually made for application to several objects of the same type. Moreover, I did not find examples for individual event-type nominals in instrument reading. This, however, may not be surprising as it is hard to imagine that there are repeatedly occurring events that can be executed with exactly one instrument per context.

Locations. There are several deverbal *-ung* nouns that refer to the locality where an action is repeatedly performed. For instance, *reinigen* 'to clean' >> *Reinigung* 'clean-

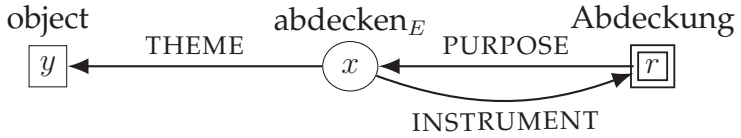


Figure 4.28 Frame of *abdecken* 'to cover' >> *Abdeckung* 'cap for sth..'

Figure 4.29 Frame of *reinigen* 'to clean' >> *Reinigung* 'cleaning.'

ing,' *anmelden* ´to register' >> *Anmeldung* 'reception.' Deverbal *-er* nouns are also possible, but occur less frequently; e.g., *anlegen* 'to buckle on' >> *Anleger* 'ship landing place.' These examples are sortal and can be frame-theoretically modeled by using a PURPOSE attribute, similar to the analysis of deverbal nouns that refer to instruments. Figure 4.29 gives an example.

When analyzing the single-event nominal *wohnen* 'to live' >> *Wohnung* 'apartment' in the previous section, I already announced that the noun also allows an event-type interpretation. In contrast to the single-event interpretation, which is functional, the event-type nominal is sortal because it describes a location where one can live. In this case, different subjects can live in it at several points in time. This explains why the event-type nominal is sortal. Its frame-analysis is equivalent to the one in Figure 4.29.

Relational meanings are hard to find: There are no deverbal nouns that characterize their potential referents in dependence of the arguments which are generically involved in the actions described by the base verb. Even if relational nouns have been enabled, functional meanings would be impossible: Like instruments, functional nouns do not seem to be possible because the characteristic actions performed at the locations established for these actions apply to several possible themes.

Events. Event-type nominals in event reading do not seem to exist. Instead, deverbal *-er* and *-ung* nominals always seem to refer to single events and not to conglomerates of potentially repeatedly occurring events.

4.4 Summary

In this chapter, a frame-based approach to compositional deverbal *-er* and *-ung* nominals has been proposed that also takes Löbner's (2011) concept-type theory into account. The meanings of these nouns have been analyzed as resulting from different derivational rules. The general principle of these rules is this: The central node is either maintained (in the case of event readings) or shifted to a node within the frame of the base verb (otherwise). The original central node represents either a sin-

gle event or an event type. The concept type of the nominal arises from the way in which the argument nodes that are inherited from the base verb and the referent node of the deverbal noun are conceptually related via the event node. These relations determine which values the features [±R, ±U] may take.

Several derivational rules have been explicated in terms of frames based on examples. Each derivational rule was explicitly decomposed. It has been shown that the derivational rules concern three types of fixation that I refer to as central-node fixation, event-node fixation, and concept-type fixation. The first states the referent of a deverbal nominal by shifting the original central node to another node it is linked to. This process is similar to the frame operation on which metonymy is based. In the case of event-node fixation, it is stated whether the reference of a deverbal noun builds on a concrete event or on an event type. And concept-type fixation means to fix the concept type of a deverbal noun. Thereby, all three types of fixation are restricted by the semantics of the underlying base verb.

The discussed examples, which were used to illustrate the three types of fixation, suggest that the derivational rules for deverbal nouns do not have to be assumed as underspecified. Instead, the analysis claims the polysemy of the suffixes *-er* and *-ung*: Each morpheme is associated with different derivational rules. Building on that, the ambiguity of deverbal *-er* and *-ung* nouns results from the fact that different derivational rules can be applied to the same base verb.

Moreover, there are some deverbal nouns that do not refer to an argument of the base verb, but to a result that is not part of the argument structure of the base verb. The meanings of these nominals have been explained based on an ORIGIN or RESULT attribute.

Authors like (Hovav & Levin, 1992) assume that several *-er* nouns have a default noneventive interpretation. When occurring with arguments, an eventive interpretation of these nouns can be enforced. The view of derivational rules differs from this approach. In terms of derivational rules, occurrence with arguments does not enforce a reinterpretation of the deverbal noun. Instead, the derivational rules support different readings of a deverbal noun, among others a single-event and an event-type interpretation. The different readings constitute meaning variants of the deverbal noun from which the one is selected that fits the context best. Thus, the occurrence of arguments does not enforce a reinterpretation, but rather an elimination of an event-type reading, in the same way that polysemy of nonderived nouns is eliminated when the nouns are used in sentential contexts.

5 Compounding

Compounding is a process frequently used in German to spontaneously produce complex lexemes. In recent decades, several linguistic approaches to compounding have been developed, rival ones as well as those that complement one another. In this chapter, I present an approach to compounding that builds on Löbner (2013: Chapter 12). It induces a new classification for German compounds that sheds new light on some of the already existing approaches. Moreover, it has several implications for the approaches to compounding that have been developed in cognitive psychology.

Compounding as such is a very complex field because there are several subtypes that have to be distinguished. In the following, I focus on subordinate N-N compounds that have compositional meanings. Section 5.1 explicates the characteristics of this compound type. Afterwards, Section 5.2 provides an overview about already existing classifications of compounds, whereas Section 5.3 summarizes cognitive-psychological theories on the interpretation of compounds. Finally, the frame analysis of compounds is developed in Section 5.4.

5.1 Object of investigation

In this chapter, I specify the type of compounds to which the frame analysis will be applied. The definition of what subordinated N-N compounds with compositional meanings are will be developed in the following four subsections, each of them restricting the totality of compounds with respect to a certain aspect.

5.1.1 Morphological criteria

Analogously to nominalization, I consider compounding as a single-step morphological process in which two lexemes, or stems of lexemes, are combined. Morphologically, different grammatical categories are involved in compounding. Consider the compounds in (1a), (1b), (1c), and (1d), where two nouns, two adjectives, a verb

and a noun, as well as an adjective and a noun are combined to a compound, respectively. In the following, I refer to the ingredients of a compound as the compound's *constituents*.

(1) a. Wohnung 'flat,' Brand 'fire' >> Wohnungsbrand 'fire in a flat' (LCC 23078)[24]
b. hübsch 'pretty,' häßlich 'ugly' >> hübsch-häßlich 'pretty as well as ugly'
c. klettern 'to climb,' Wand 'wall' >> Kletterwand 'wall on which one can climb' (LCC 62790)
d. groß 'big,' Handel 'sale' >> Großhandel 'wholesale'

Compounding in German is right-headed. That is, the last constituent of a compound determines its grammatical category. Thus, the compounds in (1a), (1c), and (1d) belong to the class of nouns whereas the compound in (1b) is an adjective. I refer to those compounds that belong to the class of nouns as *nominal compounds*.

When interpreting a compound, the meanings of the constituents are semantically related. For instance in (1c), the object designated by the right constituent is described as being purposed for performing the action designated by the first constituent. In the following, I refer to the semantic relation that is established between the meaning of the constituents as a *meaning relation*. Compounds are often ambiguous because the same constituents can be related differently, resulting in different meaning relations. For instance, Heringer (1984: 2) discusses the meaning of the compound *Fisch* 'fish,' *Frau* 'woman' >> *Fischfrau* for which he lists ten meanings, without excluding that there might be many more possibilities. These meanings are: 'woman who sells fish,' 'woman of the fish,' 'woman whose astrological sign is pisces,' 'mermaid,' 'woman who produces fish,' 'woman descending from a fish,' 'woman who is emotionally cold (like a fish),' 'woman who brought fish,' 'woman who is locally near a fish.'

In general, compounds are either binary or tertiary because either two or three constituents are combined. Examples of binary compounds have already been given in (1). Examples of tertiary compounds are provided below.

(2) a. Mensch 'human,' Maschine 'machine,' Interaktion 'interaction' >> Mensch-Maschinen-Interaktion 'interaction of human and machine'
b. Type 'type,' Token 'token,' Unterscheidung 'distinction' >> Type-Token-Unterscheidung 'distinction between type and token'

However, tertiary compounds occur rarely, as the corpus-based study by Ortner et al. (1991) has shown. The authors investigated more than 64,000 nominal compounds and found that 80 % of the investigated compounds were binary.

[24] Once again, *LCC* stands for *Leipzig Corpora Collection*. The number refers to the sentence that contains the respective compound.

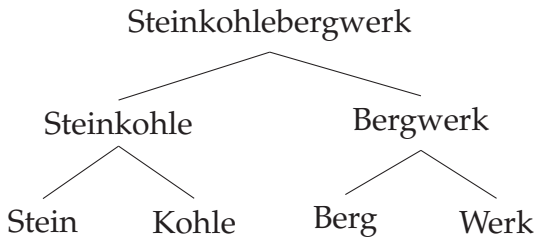


Figure 5.1 Binary structure of multi-part compounds. The Figure illustrates the morphological structure of the compound in 3.

Moreover, compounding can be applied recursively in that the constituents of a compound can be compounds themselves (Erben 2000: 32). Consider the compound in (3) that consists of two binary compounds as constituents, as its decomposition in Figure 5.1 suggests (the example is taken from Schäfer 2008: 27).

(3) Stein 'stone,' Kohle 'coal,' Berg 'mountain,' Werk 'factory' >> Steinkohlebergwerk 'pit where stone coal is mined'

The number of times that compounding can be recursively applied is, at least theoretically, not limited. Hence, huge compounds like the frequently cited one in (4) can be created.

(4) Donaudampfschifffahrtskapitänsmützenhaken
Donau 'the Danube' *Dampf* 'steam' *Schiff* 'ship' *Fahrt* 'journey' *Kapitän* 'captain' *Mütze* 'cap' *Haken* 'hook'

In the following analysis, I focus on binary compounds in which nouns are combined. I refer to such compounds as *N-N compounds*. Semantically, this type of compound is supposed to be one of the most interesting because it is supposed to be the most frequent and seems to offer the broadest range of possible meanings: In their corpus-based study, Ortner et al. (1991) investigated nominal compounds. They state that over 80 % of the investigated nominal compounds were N-N compounds. Most of the meaning relations listed by Ortner et al. (1991) were observed for this type of compound.

N-N compounds may contain interfixes; e.g., the interfix *-s-* in *König* 'king,' *Weg* 'path' >> *Königsweg* 'silver bullet.' These interfixes are not semantically motivated, however, as the investigations of the morphological formation rules for compounding by Motsch (2004), Neef (2009), and Spencer & Zwick (1998), among others, have shown. Since I am only interested in the semantics of compounds, I will not address this topic in the following.

5.1.2 Context-dependency and compositionality

Compounds offer a high degree of ambiguity in that their constituents can usually be related based on different meaning relations. Remember the meaning relations of Heringer's (1984) *Fischfrau* example cited before: Among others, the author assumes that the compound can be interpreted locally 'woman near the fish' as well as emotionally 'woman who is cold like a fish.' Due to the broad variety of meaning relations based on which the constituents of compounds can usually be related, one must at least question whether compounds are compositional at all. In the following, I will discuss the different positions on that topic.

There are compounds that are obviously noncompositional because their meanings do not incorporate the meanings of their constituents. Examples include compounds like *Kot* 'dirt, feces,' *Flügel* 'wing' >> *Kotflügel* 'car wing.' These compounds differ from the *Fischfrau* example in that their meanings cannot be described in terms of the compound's constituents. By contrast, in the paraphrases of the meaning relations of *Fischfrau*, the constituents always recur. Thus, the question arises as to how far those compounds whose meanings can be expressed in terms of their constituents are compositional.

The meaning relations of the *Fischfrau* example suggest a crucial difference between deverbal nouns and compounds. Whereas the interpretation of deverbal nouns is not influenced by the context, but only depends on a variety of derivational rules (see Section 4.2), the meaning relations of compounds may be bound more strongly to the context. For instance, the meaning relation 'woman near the fish' is bound to a certain situation. The context-dependence can be so strong that the meaning of a compound applies only to a single situation. According to Kanngießer (1987), compounds are often contingent ("kontingent"). Kanngießer (1987: 28) illustrates his considerations with the example *Blumenfan* (*Blume* 'flower,' *Fan* 'fan'): although a plausible interpretation would be 'fan of flowers,' it can be interpreted in a more complex way if suggested by the situation. For instance, if a father regularly finds roses in front of the entrance door of his apartment and, some day, sees a young man putting roses there, he could call the young man *Blumenfan*, understood as 'the fan of the father's daughter who regularly deposits flowers (in particular roses) in front of the entrance door of the father's flat.'

From the perspective of concept types, contingent compounds are bound to single situations in which the designate uniquely determined entities and thus always generate individual concepts. This is why I call such compounds *individual compounds*. Such compounds occur frequently in the tabloid press. For instance, the compound *Koma* 'coma,' *Wirt* 'innkeeper' >> *Komawirt* was used to designate an innkeeper who gave alcohol to an underage person who fell into a coma and

then died. Similar to *Blumenfan* in the interpretation above, the conceptual relation between *Koma* 'coma' and *Wirt* 'innkeeper' cannot be derived from the semantic meanings of the constituents only, but also requires knowledge about a certain situation whose most prominent aspects are designated by the compound constituents. Thereby, the situation cannot be reconstructed based on the meanings of the constituents. Instead, the situation constitutes required background knowledge based on which the compound is interpreted. That is, if someone who has the respective background knowledge, the combination of the constituents is supposed to trigger access to this information based on which the compound is interpreted. Without such background knowledge, the compound would be difficult of even impossible to interpret. As initially mentioned, compositionality has the properties to be systematic and regular. When the interpretation of a compound is contingently bound to a single situation, however, the interpretation as such cannot be regular and thus does not underlie compositional rules. Thus, contingent compounds are usually not compositional.

In fact, the contiguity of compound interpretation has been the source for radical positions. Downing (1977) argues that most compounds cannot be interpreted without contextual knowledge. This is why she treats compounding as a purely pragmatic instead of a semantic phenomenon. It is claimed, however, that this view is too rigid because there are a lot of compounds like *Holztisch* 'table made of wood' whose meaning can be explained without drawing a possible context in which the meaning arises.

I suggest that there are contingent compounds whose interpretation is based on a single context, and noncontingent compounds that can be interpreted independently of a single situation. This is supported by experimental psychology. The studies by Clark et al. (1985) have shown that children at the age of two are able to interpret compounds without any contextual information. Thus, compounds can be interpreted context-independently but also allow context-dependencies. This is in line with the results of Wisniewski's (1996; 1997) associational experiments, where subjects were advised to write down possible meanings of given compounds. The experiment shows that subjects are able to create about 20 meanings of a compound with hardly any effort. For instance, the English compound *square clock* was interpreted as 'a square clock' as well as 'clock contained in a box' (Wisniewski 1996: 438). The second reading, additionally, makes clear that subjects are not only able to create new meanings for compounds but also to conceptualize a situation in which the meaning could arise. Thus, subjects not only seem to be able to interpret compounds without a given context but also to take into account how the interpretation of compounds can vary with the context.

Due to the fact that compounds usually allow context-dependent as well as

context-independent interpretations, Kanngießer (1987) suggests distinguishing between three types of compounds, depending on the information required for their interpretation. He distinguishes between compounds whose meaning can be derived only from the lexical meaning of their constituents (*Autofahrer* 'car driver'), compounds whose meaning also takes world knowledge into account in order to infer an implicit relationship between the meanings of the constituents (*Holztisch* 'table made of wood'), and compounds whose meaning is based on contextual information that is not derivable from the meaning of the constituents (e.g., *Blumenfan* in the complex interpretation mentioned above).

Compounds of the type *Rosenfan* do not seem to be compositional in the strict sense because the patterns generating their meanings do not occur systematically. However, there are a lot of compounds that can be interpreted analogously to *Autofahrer* or *Holztisch*, as the examples below demonstrate.

(5) a. Zeitung 'newspaper,' Leser 'reader' >> Zeitungsleser 'newspaper reader' (LCC 164252)
b. Fahrrad 'bicycle,' Reparatur 'repair' >> Fahrradreparatur 'bicycle repair'

(6) a. Stahl 'steel,' Tür 'door' >> Stahltür 'steel door'
b. Seide 'silk,' Decke 'quilt' >> Seidendecke 'silk quilt'

In (5), the second constituent is a deverbal noun, and one of its arguments is specified by the first constituent. Thus, these compounds are interpreted analogously to *Autofahrer*. In (6), the first constituent can be interpreted as specifying the material out of which the referent of the second constituent is made. Thus, the compounds can be interpreted analogously to *Holztisch*. The occurrence of analogous meaning relations gives rise to the conjecture that compounds with analogous meaning relations result from the application of analogous interpretational patterns that occur productively.

However, even in these cases, some authors reject the assertion that the interpretation of such compounds is compositional in the strict sense. For instance, Ungerer & Schmid (1996: 92ff) argue that the meanings of compounds always contain components of meanings that cannot be described by the meanings of the constituents. For exemplification, they consider the compound *apple juice*: Subjects were instructed to list the characteristics, first, of the potential referents of the constituents *apple* and *juice* and, second, of the potential referents of the compound. They claim that the characteristics 'naturally cloudy' and 'mixed with soda water' were mentioned in the second case, but not in the first cases. Thus, they reason that the meaning of the compound contains information that can be derived neither from the meaning of the modifier nor from the meaning of the head. Consequently, they claim that compounding does not seem to be compositional.

However, Löbner (2013: 295) takes an opposite position. He argues that what Ungerer & Schmid (1996) have analyzed, is just the cultural knowledge associated with *apple juice*, which is, nevertheless, added to the noncultural core meaning of the compound 'juice made from apples.' This core meaning, however, arises compositionally from the meanings of *apple* and *juice*.

What also supports the compositionality of the interpretation of compounds is the fact that the meaning relations of compounds used in daily communication are not unrestricted but rather follow a small number of patterns, as Maguire et al. (2010) have shown: Their corpus-based study on English compounds provides evidence that semantically similar constituents are always used in compounds that are interpreted in semantically similar ways (where the authors do not specify precisely what they understood as *similar*, but leave it open to the interpretation of the reader). For instance, the English nouns *gold* and *silver* are semantically similar so that it is not surprising that the English compounds *gold ring* and *silver ring* are predominantly used in the meaning 'ring made of gold/silver' when they occur in corpora (Maguire et al. 2010: 53). Consequently, there are some meaning relations that occur systematically and regularly, the crucial properties of compositional rules. In these cases, the extra-linguistic context does not influence the interpretation of compounds as such. Of course, the context may rule out results of such interpretational patterns. The crucial difference to compounds like *Rosenfan* however is that the context does not affect the interpretation as such, but only makes demands on which results of the interpretation process may fit the context. This is analogous to polysemy where meaning variants of a polysemous expression may be ruled out for contextual reasons.

Assuming that the meaning of compounds is compositional, however, Fabb (1998: 66) claims that compounds are "to some extent compositional, though it is often not predictable." Thus, one can perceive compounding as such as a challenging field in semantics. In the following, I aim at the regular compositional patterns and rules underlying the meaning of compounds, analyzed in terms of frames. Thereby, I consider those compounds that fulfill two positive conditions and one negative condition as *compositional*.

- Their meanings can be expressed in terms of the meanings of their constituents.
- Their meanings arise systematically insofar as analogous interpretations are possible for semantically similar constituents.
- Their interpretation is not bound to a single context.

In the frame analysis, I only focus on compositional compounds. Further types of

compounds, especially what I have called individual compounds, offer an interesting phenomenon for future research.

5.1.3 Subordinate vs. coordinate compounds

In this section, I focus on the internal structure of compounds. In this regard, one usually distinguishes between *subordinate* and *coordinate* compounds. Speaking set-theoretically, subordinate compounds designate a subset of the denotation of the right constituent, but not of the left one. Instead, the left constituent introduces a restriction in that it specifies properties of the referent of the right constituent that holds for some, but not for all, elements in the category the constituent denotes in isolation. By contrast, coordinate compounds designate the intersection of both denotations, the one of the left and the one of the right constituent. Compare the examples below.

(7) a. Holz 'wood,' Bank 'bench' >> Holzbank 'wooden bench' (LCC 213083)
b. Fisch 'fish,' Kutter 'boat' >> Fischkutter 'fishing boat' (LCC 271415)
c. Passagier 'passenger,' Dampfer 'steamer' >> Passagierdampfer 'steamer for transporting passengers' (LCC 60872)

(8) a. Singer-Songwriter 'singer-songwriter'
b. Autor 'author,' Filmer 'director' >> Autorenfilmer 'someone writing and directing his own movies' (LCC 26285)

In (7), the denotation of the whole compound constitutes a subset of the denotation of the right constituent, whereas in (8), the compounds can only be used to refer to those subjects that are potential referents of the first as well as the second constituent.

The distinction between subordinate and coordinate compounds is well established in the literature. In the case of subordinate compounds, I refer to the left constituent as *modifier* and to the right constituent as *head*. In the literature, rival terms are also common. For instance, Marchand (1969) refers to the former as *determiner* and to the latter as *determinant*, whereas Haspelmath & Sims (2010: Chapter 7) speak of the *dependent* and the *semantic head*, respectively.

In the following, I only focus on subordinate compounds and will always speak of the left constituent as *modifier* and of the right constituent as *head*.

5.1.4 Metaphoric and metonymic compounds

Several compounds are subject to metonymic or metaphoric processes. For instance, the compound below does not designate a storm in the literal but in the figurative sense.

(9) Beifall 'applause,' Sturm 'storm' >> Beifallssturm 'frenetic applause'

Metonymic or metaphoric processes may occur on two different stages. On the one hand, a meaning shift may occur compound-internally, when the meaning of a constituent is shifted to make the constituents fit each other within an appropriate meaning relation. This is the case in (9). On the other hand, a meaning shift may occur compound-externally, when the meaning of the compound as a whole is shifted. This is the case in (10): The compound *Knochen* 'bone,' *Bruch* 'break' >> *Knochenbruch* 'bone break' allows a nonfigurative interpretation that is metaphorically varied in the sentence.

(10) Das Scheitern der EU-Verfassung ist ein Knochenbruch, aber keine Querschnittslähmung. (Helmut Schmidt, Die Zeit, 09.06.2005: 2)
'The failure of the EU Constitution is a bone break but no paraplegia.'

Compound-internal and compound-external meaning modifications differ since only the former belong to the compound interpretation as such whereas the latter only adopts the result of the compound interpretation.

The English literature often distinguishes between endocentric and exocentric compounds (Haspelmath & Sims, 2010; Booij, 2007). Compounds of the former are those that refer to a subcategory of the compound's head that is determined by the compound's modifier. By contrast, exocentric compounds do not refer to an entity that is usually designated by the compound's head but rather to something to which its typical referents are related by metonymical or metaphorical processes. Exocentric compounds may underlie both, internal and external modifications. For instance, the compounds in (11) are both considered as exocentric. However, the meaning shift in (11a) occurs internally because only *lion* is metaphorically shifted, whereas in (11b), the meaning shift occurs externally because the compound is literally interpreted as a pickpocket and afterwards metonymically shifted to the one who picked it. The examples show that the internal vs. external distinction is missing in recent research.

(11) a. stone lion 'figure made of stone that looks like a lion'
b. pickpocket

There are some external shifts that seem to occur systematically with a broad range of compounds. These compounds include some of those that are usually designated

as *possessive* (Knobloch 1997: Possessivkomposita) or by the Sanskrit term *bahuvrīhi*. Following Knobloch (1997), these compounds show the characteristic that they do not refer to their literal referents but to something to which their literal referents are metonymically related; consider the examples in (12).

(12) hinken 'to limp,' Bein 'leg' >> Hinkebein 'someone who limps'

Although the compound can also be used in its literal meaning, see (13), it is usually used in the metonymic interpretation explicated in (12).

(13) Mein Hinkebein ist jetzt bandagiert.
'My gammy leg is now bandaged.'

Using compounds designating body parts to refer to the possessor of these body parts seems to be a very frequent pattern in German. The externally shifted compound can already include internal shifts, as in *Milch* 'milk,' *Gesicht* 'face' >> (14a) 'milksop' where *milk* 'Milch' is used to characterize the physiognomy of a face metaphorically. Afterwards, the meaning of the compound is externally shifted to designate persons that have such faces. Beyond that, the example in (14b) demonstrates that possessive compounds can be based simultaneously on metaphoric and metonymic shifts: The compound as such can be interpreted literally. Afterwards, it is used metonymically to refer to its possessor, where the possessor is assumed to have some unpleasant character traits that are metaphorically derived from the literal meaning of *Arschloch* 'asshole' that are based on the knowledge that the anus is some kind of a dirty body part (the *asshole* example is also discussed in Löbner, 2013, 58).

(14) a. Milch 'milk,' Gesicht 'face' >> *Milchgesicht* 'milksop'
b. Arsch 'ass,' Loch 'hole' >> Arschloch 'asshole'

Whether external shifts (as they occur with possessive compounds) are subject to the compositional mechanisms underlying the interpretation of compounds is questionable. It might also be possible that compounding and metonymy are separate processes. I will address this question more deeply in Section 5.4. Certainly, since the frame model used here is not able to describe metaphors adequately, I restrict the discussion to those compounds whose interpretation involves metonymic processes. In describing these processes, we are able to build on the work of Chapter 3.

5.2 Classification of compounds

This section will provide an overview about semantic classifications of compounds that have been developed in linguistics. Initially, Section 5.2.1 discusses general cat-

egories that are widely accepted in semantic research on compounding. Section 5.2.2 summarizes the empirical studies of Ortner et al. (1991), which is the most extensive semantic investigation of German compounding. Subsequently, Section 5.2.3 deals with the classification developed by Marchand (1969) that is often adopted in linguistic research.

5.2.1 Traditional categories

Most classifications distinguish between coordinate and subordinate compounds in the aforementioned sense. These classes are usually further subdivided. A prominent category is the class of *synthetic compounds*. By contrast to the coordinate vs. subordinate distinction, which is strictly based on semantic criteria, the definition of synthetic compounds takes also a morphological criterion into account: Synthetic compounds consist of two constituents where the right constituent is a deverbal noun, while the left constituent specifies a θ-role of its base verb (Fabb, 1998; Marchand, 1969). Consider the examples in (15). In this regard, Spencer (1991: 319) distinguishes between synthetic compounds in the aforementioned sense on the one hand and *root compounds* understood as the set of compounds that are nonsynthetic on the other.

(15) a. Auto 'car,' Fahrer 'driver' >> Autofahrer 'car driver'
b. Straße 'street,' Absperrung 'blocking' >> Straßenabsperrung 'blocking of a street'

The fact, however, that not only deverbal nouns, but also bare nouns can require further arguments means that the category of synthetic compounds can also be applied to compounds with relational or functional nouns as heads where the modifier saturates their argument; e.g., *Priester* 'priest,' *Vater* 'father' >> *Priestervater* 'father of a priest.' In this regard, authors like Fabregas & Scalise (2012) distinguish between subordinate compounds and *attributive compounds*. In attributive compounds, "the nonhead does not get a semantic role from the head, but rather predicates some of its properties, acting like the attribute inside a noun phrase" (Fabregas & Scalise 2012: 115). Consequently, *Priestervater* 'father of a priest' would be considered as a subordinate compound, whereas a compound like *Rose* 'rose,' *Garten* 'garden' >> *Rosengarten* 'rose garden' would be considered as an attributive compound.

Several classifications build on the categories introduced so far, i.e., subordinate, coordinate, synthetic, possessive, attributive, exocentric, and endocentric compounds (see Scalise & Bisetto, 2009, for an overview). I follow the distinction proposed by Bloomfield (1933), who distinguishes between determinative and copulative compounds where the terms *determinative* and *copulative* correspond to subor-

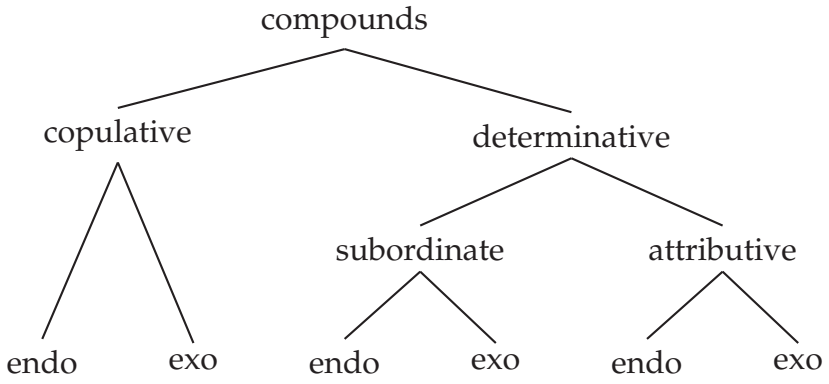


Figure 5.2 Bloomfield's (1933) compound classification.

dinate and coordinate, respectively. The copulative compounds are divided into exocentric and endocentric compounds. The determinative compounds, on the other hand, are divided into subordinate and attributive compounds, where each of the categories is subdivided into endocentric and exocentric ones. Figure 5.2 illustrates the distinction. Here, possessive compounds are not mentioned but only implicitly covered by exocentric subordinate or attributive compounds.

The compounds investigated in this thesis fall into several of the categories distinguished by Bloomfield (1933). There are only two exceptions. First, I do not deal with copulative compounds. Second, regarding exocentric compounds, those that involve metaphoric processes are not considered.

5.2.2 Marchand's (1969) approach

Marchand (1969: 60–82) develops a classification of compounds that focuses primarily on the English language, but also addresses German compounds. The postulated categories can widely be adopted to German. He developed a two-level distinction of compounds: First, compounds are classified depending on the grammatical categories of their constituents; second, these classes are subdivided depending on the meaning relations that occur in these classes. For the sake of illustration, he refers to the meaning relations with one of their prototypical representatives. Thus, these representatives function simultaneously as examples and category labels.

With respect to the compounds that have been defined as the object of investigation, he distinguishes the types *steamboat*, *craftsman*, *housekeeping*, *earthquake*, and *watchmaker*. The categories *housekeeping* and *watchmaker* are subtypes of the aforementioned synthetic compounds and only differ in that the first type is always built with *-ing* nominals as head, and the second with deverbal *-er* nouns in the agent

reading. However, the types have in common that a θ role of the base verb is specified by the modifier in each case. Thus, they are subcategories of the aforementioned synthetic compounds.

The type *steamboat* refers to compounds in which a noun is used as a modifier to restrict the original denotation of the compound's head. Marchand (1969: 60) assumes the number of meaning relations occurring in this type of compound as "practically unlimited" and thus as hard to predict.

In contrast to compounds of the type *steamboat*, compounds of the type *craftsman* allow the paraphrase as genitive constructions; e.g., 'man of the craft.' Depending on the relationship expressed by the genitive construction, Marchand (1969) differs between further subcategories of this type, such as the material relationship as in *fuller's earth* or possessive relationships as in *bishop's cap*. While it is disputable in some cases of the English language whether the cited examples have to be considered as compounds rather than genitive constructions, their German counterparts can be indisputably identified as compounds due to the compound spelling that is typical for German. These German counterparts are built with the interfix *-s* in most cases, e.g., the *-s* in *Kapitänsmütze*.

Marchand (1969) uses the type *earthquake* in order to refer to compounds whose heads do not have referents. Beyond that, they behave like compounds of the type *steamboat*. However, I do not agree with Marchand's analyses because it cannot be claimed that nouns like *quake* do not have any reference. Rather, they refer to an action and are thus comparable to verbs. This is why I do not consider this category in the following.

When analyzing compounds in frames, we will see that some of Marchand's (1969) classes can be defined in terms of frames. This is important insofar as Marchand does not hold a conceptual but rather a logical view on semantics. Nevertheless, I will point to some inconsistencies of Marchand's classification that will become obvious during the analysis.

5.2.3 The studies of Ortner et al. (1991)

The corpus-based study of Ortner et al. (1991) is the largest empirical investigation of German compounds. The authors investigated more than $64,000$ compounds occurring in German newspapers and fictional texts, focusing especially on their internal meaning relations. They distinguish between more than 30 meaning relations that occur for nominal compounds. That is, the second constituent is a noun, whereas the first constituent is not restricted with respect to its grammatical category. Thus, the object of investigation is larger than that of this thesis. In the following, I discuss those meaning relations that the authors exemplify with N-N com-

pounds. For the sake of clarity, I divide the meaning relations into different classes.[25] Moreover, I only list those classes that fall into the object of investigation defined in Section 5.1. In particular, I do not list classes that are restricted to coordinate compounds or to compounds whose meaning is based on metaphorical processes. Following Ortner et al. (1991), I refer to the referent of the first constituent as A and to the referent of the second constituent as B and use this notation to paraphrase the internal meaning relations of compounds. The original terms of the categories are mentioned in brackets. All the examples are taken from Ortner et al. (1991: 126–142).

- A and B are causally or processually related or part of an action.
  - agentive ("agentiv"): B creates A (*Stück* 'play,' *Schreiber* 'writer' >> *Stückeschreiber* 'writer of plays,' *Beton* 'concrete,' *Maschine* 'machine' >> *Betonmaschine* 'machine for mixing concrete'), A creates B (*Biene* 'bee,' *Honig* 'honey' >> *Bienenhonig* 'honey made by bees'), or A occurs in/with B (*Werkstatt* 'workshop' >> *Elektrikerwerkstatt* 'workshop where electricians work').
  - instrumental ("instrumental"): A is used by B (*Benzin* 'gasoline,' *Motor* 'engine' >> *Benzinmotor* 'gasoline engine')
  - causal ("kausal"): A causes B (*Schmerz* 'pain,' *Schrei* 'scream' >> *Schmerzensschrei* 'scream of pain')
  - final ("final"): B is destined or suitable for A (*Strand* 'beach,' *Anzug* 'dress' >> *Strandanzug* 'dress made for being worn at the beach')
  - processual ("prozessual"): A occurs with B (*Druck* 'pressure,' *Abfall* 'decrease' >> *Druckabfall* 'drop in pressure')
  - substitutive ("substitutiv"): B is a payment for A (*Transport* 'transport,' *Gebühr* 'charge' >> *Transportgebühr* 'charge for transport'), or vice versa (*Lohn* 'pay,' *Arbeit* 'work' >> *Lohnarbeit* 'work that is recompensed with a payment')
  - conditional/accasional ("konditional/akkasional"): A is a condition for or motivation for B (*Jubiläum* 'anniversary,' *Ausstellung* 'exhibition' >> *Jubiläumsausstellung* 'exhibition because of an anniversary,' *Nebel* 'fog,' *Horn* 'horn' >> *Nebelhorn* 'foghorn')
  - consecutive/causative ("konsekutiv/kausativ"): A is effect of or for B (*Fieber* 'fever,' *Wahn* 'delusion' >> *Fieberwahn* 'delusion caused by fever')
  - patiens ("Patiens"): B is done with A (*Kohle* 'coal,' *Abbau* 'mining' >> *Kohleabbau* 'coal mining')

[25] The classification of the meaning relations has been postulated in Schulzek (2008).

- *A* and *B* are materially related.
  - substantial ("substanziell"): *B* consists of *A* (*Granit* 'granite,' *Felsen* 'rock' >> *Granitfelsen* 'granitic rock') or *B* is made of *A* (*Holz* 'wood,' *Hütte* 'cabin' >> *Holzhütte* 'cabin made of wood').
  - constitutional ("konstitutionell"): *B* is composed by *A* (*Blume* 'flower,' *Strauß* 'bouquet' >> *Blumenstrauß* 'bouquet of flowers').
  - specificative ("spezifikativ"): *B* explicates *A* (*Kaffee* 'coffee,' *Sorte* 'sort' >> *Kaffeesorte* 'sort of coffee').
  - mensurative ("mensurativ"): *A* is a mass that is measured in terms of *B* (*Fleisch* 'flesh,' *Portion* 'portion' >> *Fleischportion* 'portion of flesh').
  - formative ("figurativ"): the mass *B* has the form or appearance of *A* (*Würfel* 'cube,' *Zucker*, 'sugar' >> *Würfelzucker* 'cube of sugar (lump of sugar)'), or vice versa (*Kakao* 'cocoa,' *Pulver* 'powder' >> *Kakaopulver* 'cocoa (as powder)').
- *A* and *B* are spatially or temporally related.
  - local ("lokal"): *B* occurs in *A* (*Büro* 'office,' *Arbeit* 'work' >> *Büroarbeit* 'clerical job'; *Bank* 'bank,' *Guthaben* '(credit) balance' >> *Bankguthaben* 'bank balance') or *B* comes from *A* (*Seite* 'side,' *Wind* 'wind' >> *Seitenwind* 'crosswind') or *B* leads to *A* (*Keller* 'cellar,' *Treppe* 'stairs' >> *Kellertreppe* 'stairs to the cellar') .
  - temporal ("temporal"): *A* explicates the time point when *B* takes place or the time measure on which *B* is based (*Monat* 'month,' *Plan* 'plan' >> *Monatsplan* 'monthly plan'; *Morgen* 'morning,' *Frühstück* 'breakfast' >> *Morgenfrühstück* '(early) morning breakfast').
  - existential ("existential"): *B* states where or when *A* exists (*Arbeiter* 'worker,' *Stadt* 'town' >> *Arbeiterstadt* 'worker's town'; *Frieden* 'peace,' *Zeit* 'time' >> *Friedenszeit* 'time of peace').
- *A* and *B* are in a part-whole relation.
  - partitive ("partitiv"): B is (obligatory) part of A (*Buch* 'book,' *Rücken* 'back' >> *Buchrücken* 'spine of a book').
  - ornative ("ornativ"): B is provided with A (*Henkel* 'handle,' *Korb* 'basket >> *Henkelkorb* 'basket with a handle').
- *A* and *B* are possessively related.

  - benefactive ("possessorisch/benefaktiv"): *B* is owned by *A* (*Verein* 'club,' *Vermögen* 'wealth' >> *Vereinsvermögen* 'club funds'; *Gemeinde* 'community,' *Wald* 'forest' >> *Gemeindewald* 'communal forest').
  - possessive ("possessiv"): *A* (saliently) belongs to *B* (*Hose* 'trousers,' *Mädchen* 'girl' >> *Hosenmädchen* 'girl wearing trousers')

- *A* and *B* correspond to each other, or they are equated to each other.
  - referential ("referentiell"): *A* is the topic of *B* (*Bedeutung* 'meaning,' *Lehre* 'teaching' >> *Bedeutungslehre* 'semantics') or *A* concerns *B* (*Frieden* 'peace,' *Zeichen* 'sign' >> *Friedenszeichen* 'sign of peace').
  - graduative ("graduativ"): *A* indicates the size of *B* (*Riesenskandal*) or *A* indicates the noncompleteness of *B* (*Teilabschnitt*)
  - appelative ("nominatorisch/appellativ"): *B* (re-)names *A* (*Njassa* (name of a lake), *See* 'lake' >> *Njassasee* 'Lake Njassa')
  - professional ("kompetentiell"): *B* is the profession of *A* (*Verkehr* 'traffic,' *Ministerium* 'ministry' >> *Verkehrsministerium* 'ministry for transportation')
  - congruent ("kongruent"): *A* corresponds to the quantity of *B* (*Gebäude* 'building,' *Wert* 'value' >> *Gebäudewert* 'value of a building')

Ortner et al. (1991) do not precisely delineate their categories from each other. Consequently, some open questions remain. For instance, it is not clear what the exact difference between benefactive and possessive is. Nevertheless, the classification provides interesting data for the frame analysis developed here. In this regard, it will be a central aim to demonstrate that several of the classes introduced above can be explained by analogous frame operations.

5.3 Theories on the interpretation of compounds

Approaches to the interpretation of (novel) compounds have arisen from the 1960s on. Early approaches to generative grammar were developed in which compounds were assumed to be contracted relative clauses from which only the most important lexical elements are represented on the linguistic surface in the form of the compounds' constituents (Lees, 1966). The interpretation of compounds is then considered as reconstructing the relative clause underlying the compound's meaning from its constituents. Thereby, the reconstructional processes are assumed to be based on several principles that can also be observed in syntax. However, as ten Hacken (2009) states, the approaches to compounding in generative grammar are obsolete

by now because they build on the problematic assumption that human thinking is organized isomorphically to the linguistic surface.

More recent, later approaches have been developed by Wisniewski (1996, 1997) and Gagne & Shoben (1997) as well as Gagne (2001, 2002). Wisniewski (1997) refers to his approach as the *schema approach* and to Gagne's approach as the *thematic-relation view*. However, I prefer to refer to these approaches as the *concept-linking* and the *relation-set* approach, respectively, because from a semantic perspective these terms are more appropriate. In a nutshell, the crucial difference is this: The basic assumption of the concept-linking approaches is that the concepts activated by a compound's constituents are combined spontaneously to a coherent concept. It is assumed that the process of combination is performed on the fly, therefore most representatives of the concept-linking approach reject the assumption that the patterns underlying the combinational process are restricted. The relation-set approach, on the other hand, assumes that the interpretation of compounds is based on a finite set of thematic relations. These thematic relations have been derived from existing compounds and are stored in the mental lexicon. When a novel compound is interpreted, the most appropriate relation is chosen.

In contrast to this thesis, which considers compounding from a purely theoretical perspective, the concept-linking and the relation-set approach investigate compounding empirically based on reaction-time or association experiments. Thus, I will not be able to evaluate their empirical results. Rather, I will summarize the central results of these approaches and explain them frame-theoretically afterwards.

The concept-linking approach. Wisniewski (1996, 1997) uses frames in the sense of Minsky (1975) to model the meaning of N-N compounds, whereby he refers to *frames* as *schemata*. Such schemata are considered as networks of *slots* and *fillers*, where slots describe aspects of the represented object that are specified by fillers. Thus, slots and fillers in the sense of Minsky (1975) correspond to the attributes and values in the frame approach used here, respectively. Wisniewski (1996, 1997) treats compounding from a cognitive-psychological angle and is interested in the conceptual patterns and processes that enable subjects to interpret compounds with hardly any effort. The interpretation of compounds is also assumed to be based on principles of slot-filling in that the schema of the first constituent is related to the schema of the second constituent.

Based on empirical studies, Wisniewski (1997: 168) argues that the interpretation of N-N compounds is based on three basic principles which he refers to as *relation-linking interpretation*, *property interpretation*, and *hybridization*. Interpretations of the first type arise when the schemata of the constituents are related on the basis of scenarios in which their referents can potentially be involved. Meanings of compounds that are subject to relation-linking interpretation can be further distinguished into

two types: first, the modifier can be used to specify a dimension of the compound's head, e.g., *strawberry cake* 'cake with strawberries,' and second, the modifier and the head are understood as entities that are involved in the same action, e.g., *dish rag* 'rag for cleaning dishes.'

The first type is explained by slot-filling principles insofar as the schema activated by the modifier fills an appropriate slot in the schema activated by the head. The second type of compounds is explained in that both schemata, the one for the modifier and the one for the head, activate a schema for the actions in which their referents can be involved. Afterwards, the schemata of the modifier and the head are integrated into the schema of the action via slot-filling processes similar to the process of attribute specification based on which compounds of the first type are explained.

Compounds that underlie property interpretation are coordinate compounds, in which a property is derived metaphorically from the modifier and then used to specify an aspect of the referent of the compound's head; e.g., in *zebra mussel* 'mussel with stripes,' the modifier is metaphorically used to describe the visual nature of a mussel (Wisniewski 1997: 170).

Wisniewski (1997: 177f) designates those compounds that are interpreted according to what has been called copulative compounds as hybridization; i.e., the compound constituents in isolation designate separate categories, and the compound is interpreted as denoting one of their crossbreeds (e.g., a *robin canary* is 'a bird that is a cross between a robin and a canary') or their intersection (e.g., a *musician painter* could refer to someone who is both a musician and a painter).

The compounds Wisniewski (1997) refers to as property compounds and hybridization do not fall into the scope of investigation that has been explicated in Section 5.1. Property compounds involve metaphorical processes that cannot be modeled in frames so far, and hybridization compounds do not have a subordinate structure. However, one thing that does belong to the object of investigation is what the author calls relation-linking interpretation. The two types distinguished by Wisniewski (1997) will be represented in the frame approach developed in Section 5.4.

The relation-set approach. Gagne (2001, 2002) builds her approach on the ideas developed in Gagne & Shoben (1997). Gagne (2002) assumes that the interpretation of novel compounds underlies a set of about 20 meaning relations. She claims that, when a novel compound is interpreted, the meaning relation in which the meaning of the constituents can best be integrated is chosen. Gagne presents evidence from several experimental studies that the selection of an appropriate meaning relation is widely determined by the modifier. In more detail, she investigated whether the meaning relation of compounds can be primed by the modifier or the head of coor-

dinate compounds. In her experiments, she delivers evidence that it can be primed by the modifier but not by the head. This is why she claims that the interpretation of novel compounds is primarily subject to the compound's modifier. Although Gagne (2002) obviously assumes that the set of meaning relations is derived from existing compounds, she leaves the question of how they have been derived open.

Both the concept-linking and the relation-set approach aim at explaining productive mechanisms in the interpretation of compounds. In principle, the two approaches do not exclude each other. Rather, it could be possible that the concept-relation approach addresses the interpretation of innovative compounds, whereas the relation-set approach addresses the interpretation of those compounds that can be interpreted analogously to compounds whose meaning is stored in the lexicon due to their frequent occurrence. Since this question is subject to further experimental research on compounding, this thesis cannot contribute to this issue. However, the approaches can be addressed from a theoretic perspective. In the following, I will argue that the frame approach is compatible with the weak interpretation of the concept-linking and the relation-set approach.

5.4 Frame analyses

In the following, I present a frame-based analysis of compounds and relate it to rival classifications in linguistics as well as to theories about the interpretation of compounds that have been developed in the cognitive sciences. In Section 5.4.1, I will introduce Löbner's (2013: Chapter 12) frame approach that motivates the distinction of four types of compounds. In Section 5.4.2 to 5.4.5, I will discuss these categories extensively. In this regard, I will make several remarks that are not mentioned in Löbner (2013). In particular, I will point out the extent to which these categories cover previous classifications of compounds. Afterwards, I will briefly comment on so-called possessive compounds from a frame-theoretic view (Section 5.4.6). Finally, I will relate the frame approach to the concept-linking and the relation-set approach (Section 5.4.7).

5.4.1 Löbner's (2013) approach

Löbner (2013: 316–319) focuses on subordinate compounds in English that do not involve metaphoric or metonymic processes. However, the analysis is completely transferable to German. The interpretation of compounds is understood as consistently unifying the frames of the constituents. Depending on the way in which

frames are unified, he distinguishes four classes of compounds where the classification is not claimed to be complete.

Value compounds. In these compounds, the modifier specifies the value of an attribute in the frame of the head noun. The examples Löbner (2015b: 388) provides are

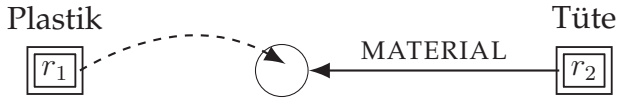
(16) a. Plastik 'plastic,' Tüte 'bag' >> Plastiktüte 'plastic bag'
b. Ufer 'waterside,' Promenade 'promenade' >> Uferpromenade 'waterside promenade'
c. Werk 'company,' Wohnung 'apartment' >> Werkswohnung 'company-owned apartment'

In these compounds, the modifier specifies the value of the MATERIAL, OWNER, and LOCATION attribute in the frame of *bag*, *flag*, or *bench*, respectively. Figure 5.3 shows the frame of the compound 16a. The example is taken from Löbner (2015b: 388), in which the frame notation has been adapted to the one used in this thesis and slightly differs from Löbner's notation.

Figure 5.3A shows the frames of *Plastik* 'plastic' and *Tüte* 'bag' in isolation. Both nouns are sortal and thus have only one rectangular node and do not contain possessor arguments. Figure 5.3B shows the unified frames. Here, the frame of *Plastik* 'plastic' specifies the MATERIAL attribute in the *Tüte* 'bag' frame, whose assumption is plausible since a bag is a physical object. Since the material is not an argument of the conceptual description of a bag, the originally rectangular central node of the *Plastik* 'plastic' frame is transformed into a round node when specifying the MATERIAL attribute in the *Tüte* 'bag' frame.

Since English, as well as German, compounding is right-headed, the frame of the right constituent becomes the central node in the frame of the compound. The frame of the left constituent is integrated in the frame of the head noun by specifying one of its arguments. Since the left constituent specifies neither the referential argument of the compound nor one of its open arguments, it is transformed into a round node. In the example, the *Plastik* 'plastic' node is transformed into a round node because it has to be understood as an attribute specification. In terms of Löbner (2013: 318), "the modifier node is stripped of its referent status."

The attribute specification by the modifier leads to a *Tüte* 'bag' frame that is more specific than the general *Tüte* 'bag' frame in which the MATERIAL attribute remains unspecified. Thus, the specification of the attribute causes a restriction of the satisfaction class of the original *Tüte* 'bag' frame. Consequently, the denotation of the *Plastiktüte* 'plastic bag' frame constitutes a subclass of the denotation of the general *Tüte* 'bag' frame.



A Unification of the frames

B Unified frames.

Figure 5.3 Example of a value compound. The meaning of *Plastiktüte* 'bag made of plastic' arises by means of a unification of frames. The example is taken from Löbner (2015b: 388). However, it differs from the original in notational details.

Argument compounds. These compounds are very similar to the former type.[26] They only differ from value compounds in that the modifier specifies the possessor argument of the head noun. By contrast, in value compounds the modifier always specifies a nonargument node in the frame of the head noun. Since the modifiers of argument compounds specify a possessor of the head noun, the head nouns have to be functional or relational. The examples Löbner (2015b: 388) provides are:

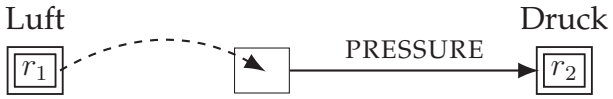
(17) a. Luft 'air,' Druck 'pressure' >> Luftdruck 'air pressure'
b. Öl 'oil,' Preis 'price' >> Ölpreis 'oil price'
c. Huhn 'chicken,' Bein 'leg' >> Hüherbein 'chicken leg'

Figure 5.4 provides the frame analysis of the compound in 17a. Note that the saturation of the argument node is marked by transforming the rectangular argument node of *Druck* 'pressure' (Figure 5.4A) into a round node (Figure 5.4B). Argument compounds are very interesting from the perspective of concept types. In Section 5.4.3, I will comment on this more closely.

Synthetic compounds. The modifier specifies an argument of the base verb of the deverbal head noun.[27] Examples are:

(18) a. Bus 'bus,' Fahrer 'driver' >> Busfahrer 'bus driver'
b. Klavier 'piano,' Spieler 'player' >> Klavierspieler 'piano player' (Löbner 2015b: 389)
c. Rad 'bicycle,' Fahrer 'rider (lit. driver)' >> Radfahrer 'bicycle rider' (Löbner 2015b: 389)

[26] In Schulzek (2008), I refer to value and argument compounds as *Typ I Komposita*.
[27] This class of compounds is identical to what is called *Typ II Komposita* in Schulzek (2008).



A Frame unification.

B Result of the unification.

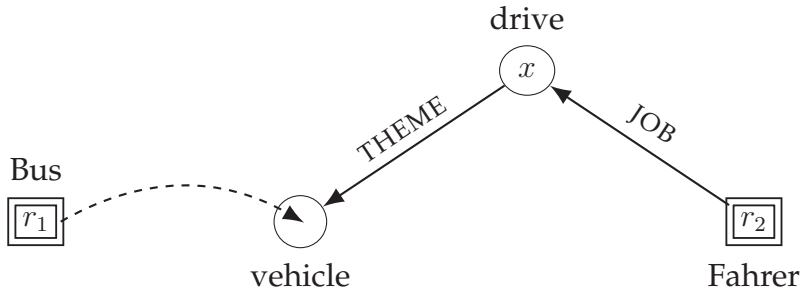
Figure 5.4 Example of an argument compound. The meaning of the compound *Luftdruck* 'air pressure' results from argument saturation. The example is taken from Löbner (2015b: 388), but differs from the original in notational aspects.

Löbner (2013) does not exemplify the frame structure of these compounds. Nevertheless, they can be modeled very easily in frames. Figure 5.5 gives an example. The analysis assumes that the deverbal noun *driver* describes someone driving for job-related reasons and thus has a noneventive interpretation. In Section 5.4.4, I will also consider further types of deverbal nouns as head nouns of synthetic compounds.

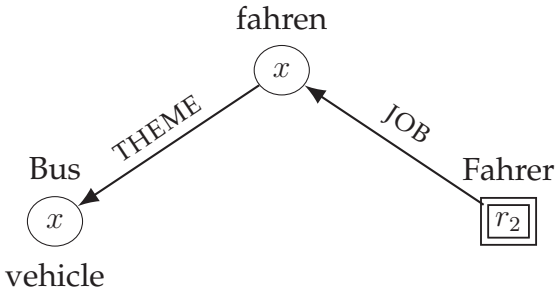
(Action) frame compounds. Löbner (2013: 217) refers to these compounds as *frame compounds*. I use the term *action frame compound* because it seems to be more self-explanatory in terms of what the characteristics of these compounds are.[28] These compounds are interpreted based on actions in which the referents of the constituents are potentially involved. Thus, the action is an affordance of the referents of the constituents. The example Löbner (2015b: 387) provides is *Tee* 'tea,' *Tasse* 'cup' >> *Teetasse* 'teacup' whose interpretation is based on the action of drinking. Figure 5.6 illustrates the frame of the compound. The frames of both constituents contain knowledge about the action of drinking because cups and also tea are made for drinking. The roles, however, by which cups and tea are involved in the drinking action differ: Cups are the instrument and tea the theme of a drinking event (see Figure 5.6A). Since the constituents specify different roles in the *drinking* frame, their frames can be unified consistently. Once again, the central node in the frame of the head noun constitutes the central node in the frame of the whole compound (see Figure 5.6B).

The unification of frames is very similar to the unification process underlying synthetic compounds: in both types of compounds, the frames of the constituents are related on the basis of an action frame. However, the types of compounds differ

[28] The class of compounds is identical to what is called *Typ III Komposita* in Schulzek (2008). In Schulzek (2014), I also use the term *frame compound*.



A Frame unification.



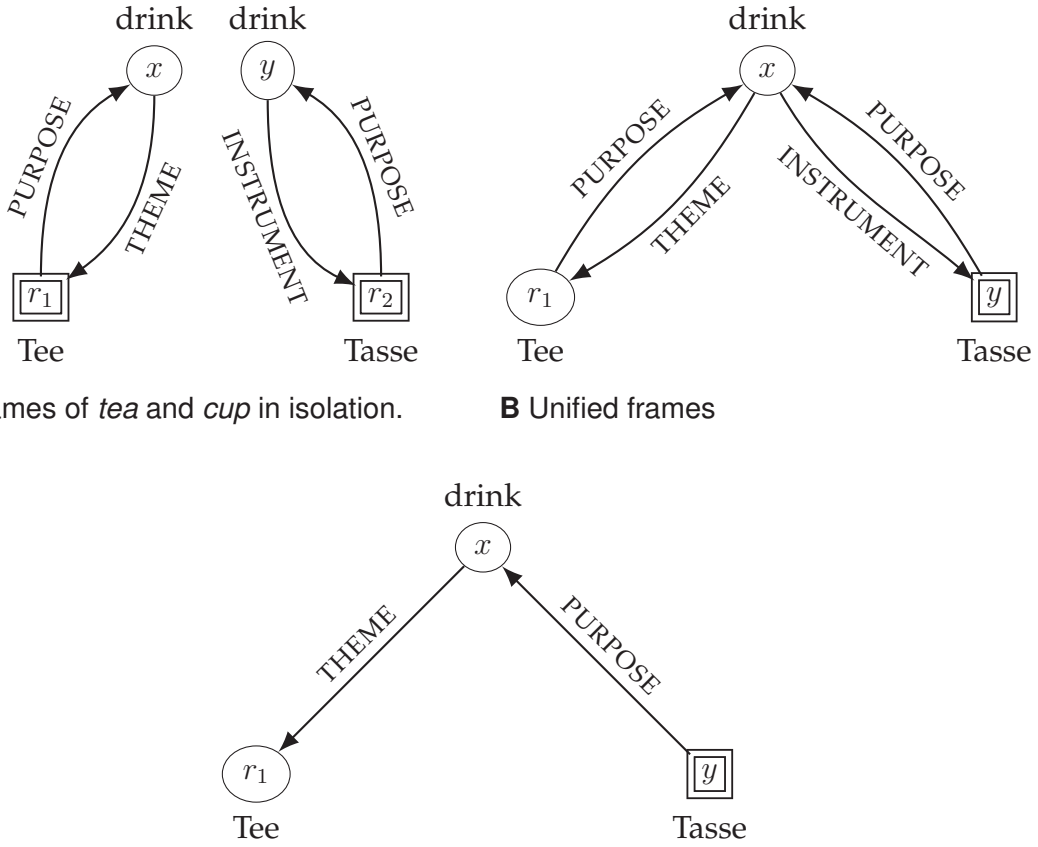
B Result of the unification.

Figure 5.5 Example of a synthetic compound. The interpretation of *Busfahrer* 'bus driver' is based on a nonevent interpretation of the deverbal *-er* nominal *fahren* 'to drive' >> *Fahrer* 'driver.'

only in that in the case of synthetic compounds, the action frame is already represented on the linguistic surface, where the action is designated by the base verb of the deverbal head noun.

The compound *Teetasse* 'teacup' is obviously sortal because it specifies a subclass of cups, namely those cups that are made for drinking tea. Since every node in the frame can be reached from the central node, the frame is a well-structured sortal frame graph in the sense of Postulate 2.7. As Löbner (2013: 317) mentions, the INSTRUMENT attribute that links the *Tasse* 'cup' node to the *drinking* node as well as the PURPOSE attribute that links the *Tee* 'tea' to the *drinking* node can also be omitted, as in Figure 5.6C, since the attributes are implied by their inverses. In such a case, the frame fits a strict interpretation of Postulate 2.7 according to which the central node of sortal frames does not have ingoing arcs. According to Löbner (2013: 318), "the example is representative of a very frequent conceptual pattern of compounding."

In the example, the action frame is established by the modifier and the head noun. However, as Löbner (2013: 318) points out, it is also possible that the action is associated more strongly with the head noun than with the modifier. For instance, the compound *Buch* 'book,' *Laden* 'store' >> *Buchladen* 'bookstore' is inter-



A Frames of *tea* and *cup* in isolation.

B Unified frames

C Restructuring the unified frame.

Figure 5.6 Example of an action frame compound. The figure shows the frame analysis of the compound *Tee* 'tea,' *Tasse* 'cup' >> *Teetasse* 'teacup.'

preted based on a buying action that is associated with *Laden* 'store' and, if at all, only to a less degree with *Buch* 'book' (Löbner 2015b: 388). In Section 5.4.5, I will comment on this in more detail.

5.4.2 Value compounds

We have already seen the diversity of aspects that are described by attributes in the frame analysis of metonymy. Consequently, there is a broad diversity of meaning relations covered by the category of value compounds. In Chapter 3 on metonymy, four types of attributes were distinguished: attributes for parts, dimensions, correlates, and events. Attributes for events are involved in action frame compounds (see Section 5.4.5). Attributes for parts, however, occur frequently in argument compounds. Value compounds are predominantly based on dimensions, as the exam-

ples in (19) suggest, but they also include attributes for correlates, as the examples in (20) demonstrate.

(19) a. Diesel 'diesel,' Motor 'engine' >> Dieselmotor 'diesel engine' (LCC 24594)

b. Finanzen 'finances,' Ministerium 'ministry' >> Finanzministerium 'Treasury Department' (LCC 17911)

(20) a. Verein 'club,' Gelände 'area' >> Vereinsgelände 'area that is possessed by a club' (where *possessed* may mean 'rented,' 'owned,' among others) (LCC 10898)

b. Semantik 'semantics,' Kapitel 'chapter' >> Semantikkapitel 'chapter about semantics'

The meanings of the compounds in (19) are based on attributes for dimensions: the interpretation of (19a) operates on a FUEL attribute, whereas the one of (19b) operates on a RESPONSIBILITY attribute. The assumption of both attributes is plausible because they describe functional aspects of engines or political institutions, respectively.

In (20a), the modifier specifies the lawful owner of the potential referent of the head noun. The lawful owner may be legitimated by leasing, renting, or buying the possessed area. Thus, the compound is potentially ambiguous, resulting from different possessive relations by which the meaning relation of the compound may be established. The mentioned possessive relations are always unique. Therefore it is plausible that the interpretation of the compound operates on an OWNER, RENTER, or LEASEHOLDER attribute in the frame of the head noun, respectively. This shows that one source of the ambiguity of compounds results from the fact that in value compounds the frame of the modifier enables the specification of different attributes in the frame of the owner.

In (20b), the head noun of the compound is a relational noun, because a chapter is always related to the book in which it is contained. Nevertheless, the example is not an argument compound but a value compound because the modifier does not specify the possessor of the head noun, but rather one of its dimensions. To be more precise, it specifies its topic. The frame of the compound is shown in Figure 5.7.

Let us consider the concept types of value compounds. Since the central node of value compounds is determined by the frame of the head noun, type shifts of the concept type should operate on the frame of the head noun. This leads to the question whether the $[\pm R, \pm U]$ features of the head noun may change if a property in the frame of the noun is specified. In principle, the feature $[\pm R]$ may change if an argument is saturated or added. The saturation of an argument is excluded because this is the characteristic feature of argument compounds. So, what about adding

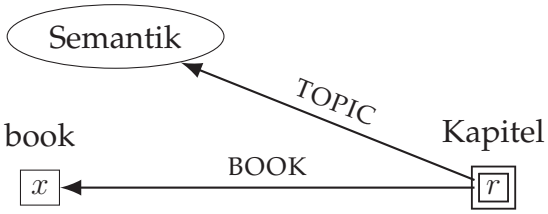


Figure 5.7 Frame of the compound *Semantik* 'semantics,' *Kapitel* 'chapter' >> *Semantikkapitel* 'chapter about semantics.'

an argument? If the head noun has an argument, it seems to be absorbed within the unification process. For instance, *Hand* 'hand,' *Tuch* 'cloth' >> *Handtuch* 'towel' is nonrelational, although the modifier requires an additional argument. Thus, the [±R] feature of the head noun is said to be maintained in argument compounds.

The feature [±U], on the other hand, obviously cannot be changed by the modifier since the value of a single attribute is not able to restrict its preimage to a set containing one and only one value. The invariance of the concept type can, nevertheless, be overthrown by pragmatic uniqueness. For instance, the frame analysis in Figure 5.7, where the head noun *Kapitel* 'chapter' is relational because a chapter is constitutively a nonunique part of a book, the possessor node is not determined by the specification of the TOPIC attribute and thus remains unsaturated. Thus the concept type of the head noun is not changed and the compound as such should be relational. When a compound like *Semantikkapitel* 'chapter about semantics' is used functionally to designate a unique chapter of a book, as in (21), this is based on contextual information; for instance, the background knowledge that each chapter in a book usually deals with one and only one specific topic. Here, the $[-U]$ feature of the compound is overwritten to $[+U]$ based on world knowledge.

(21) Ich habe das Semantikkapitel von Lakoff gelesen.
'I have read the semantics chapter by Lakoff.'

So far, I have only discussed compounds with noncomplex constituents. Nevertheless, value compounds may also occur with deverbal head nouns. Consider the examples below. In (22), the compound has a deverbal head noun. In its frame, the attribute FUEL is specified by the frame of the modifier. The result is shown in Figure 5.8.

(22) Gas 'gas,' Heizung 'heater' >> Gasheizung 'gas heater' (LCC 97178)

Note that the compound can also be decomposed as an action frame compound in the sense of a'heater burning gas for heating' that is based on an action of burning.

Figure 5.8 Frame of the compound *Gas* 'gas,' *Heizung* 'heater' >> *Gasheizung* 'gas heater.'

Consequently, there are often different ways to model the meanings of compounds, in the same way that there are also different ways to conceptualize meanings.

Compared to the traditional categories, value compounds constitute a subset of subordinate or, more precisely, attributive compounds. Compared to the investigations by Ortner et al. (1991) (see Section 5.2.3), the class of value compounds covers the following meaning relations.

- Instrumental relations: The modifier specifies something that is required by the referent of the head noun, as in example (19a) whose modeling in frames is based on a FUEL attribute. However, as we will see in section 5.4.5, instrumental relations also occur in action frame compounds (where their occurrence is, in addition, more frequent).

- Causal relations: The modifier specifies the cause or the consequence for the referent of the head noun, as in the compound *Schmerz* 'pain,' *Schrei* 'scream' >> *Schmerzensschrei* 'scream of pain' whose meaning can be explained on the basis of a CAUSE attribute, as it has been discussed in the context of metonymy.

- Consecutive/causative relations: The meaning of the compound *Fieber* 'fever,' *Wahn* 'delusion' >> *Fieberwahn* 'delusion caused by fever' allows a frame-theoretic modeling in that the frame of *Fieber* specifies the CAUSE attribute in the frame of *Wahn* 'delusion.' Since causal relations as well as consecutive/causative relations can be modeled by a CAUSE attribute, the meaning relations seem to be very close.

- Substantial relations: In these compounds, the modifier specifies the material of the potential referent of the head noun based on a MATERIAL attribute in its frame; e.g., *Holz* 'wood,' *Tisch* 'table' >> *Holztisch* 'wooden table.'

- Possessive relations: The modifier specifies the owner of the potential referent of the head noun as in (20a). Such compounds must not be confused with so-called possessive compounds.

- Competentive relations: The modifier specifies the profession of the referent of the head noun or the field of activity for which he is responsible; e.g., *Verkehr*

Figure 5.9 Frame of the compound *Würfel* 'square,' *Zucker*, 'sugar' >> *Würfelzucker* 'cube of sugar (lump of sugar).'

'traffic,' *Ministerium* 'ministry' >> *Verkehrsministerium* 'ministry for transportation.'

- Formative relations: In these compounds, the modifier specifies the form of the referent of the head noun, as in *Würfel* 'cube,' *Zucker*, 'sugar' >> *Würfelzucker* 'cube of sugar (lump of sugar).' In this case, the modifier frame is used to specify a value in the frame of the head noun, as seen in Figure 5.9.
- Referential relations: The modifier specifies a property of the head noun. For instance, compounds like *Bedeutung* 'meaning,' *Lehre* 'teaching' >> *Bedeutungslehre* 'semantics' can be modeled based on a TOPIC attribute.
- Professional relations: The modifier expresses a profession or field of responsibility of the potential referent of the head noun; e.g., *Verkehr* 'traffic' , *Minister* 'minister' >> *Verkehrsminister* 'minister for transport,' where the compound can be explained based on a RESPONSIBILITY attribute. The assumption of such an attribute is plausible because it describes a unique relation due to the fact that ministers usually have one and only one working field.
- Ornative relations: The referent of the head noun is provided with the referent of the modifier, as in *Henkel* 'handle,' *Korb* 'basket >> *Henkelkorb* 'basket with a handle.' The noun *Henkel* 'handle' is functional since objects have usually one and only one handle (if they have handles at all). Thus, HANDLE is a potential attribute in the frame of *Korb* 'basket' that is specified by the modifier.

Compared to the classes of compounds distinguished by Marchand (1969), value compounds cover those compounds the author considers either as being members of the type *steamboat* or of the type *craftsman* (regarding these categories see Section 5.2.2): Since value compounds restrict the potential referents of the head noun, they correspond to compounds of the type *steamboat*. Furthermore, compounds like the one in (20a) allow a genitive paraphrase as in *das Gelände des Vereins* 'the area of the club' and are thus of the type *craftsman*. The fact that value compounds constitute examples of two categories in the sense of Marchand results from the following inconsistency in Marchand's terminology: Compounds of the type *craftsman* also restrict the denotation of the head noun and are thus of the type *steamboat*.

5.4.3 Argument compounds

According to Löbner (2013), argument compounds differ from value compounds in that their modifier specifies an argument of the relational or functional head noun. By contrast, the modifier of value compounds always specifies a nonargument attribute. Examples for argument compounds are given below.

(23) a. Schwein 'pig,' Nase 'nose' >> Schweinenase 'pig nose'
b. Universität 'university,' Rektor 'rector' >> Universitätsrektor 'university rector'

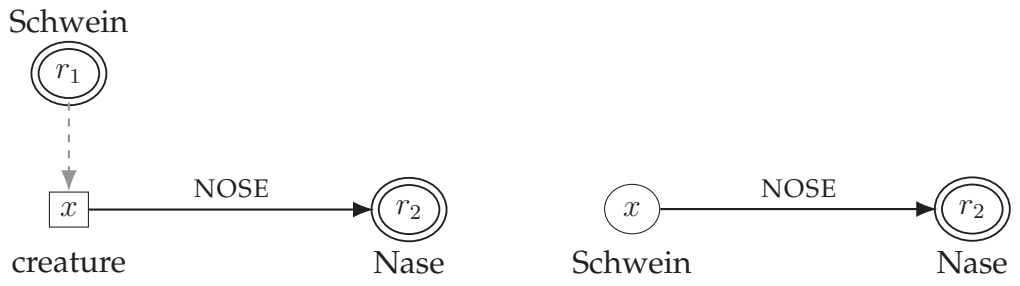
(24) a. Pfarrer 'vicar,' Tochter 'daughter' >> Pfarrerstochter 'daughter of a vicar'
b. Vorstand 'management board,' Mitglied 'member' >> Vorstandsmitglied 'member of the management board'

Since the modifier saturates the possessor argument of the head noun, the concept type of the compound differs from the original concept type of the head noun. See Figure 5.10 for illustration, where the modifier *Schwein* 'pig' specifies the possessor argument in the *Nase* 'nose' frame. Since the open argument in the frame of the head noun is saturated, it is transformed into a round node. The resulting frame represents a sortal meaning because the concept does not have open arguments anymore. Thus, the compound is sortal.

As summarized in Table 2.2, Löbner (2011) analyzed the rules based on which the concept type of possessive constructions with relational or functional heads results compositionally. In Schulzek et al. (2010), it was demonstrated that argument compounds follow these compositional rules, too. In the following, I summarize the results of the analysis.

The examples below show argument compounds with functional head nouns. The modifier is a sortal, individual, relational, and functional noun in (25a), (25b), (25c), and (25d), respectively. If the modifier is relational, as in (25c) and (25d), the paraphrases of the compounds' meaning make the possessor explicit by means of the pronoun *someone*.

(25) a. SN + FN → SN
Schwein 'pig,' Nase 'nose' >> Schweinenase 'pig nose'
b. IN + FN → IN
Mond '(Earth's) moon,' Oberfläche 'surface' >> Mondoberfläche 'surface of the Moon'
c. RN + FN → RN
Finger 'finger,' Ende 'end' >> Fingerende 'end of someone's finger'



A Frame of the constituents. **B** Unified frames.

Figure 5.10 Frame representation of the compound *Schwein* 'pig' + *Nase* 'nose' >> Schweinenase 'pig nose.'

d. FN + FN → FN
Hirn 'brain,' Struktur 'structure' >> Hirnstruktur 'structure of someone's brain'

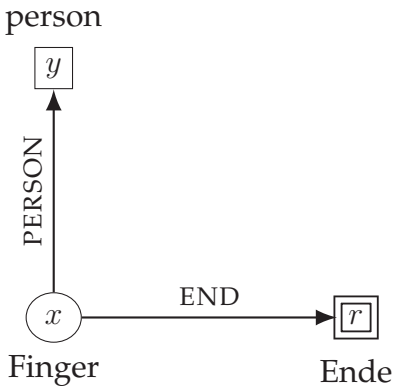
Figure 5.10 shows the frame analysis of the compound in (25a). The first constituent *Schwein* 'pig' saturates the argument of the second constituent *Nase* 'nose,' which is functional. Due to the argument saturation, the angular node representing the argument of the functional noun is transformed into a round node. Since the resulting frame has no open argument nodes, the compound is sortal.

In Figure 5.11, the paraphrased meanings of the compounds are modeled as unification processes of the frames of the modifier and the head noun. In these cases, only the results of the unification processes are shown, whereas in contrast to Figure 5.10, the original frames of the constituents are not pointed out. I do so, because the unification processes in Figure 5.11 are analogous to the one in Figure 5.10 insofar as the frame of the first constituent saturates the argument node of the frame of the second constituent.

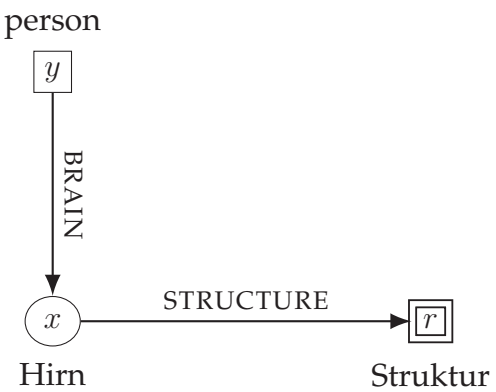
In Figure 5.11A, the value of the central node is uniquely determined by its possessor. This is why not only the possessor but also the central node is depicted as a round node. Thus, the frame represents an individual concept.

Figure 5.11B shows the concept in (25c). The original possessor node of *Ende* 'end' is saturated by *Finger* 'finger.' Certainly, the frame of *Finger* 'finger' has an open possessor argument. Hence, the frame has two rectangular nodes, where the central node is not determined uniquely by the value of the possessor node. Consider, for instance, the case when the *person* would be specified as an individual: Since an individual usually has more than one finger, the number of fingers and also their ends to which the compound can potentially refer, is restricted, but a referent is not determined uniquely. Thus, the frame represents a relational concept.

A Frame of the compound in (25b).



B Frame of the compound in (25c).



C Frame of the compound in (25d).

Figure 5.11 Frame analyses of argument compounds with functional head nouns.

Finally, Figure (5.11) shows the frame of the compound in 25d. The original argument of the head noun is saturated by the modifier *Hirn* 'brain,' whose frame also contains a possessor argument on its own. In contrast to the former example, however, the directions of the BRAIN and the STRUCTURE attribute guarantee that the value of the central node of the frame is determined uniquely by the value of the *person* node via a chain of attributes: the value of the *person* node determines the value of the *brain* node uniquely that determines the value of the *structure* node. Thus, the frame represents a functional concept.

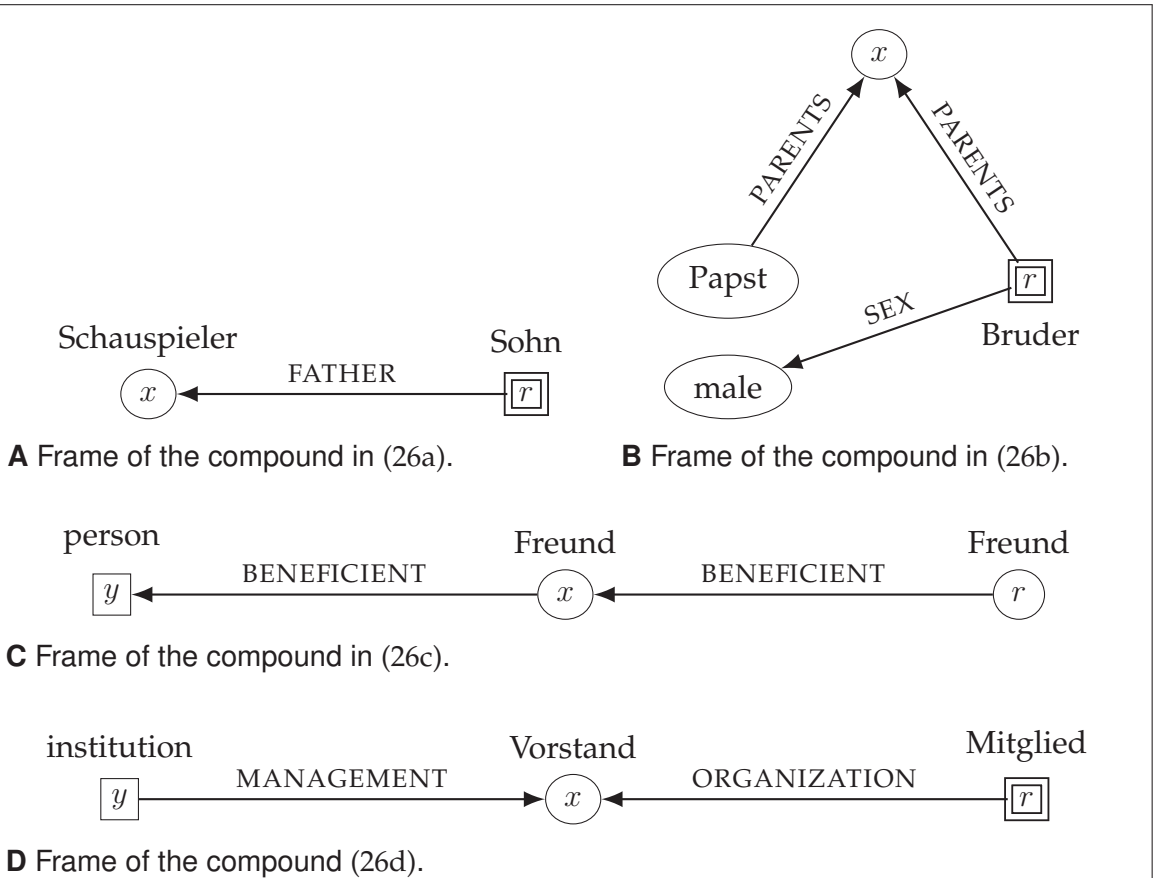
The comparison between these results with Table 2.2 demonstrates that argument compounds with functional head nouns work in the same way as their equivalent possessive constructions by which the meaning of the compounds can be paraphrased.

The argument compounds in (26) have relational head nouns, whereas their modifiers are sortal, individual, relational, and functional in (26a), (26b), (26c), and (26d), respectively.

(26) a. SN + RN → SN
Schauspieler 'actor,' Sohn 'son' >> Schauspielersohn 'son of an actor'

b. IN + RN → SN
Papst 'Pope,' Bruder 'brother' >> Papstbruder 'brother of the Pope'

c. RN + RN → RN
Freund 'friend' >> Freundesfreund 'friend of a friend'



A Frame of the compound in (26a).

B Frame of the compound in (26b).

C Frame of the compound in (26c).

D Frame of the compound (26d).

Figure 5.12 Frame analyses of argument compounds with relational head nouns.

d. FN + RN → RN
Vorstand 'management board,' Mitglied 'member' >> Vorstandsmitglied 'member of the management board'

Figure 5.12 shows the frame representations of the compounds. The frame in Figure (5.12A) does not have open arguments and thus represents a sortal concept. This holds also for the frame in Figure 5.12B. The frame in Figure 5.12C, on the other hand, has an open possessor argument. Since the value of the possessor argument does not determine the value of the frame's central node, the frame represents a relational concept. This is also the case for the frame in Figure 5.11C. Once again, the examples show that the compounds behave exactly the same way as their corresponding possessive constructions, as a comparison between the concept types of the compounds and the results summarized in Table 2.2 demonstrates.

The analysis of argument compounds may suggest that the possessor of the head noun does not allow for further specification because it is already saturated by the modifier. Nevertheless, there are examples like (27), which are discussed in Schulzek et al. (2010).

In (27), the compound *Baum* 'tree,' *Stamm* 'trunk' >> *Baumstamm* 'tree trunk' occurs in a possessive construction with Eiche 'oak' as possessor, although the possessor of the head noun *Stamm* 'trunk' has already been saturated by the modifier *Baum* 'tree.' Thus, in special contexts the saturated argument can be reactivated, as in (27), where the modiifer of the compound is specified as a tree of a certain type.

(27) Der Baumstamm der Eiche ist von innen ganz morsch.
'The (tree) trunk of the oak is very brittle from the inside.'

Since argument compounds follow the compositional rules in Table 2.2, they can be paraphrased by genitive constructions. Hence, they constitute a subtype of what Marchand (1969) considers as compounds of the type *craftsman*. This was already stated for some value compounds, as argued in the end of Section 5.4.2. From this point of view, the analysis of Marchand (1969) disregards a crucial difference between what I consider as value and argument compounds, namely that the correspondence between compounds and their genitive paraphrase is closer in the case of the latter classes of compounds. The reason for this is that the concept type of argument compounds is fixed based on the same principles that underlie the concept types of their corresponding genitive constructions, and is thus derived compositionally from the concept types of the modifier and the head noun. By contrast, the concept type of value compounds is determined by the concept type of their head nouns.

The classifications of compounds developed by Ortner et al. (1991) do not consider argument compounds as a separate class either. However, what the authors designate as *partitive* seems to cover argument compounds. The example based on which Ortner et al. (1991) introduce the category of partitive relations, is the compound *Buch* 'book,' *Rücken* 'back' >> *Buchrücken* 'spine of a book.' The compound consists of a functional noun whose argument is saturated by the sortal modifier.

5.4.4 Synthetic compounds

The interpretation of synthetic compounds is based on a verb frame that is explicitly designated by the base verb of the deverbal head. Since the argument structure of verbs is part of the grammatical knowledge, synthetic compounds are semantically transparent. Frame-theoretically, their interpretation builds on the frames of deverbal nouns whose structure has already been investigated in Chapter 4. The meaning of a synthetic compound results from unifying the modifier frame with the frame of the deverbal head noun. In Section 5.4.1, we discussed the prototypical example *truck driver*.

According to Chapter 4, the deverbal noun *Fahrer* 'driver' in the German correspondence *LKW-Fahrer* 'truck driver' can have, among others, two interpretations: a

functional single-event and a sortal event-type reading. Both readings can underlie the interpretation of *LKW-Fahrer* 'truck driver.' Although the unification processes are structurally identical, the interpretations differ with respect to concept-type theory.

In research on synthetic compounding, the concept type of the deverbal head noun is usually not considered. Instead, synthetic compounds are, per definition, considered as compounds in which the modifiers specify an argument of the head noun's base verb. However, this does not mean that the modifier specifies an argument of the head noun as such. Let us compare examples for argument saturation and nonargument specification in synthetic compounding. Figure 5.13A and 5.13B show the interpretation of *LKW-Fahrer* 'truck driver,' where *Fahrer* 'driver' occurs in a single-event reading. As mentioned in Chapter 4, the deverbal noun is functional, requiring the theme argument of the base verb as possessor. Consequently, when the argument is saturated, the concept type of the modifier determines the concept type of the whole compound. In the case of the example, the compound is sortal because *LKW* 'truck' is a sortal concept[29], and specifying the argument of a functional noun by a sortal concept leads to a further sortal concept.

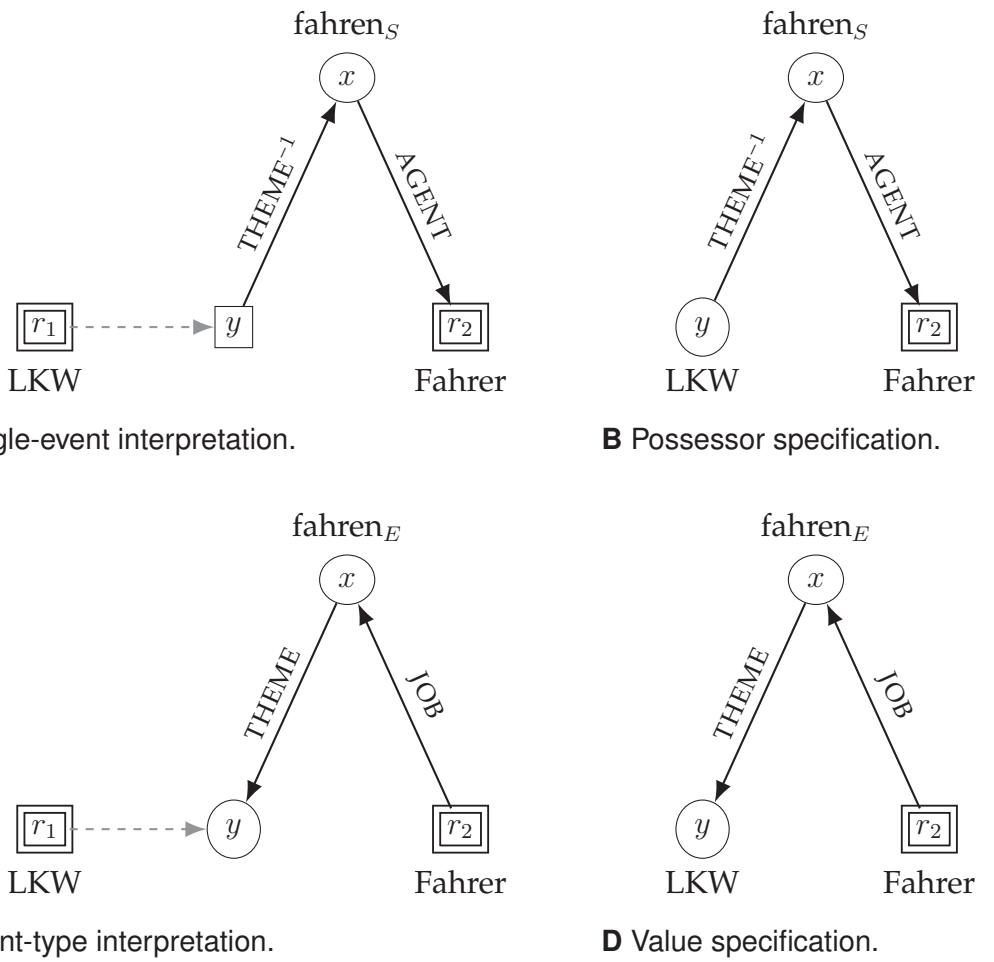
By contrast, Figure 5.13C and 5.13D show the interpretation for *LKW-Fahrer* 'truck driver' for the case that the deverbal head noun is a sortal event-type nominal, as analyzed in Chapter 4. Here, the noun does not require an argument, and a modifier specification does not influence the concept type of the whole compound. Instead, the concept type is determined by the sortal head noun.

Sortal head nouns determine the concept type of the whole compound, even if the modifier is relational, as the example below suggests.

(28) Dachboden 'attic (of a house),' Heizung 'heater' >> Dachbodenheizung 'loft heater'

The deverbal noun *Heizung* 'heater' is a sortal event-type nominal and thus does not require an argument. The noun *Dachboden* 'loft (of a house),' by contrast, is functional. In the modifier position, the noun *Dachboden* does not influence the concept type of the whole compound. Figure (5.14) shows the frame representation of the compound in (28). The deverbal head noun is sortal and thus does not require an argument. Thus, the modifier specifies a nonpossessor attribute of the head noun. This does not modify the concept type of the head noun: The compound is still sortal. Therefore, the argument node in the *Dachboden* 'loft' frame has to be transformed into a round node when the frames of *Dachboden* 'loft' and *Heizung* 'heater' are unified (see Figure 5.14B).

[29] It is explicitly mentioned that the noun is sortal with respect to the example. Beyond that, it is also possible that the noun *LKW* 'truck' is individual when it refers uniquely in a certain context.



A Single-event interpretation.

B Possessor specification.

C Event-type interpretation.

D Value specification.

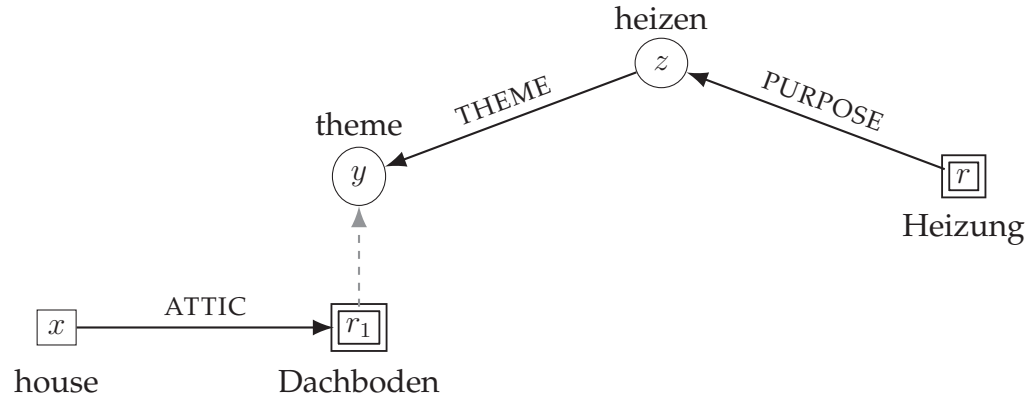
Figure 5.13 Two interpretations of the synthetic compound *LKW-Fahrer* 'truck driver.' The interpretations differ in that the deverbal noun has single-event interpretation in the first case and event-type interpretation in the second.

In sum, nonrelational nominals in head position differ from their relational correspondences in the following sense: If the nominal is nonrelational, it determines the concept type of the whole compound, similar to what was stated for value compounds in Section 5.4.2. Otherwise, the concept type of the compound arises compositionally according to the rules specified in Table 2.2, as is typical for argument compounds.

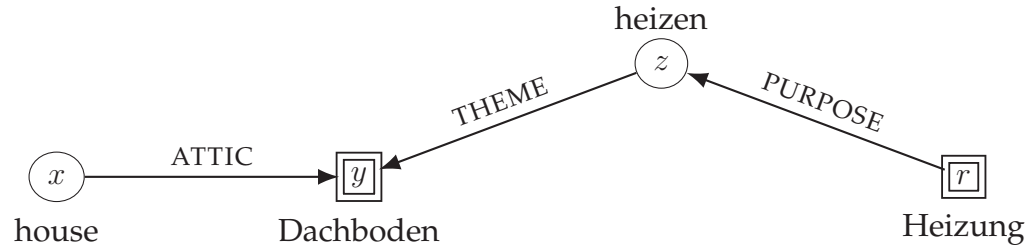
Moreover, what is usually disregarded in the literature in the context of synthetic compounds are those compounds in which the head noun specifies an argument of the base verb of the deverbal modifier. Consider the example in (29).

(29) Spender 'donor,' Niere 'kidney' >> Spenderniere 'donor kidney' (LCC 195126)

The modifier is the deverbal *-er* nominal *spenden* 'to donate' >> *Spender* 'donor.' Ac-



A Frames of the constituents in isolation.



B Unification of the frames.

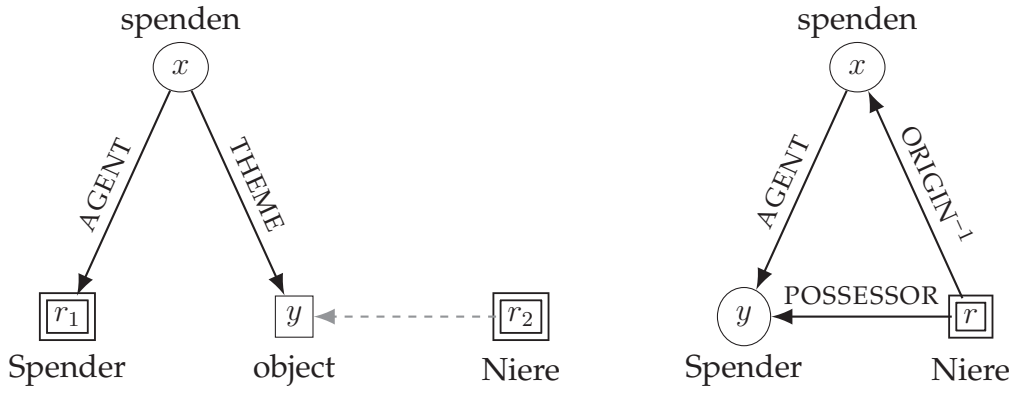
Figure 5.14 Frame representation of the synthetic compound Dachboden 'attic (of a house),' Heizung 'heater' >> Dachbodenheizung 'loft heater.'

cording to the analysis in Chapter 4, its reference results from shifting the central node of the frame of its base verb to the *agent* node. Compare Figure 5.15A: here, the head noun is integrated into the frame of the nominal by specifying the THEME attribute. Since the compound specifies those kidneys that have been donated, it describes its potential referents in terms of its properties. Hence, it is a sortal concept.

If Postulate 2.7 were to apply to the frame, the frame of the compound could also be restructured in order to fit the structure of sortal concepts. By substituting the THEME attribute in the frame of the nominal with an ORIGIN attribute, as was introduced in Chapter 4, the frame of the compound can be restructured in such a way that it is in line with the prototypical structure of frames representing sortal concepts. Moreover, the information that the donor is the possessor of the kidney, which is introduced by the POSSESSOR attribute in Figure 5.15B, is implied by the fact that a person can only donate their own kidneys but not foreign kidneys.

The meaning paraphrases of synthetic compounds with event-type nominals as heads show a very special behavior. Compare the examples below.

(30) a. Katze 'cat,' Pfote 'paw' >> Katzenpfote 'cat paw'



A Frames of the modifier and the bare head noun. **B** Unification of the frames.

Figure 5.15 Frame representation of the compound Spender 'donor,' Niere 'kidney' >> Spenderniere 'donor kidney.'

b. Pfote einer Katze 'paw of a cat'

(31) a. Wein 'wine,' Trinker 'drinker' >> Weintrinker 'someone who regularly drinks wine'

b. Trinker von Wein 'drinker of wine'

Compared to the meanings of argument compounds which can always be paraphrased by possessive constructions, as in (30), synthetic compounds with event-type nominals as modifiers do not allow adequate meaning paraphrases via genitive constructions.

For instance, the compound in (31a) allows a nonevent interpretation in that it designates a person who drinks wine habitually. Designating a person as a *Weintrinker* 'wine drinker,' does not imply that the person is actually drinking wine nor that wine is the person's favorite drink. It just expresses that there are some situations in which the person prefers to drink wine; i.e., if the person can choose between wine and beer. This, however, may not hold for different offers: maybe, the person would choose a whiskey if he can choose between whiskey, wine, and beer. The paraphrase of the compound in (31b), however, does not describe this meaning adequately: the possessive construction tends to be interpreted as related to a single event, i.e., it refers to someone who is drinking wine at a certain point in time. The possessive constructions seem to prefer an eventive interpretation, whereas compounds like *Weintrinker* seem to prefer a noneventive interpretation.

The reason for this is supposed to be that event-type nominals usually do not have arguments, whereas event nominals do (see Chapter 4). Thus, when occurring with possessor arguments, the nominal has preferably eventive interpretation. Synthetic compounds, on the other hand, are supposed to allow the "hiding" of

arguments and thus enable a nonevent interpretation, even if an argument of the original base verb is specified.

Note, however, that the compound in (31a) can also have a single-event interpretation, as in the sentence below.

(32) Am Ende des Abends waren die Weintrinker nicht so betrunken wie die Biertrinker.[30]
'At the end of the evening, the wine drinkers were not as drunk as the beer drinkers.'

Thus, a single-event reading of the compound is not excluded. Yet, the crucial point is that the compound in (31a) also allows an event-type interpretation that is not possible for the corresponding genitive paraphrase without further implications.

5.4.5 Action frame compounds

A number of some examples for action frame compounds were discussed in Section 5.4.1. They correspond to those compounds which Wisniewski (1997) assumes to be interpreted based on scenarios. Furthermore, it was mentioned that the conceptual representation of the action that forms the basis of these interpretations can be associated with the modifier and the head noun or only with the head noun. The interpretation of the following compound is of the former type.

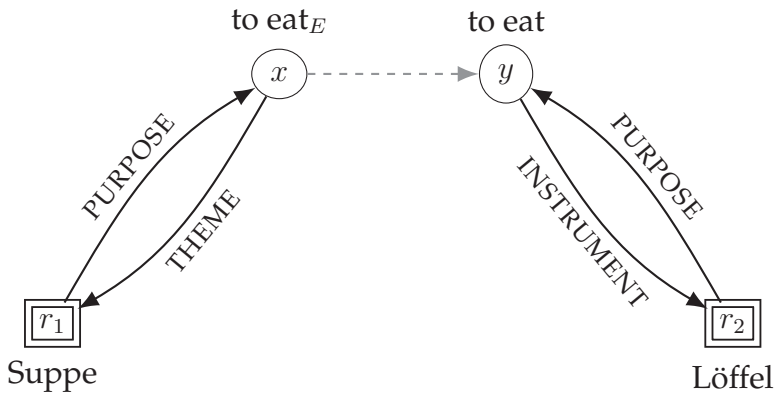
(33) Suppe 'soup,' Löffel 'spoon' >> Suppenlöffel 'soup spoon'[31]

Both spoon and soup are artifacts made for special purposes, namely for performing an eating action. The frame of the eating action, in turn, specifies the role these entities occupy in the action (see Figure 5.16A). Since the *Löffel* 'spoon' and the *Suppe* 'soup' nodes specify different roles in the eating frame, the frames of *Löffel* 'spoon' and *Suppe* 'soup' can be unified as shown in Figure 5.16B.

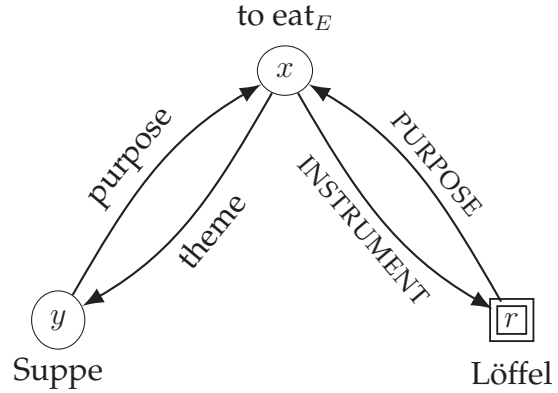
Since the frames of the constituents of action frame compounds are integrated into a verbal frame, neither an argument of the head noun nor an argument of the modifier is saturated. Thus, the concept type of the head noun determines the concept type of the whole compound. Assuming that Postulate 2.7 is valid, action frame compounds may require restructuring processes. This also holds for the compound *Suppenlöffel*. Since the compound designates artifacts that are made for special purposes, it describes its potential referents in terms of properties. The crucial property

30 I have been pointed to this example by my supervisor, Sebastian Löbner.

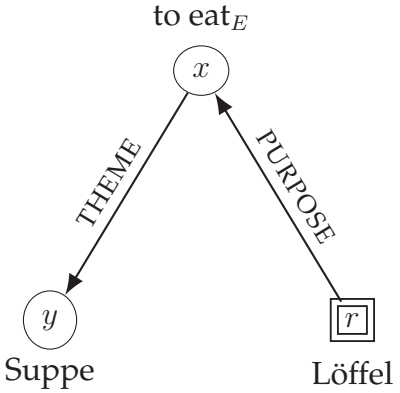
31 An analogous example is discussed by Löbner (2015b: 387f), where *Tee* 'tea, *Tasse* 'cup' >> *Teetasse* 'tea cup' is considered. The example *Suppenlöffel* 'soup spoon' is furthermore the starting point for the frame-based considerations in Schulzek (2008: 102).



A Frames of the constituents in isolation. The figure is similar to that in Löbner (2015b: Figure 12.11 and 12.12).



B Unification of the frames.



C Re-structuring the frame.

Figure 5.16 Frame representation of the compound *Suppe* 'soup,' *Löffel* 'spoon' >> *Suppenlöffel* 'soup spoon'.

is that the spoon is made for eating soup. However, this does not imply that the referent of the compound is involved in an eating action at the point of reference. Just think of a soup spoon that is actually being cleaned in a dishwasher. This is why the event specification is indexed with E in the Figure.

In Section 5.4.2, I analyzed the compound Verein 'club,' Gelände 'area' >> Vereinsgelände 'area that is possessed by a club' as a value compound (see the example in 20a). The meaning of the compound was alternatively modeled by an OWNER, RENTER, or LEASEHOLDER attribute. The compound can also be modeled as an action frame compound (see Figure 5.17). In the frame, the attribute THEME has been inverted. This is possible because objects are usually rented by exactly one agent at a given point in time. Thus, the attribute is injective. In light of this, the *renter* attribute can be considered the composition of the THEME^{-1} and the AGENT attribute.

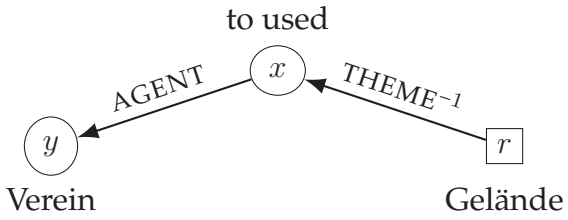


Figure 5.17 An alternative modeling of the Verein 'club,' Gelände 'area' >> Vereinsgelände 'area that is used by a club.'

The attributes OWNER and LEASEHOLDER can be derived analogously. The examples suggest that there are sometimes different ways to model compounds with equal meanings as value compounds or action frame compounds. Bear this background, the corresponding action frame compounds can be assumed as decomposition of the OWNER attribute.

In the context of action frame compounds, Löbner (2013) assumes that their frames can be restructured in such a way that every node can be reached from the central node in order to suffice a strict interpretation of Postulate 2.7 according to which the central node of sortal nouns does not have ingoing arcs. The compound in (33) can also be restructured this way: the INSTRUMENT attribute in the *Löffel* 'spoon' and the AFFORDANCE attribute in the *Suppe* 'soup' frame can be omitted because they are already implied by their inverses (see Figure 5.16C).[32]

In the frame analysis of (33), both constituents are linked to the affordance based on which the compound is interpreted. It has already been mentioned that it is also possible that only one constituent is associated with the event frame. Although which constituent is associated with an affordance is subject to experimental psychology or psycholinguistics, there are several compounds from which one presumably would assume introspectively that the affordance is associated, more strongly or exclusively, with either the modifier or the head noun. For instance, in (34), the affordance is presumably associated only with the head noun, whereas in (35), it is presumably associated only with the modifier. The latter type has not been mentioned so far. In particular, it is not addressed in Löbner (2013: Chapter 12)

(34) Wasser 'water,' Leiche 'dead body' >> Wasserleiche 'dead body found in the water' (LCC 137827)

(35) a. Kunst 'art,' Haus 'house' >> Kunsthaus 'house where art is exhibited' (LCC 102206)

[32] The analysis developed here is similar to the one in Schulzek (2008, 2014).

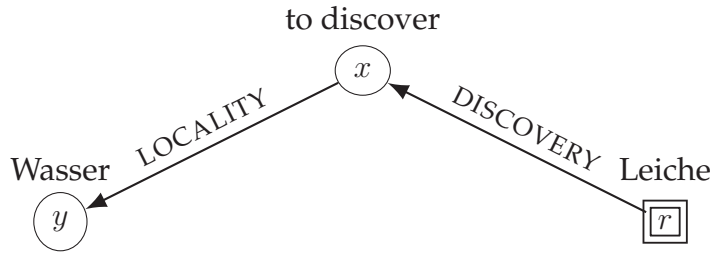
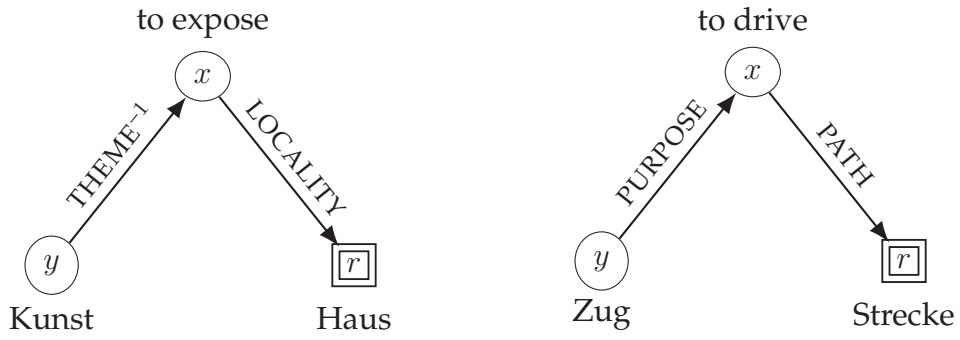


Figure 5.18 Frame of *Wasserleiche* 'dead body found in the water.'



A Frame of *Kunsthaus*.

B Frame of *Zugstrecke*.

Figure 5.19 The interpretation of two action frame compounds in which the action is associated with the modifier.

b. Zug 'train,' Strecke 'route' >> Zugstrecke 'route traveled by train' (LCC 185038)

In (34), a discovering action specifies the DISCOVERING attribute in the frame of *Leiche* 'dead body,' because it is part of our world knowledge that dead bodies are usually found somewhere. Afterwards, the modifier *water* specifies the locality of the finding action. In this case, the respective action seems to be more strongly associated with the head noun instead of the modifier. Figure 5.18 shows the frame of the compound.

The compounds in (35) illustrate the opposite behavior. In (35a), the exhibiting action is associated with *Kunst* because it is part of the knowledge that art is usually accessed. The head noun *Haus* 'house' specifies the locality of the action. In (35b), the traveling action is associated with the modifier *train* because trains are especially made for traveling. The head noun specifies the route of the traveling action. Figure 5.19 shows the frames of the compounds

Moreover, there seem to be some action frame compounds in which the frame of

the modifier is not immediately embedded into an event frame but rather one of its values. Such a case is not mentioned by Löbner (2013). Consider the example below:

(36) Urlaub 'vacation,' Geld 'money' >> Urlaubsgeld 'vacation allowance' (LCC 186532)

Usually, *Urlaubsgeld* is interpreted as money the employer gives to his employees so that they can spend it for their vacation (although it does not actually matter whether the employees do so). Therefore, what is designated as *Urlaubsgeld* is money that is purposed to be spent on a vacation. This meaning is represented in the frame shown in Figure 5.20A.

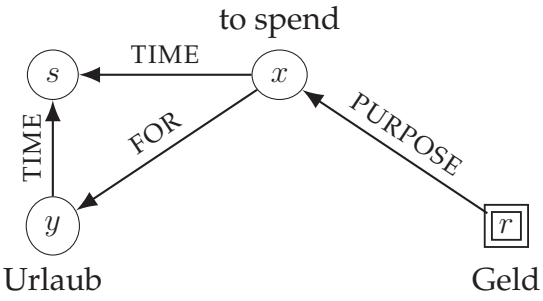
Furthermore, the frame can be enriched with additional information. The world knowledge that the money is provided by the employer can also be added to the frame, as demonstrated in Figure 5.20B. The fact that compounds can be enriched with additional knowledge that is not associated with the compound constituents has already been discussed by Ungerer & Schmid (1996: 92ff) (see Section 5.1.2 of this thesis). From the perspective of frame theory, this is also mentioned by Barsalou (1992b: 52–54) who assumes that the frames can be combined to a complex concept that contains knowledge that is not contained in the original concepts but is rather inferred because of their combination. Against this backdrop, Figure 5.20A shows the compositional interpretation of the compound, whereas Figure 5.20B shows the frame that results from inferences of the combination of the original concepts.

Action frame compounds can also occur with deverbal nominals. Such examples are complex insofar as two actions have to be related, namely the implicit action based on which the action frame compound is interpreted and the action described by the base verb of the deverbal modifier. An example is shown in (37).

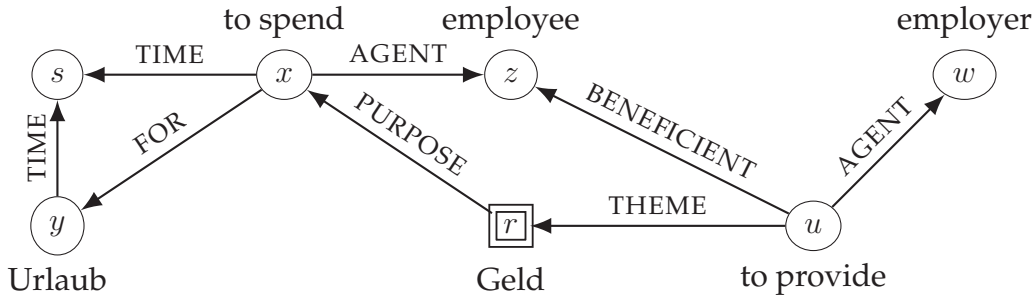
(37) Leser ´reader,' Brief 'letter' >> Leserbrief 'letter written by a reader (of a medium)' (LCC 196483)

The frame of ›letter‹ contains an ORIGIN attribute that specifies how the letter came into being, as was motivated in Chapter 3 on metonymy. In the case of the example, a letter comes into being by a process of writing. The *writing* frame contains information about the agent performing the writing process. So the frame of the modifier specifies the AGENT attribute of the *writing* frame, as shown in Figure 5.21A. The frame represents the strict compositional meaning 'letter written by someone reading habitually.'

It is hard to decide whether *Leser* 'reader' in (37) is interpreted as a single-event or an event-type nominal. Both interpretations are possible. In the single-event reading, the compound describes a letter that is written as a reaction to a single reading event. In event-type reading, the compound describes a letter written by a person



A Lexical meaning.



B Adding world knowledge.

Figure 5.20 Adding world knowledge to an action frame compound.

who reads a certain medium regularly. The deverbal modifier *Leser* 'reader' is interpreted as someone performing a reading action habitually; the constituent is an event-type related nominal. It is interpreted this way, and not as an event-related nominal, because subjects are usually not able to perform multiple actions – in this case a reading and a writing action – at the same point in time. Beyond that, the frame can be enriched with further knowledge, as shown in Figure 5.21B. Here, the THEME attribute is specified as a readable medium whose editorial office is the addressee of the letter.

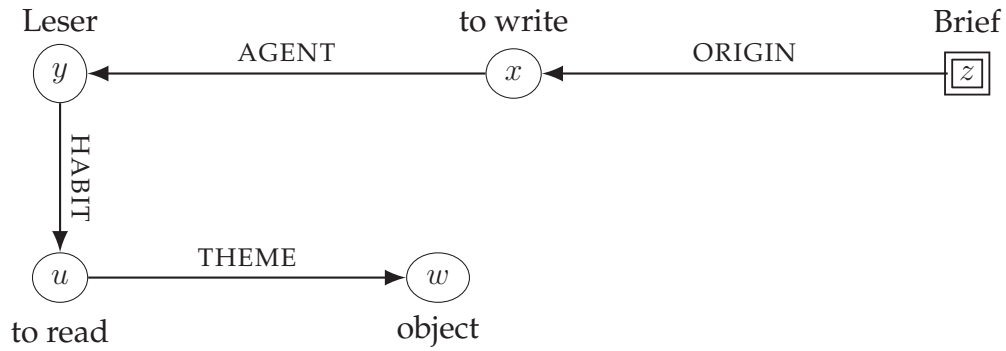
Action frame compounds seem to constitute a broad range of attributive compounds. In principle, the actions underlying the interpretation of action frame compounds seem to be unrestricted. The following listing provides some example for different types of actions.

- Actions of performing

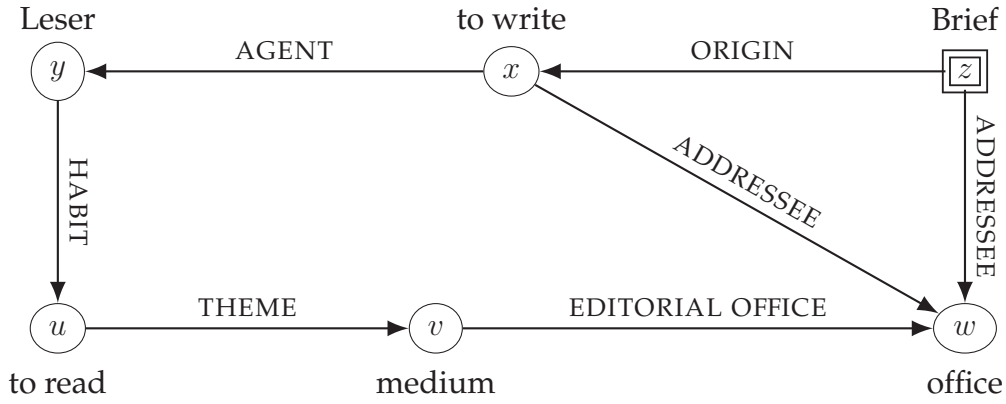
  The modifier designates the theme and the head noun the instrument of the implicit event; e.g., the *Suppenlöffel* 'soup spoon' example.

- Actions of generating

  The modifier designates the agent generating the result that is designated by



A Frame decomposition based on purely semantic knowledge.



B Frame decomposition that also takes world knowledge into account.

Figure 5.21 Frame-theoretic decomposition of the compound (*lesen* 'to read' >>) *Leser* 'reader,' *Brief* 'letter' >> *Leserbrief* 'letter written by a reader.'

the head noun, or vice versa; e.g., *Biene* 'bee,' *Honig* 'honey' >> *Bienenhonig* 'honey made by bees'; *Leser* 'reader,' *Brief* 'letter' >> *Leserbrief* 'letter written by a reader (of a medium).

- Actions of processing

  The head noun designates an instrument that is used to produce the theme that is designated by the modifier; e.g., *Beton* 'concrete,' *Maschine* 'machine' >> *Betonmaschine* 'machine for mixing concrete'; *Bus* 'bus,' *Karte* 'ticket' >> *Busfahrkarte* 'bus ticket'; *Brief* 'letter,' *Umschlag* 'envelope' >> *Briefumschlag* 'envelope in which a letter can be enclosed.'

Action frame compounds are supposed to cover several categories distinguished by Ortner et al. (1991: 126–142).

- Agentive relations: The head noun and the modifier are assumed to be involved in an event. The examples Ortner et al. (1991) cite can be explained

based on a producing event (*Zement* 'concrete,' *Maschine* 'machine' >> *Betonmaschine* 'machine producing concrete,' *Biene* 'bee,' *Honig* 'honey' >> *Bienenhonig* 'honey produced by bees') or via a working event (*Elektriker* 'electrician,' *Werkstatt* 'workshop' >> *Elektrikerwerkstatt* 'workshop where electricians work').

- Final relations: The referent of the head noun is destined for the referent of the modifier. Ortner et al. (1991) exemplify the category with the compound *Strand* 'beach,' *Anzug* 'dress' >> *Strandanzug* 'beach dress'). The compound can be modeled via integrating the frames of the constituents into a frame representing a wearing action.

- Substitutive relations: The category covers compounds where the modifier and the head noun designate a service and its payment, or vice versa. Ortner et al. (1991) provide two examples, namely the compounds *Transport* 'transport,' *Gebühr* 'charge' >> *Transportgebühr* 'charge for transport' and *Lohn* 'pay,' *Arbeit* 'work' >> *Lohnarbeit* 'work that is done for a pay.' The meaning of both compounds can be frame-theoretically represented via a paying action.

- Constitutional relations: This category covers compounds in which the modifier describes the structure material of which the potential referent of the head noun is composed. Ortner et al. (1991) provide the example *Blume* 'flower,' *Strauß* 'bouquet' >> *Blumenstrauß* 'bouquet of flowers.' It is supposed that the meaning of the compound arises based on the conceptual representation of a composing action in whose frame ›flower‹ and ›bouquet‹ specify the THEME and the RESULT attribute, respectively.

- Local relations: Ortner et al. (1991) exemplify this category with some of the compounds that can be considered action frame compounds. For instance, *Keller* 'cellar,' *Treppe* 'stairs' >> *Kellertreppe* 'stairs to the cellar' can be modeled via a walking event. And the compound *Bank* 'bank,' *Guthaben* '(credit) balance' >> *Guthaben* 'bank balance' can be modeled via a saving event.

- Possessive relations: Ortner et al. (1991) assume that this category contains compounds in which the modifier and the head noun are related via a possessive relation. The notion of possessive relations is rather broad. However, the authors cite an example that is obviously an action frame compound: *Hose* 'trousers,' *Mädchen* 'girl' >> *Hosenmädchen* 'girl wearing trousers' can be modeled by using a frame representation of a wearing event. Furthermore, the example suggests that the frame approach explicates the meaning relation of the compound more precisely than the categories proposed by Ortner et al. (1991).

- Conditional/accasional relations: Ortner et al. (1991) assume that the meaning relations of these compounds are based on conditions or motivations. They provide the example *Nebel* 'fog,' *Horn* 'horn' >> *Nebelhorn* 'foghorn' that is used because of fog.

Furthermore, action frame compounds constitute a subtype of the type *steamboat* in the sense of Marchand (1969). The fact that value compounds also constitute a subtype of this class demonstrates that the frame-based distinction is more fine-grained than that of Marchand (1969).

5.4.6 A frame-theoretic remark on possessive compounds

In Section 5.1.4, I distinguished between internal and external metonymic shifts in compounding. In the following, I will demonstrate that compounds that are usually understood as possessive may involve both internal and external metonymic processes. Whether an internal or external shift occurs is immediately reflected in frames. Let us consider the examples below.

(38) a. Der Lockenkopf ist laut und nervig.
'The curly haired person is loud and obnoxious'
b. Peter hat einen Lockenkopf.
'Peter has curly hair' (lit: 'Peter has a curly head')[33]

In (38a), the compound refers to a person having curly hair and is therefore interpreted as a possessive compound. By contrast, in (38b), the meaning of the compound is not metonymically shifted. Several possessive compounds that are generated with nouns show a very similar behavior. However, there are some V-N compounds like *blödeln* 'to act foolishly,' *Kopf* 'head' >> *Blödelkopf* 'idiot' that can only be interpreted possessively, as the examples in (39) suggest.

(39) a. Der Blödelkopf ist laut und nervig.
'The stupid person t is loud and obnoxious'
b. ??Peter hat einen Blödelkopf.
'Peter has a stupid head'

A frame analysis of the compound's lexical meaning suggests an explanation for this phenomenon. The meaning of *Lockenkopf* 'person with curly hair' can be explained in that the frame of the modifier specifies the STRUCTURE attribute of the *hair* value to which the *Kopf* 'head' node is linked via the HAIR attribute. The result is shown in Figure (5.22) in which it is already respected that *head* is a functional noun and

[33] The examples are taken from Schulzek (2014: 234), where they are cited in the opposite order.

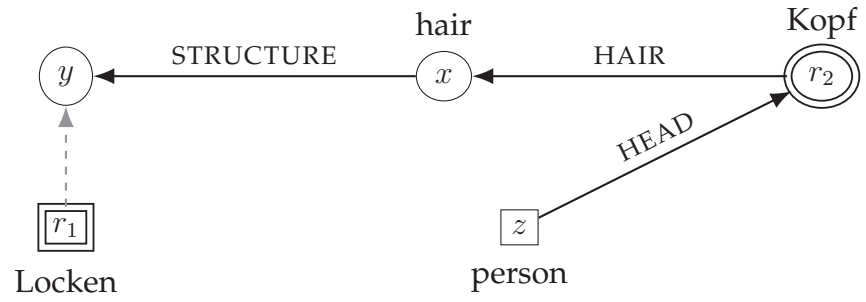
thus contains a possessor node (see Figure 5.22A). The frames of the modifier and the head noun can be unified consistently (see Figure 5.22B). The interpretation of the compound generates a functional concept that can afterwards be metonymically shifted. The external metonymic shift is shown in Figure 5.22C. Since it follows the direction of an attribute, the metonymy can be described according to the results of Chapter 3 on metonymy.

In the compound *Blödelkopf* 'idiot,' the verbal constituent is interpreted as an event type. This event type is interpreted as an action habitually performed by the possessor of the referent of the head noun. By contrast, the interpretation of *Blödelkopf* 'idiot' requires an internal metonymic shift because the value *blödeln* 'to act foolishly' cannot be integrated into the frame of the head noun. This is why the meaning of *head* is metonymically shifted to its person via the HEAD^{-1} attribute. The original attribute HEAD has been inverted, which is possible because the attribute is injective. Afterwards the AGENT attribute in the frame of *blödeln* 'to act foolishly' is specified by the *Kopf* 'head' frame (see Figure 5.23).

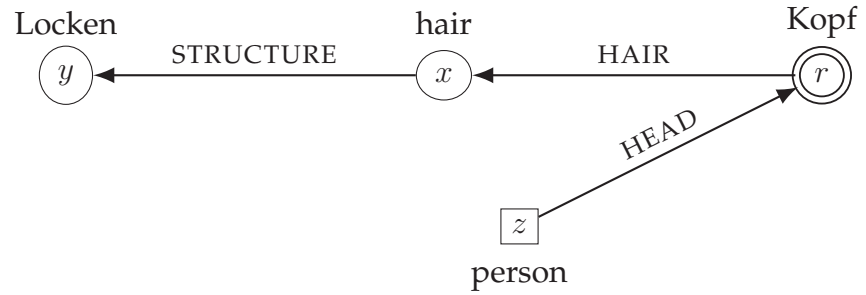
Comparing the frame-theoretic decomposition of *Lockenkopf* and *Blödelkopf*, it becomes obvious that the lexical interpretation of the latter contains a metonymic shift within the compositional interpretation of the compound and thus occurs in the first place. By contrast, the metonymy operates on the result of the compositional interpretation of the compound in case of *Lockenkopf* in order to receive a possessive meaning. More generally, the frame approach renders the notion of possessive compounds more precisely: the analysis so far suggests referring merely to those compounds as *possessive* for which the compositional interpretation is preceded by the metonymically modification of the head noun. Otherwise, the compound is nonpossessive. This does not exclude that nonpossessive compounds cannot be used possessively. Instead, they can be used possessively, as in (38a). In these examples, the metonymic shift takes place outside the lexical interpretation of the compound itself. Hence, it is not distinctive to refer to such compounds as possessive because their property of allowing possessive, or more generally, metonymic use can also be observed with bare nouns which usually allow metonymic interpretations. It is not negated that meanings of metonymically modified compounds like *Lockenkopf* 'person with curly hair' are lexicalized. In this case, the metonymically modified meaning is captured by a lexical entry. Nevertheless, the composition of frames and the metonymy of the composed frame are still different processes.

5.4.7 Excursus: analogy interpretation

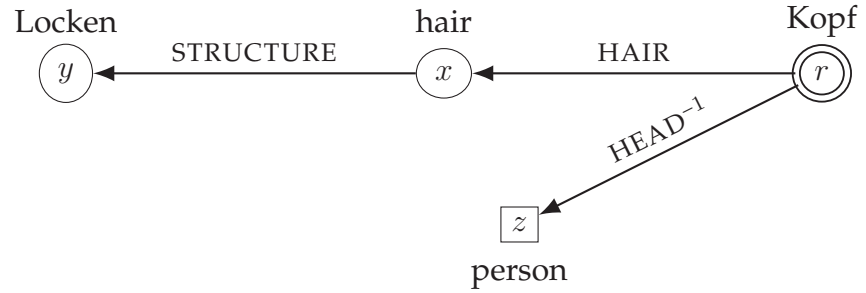
In Section 5.3, I argue for a weak interpretation of the differentiation between the concept-linking and the relation-set approach. It has been argued that the interpre-



A Frames in isolation.

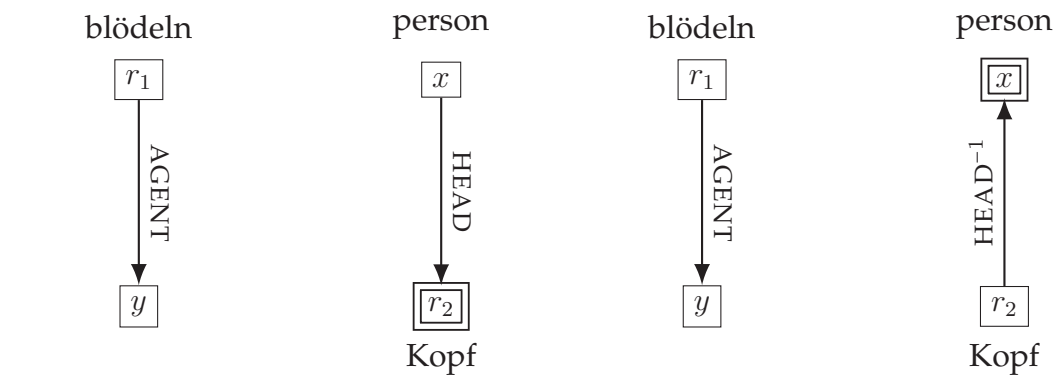


B Unified frames constituting the compound's meaning.

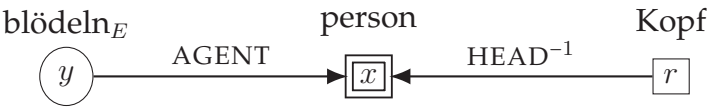


C Metonymy shift via the HEAD^{-1} attribute.

Figure 5.22 Frame representation of the compound *Lockenkopf* 'person with curly hair.'



A Frames in isolation. **B** Metonymically shifted frame.



C Unified frames.

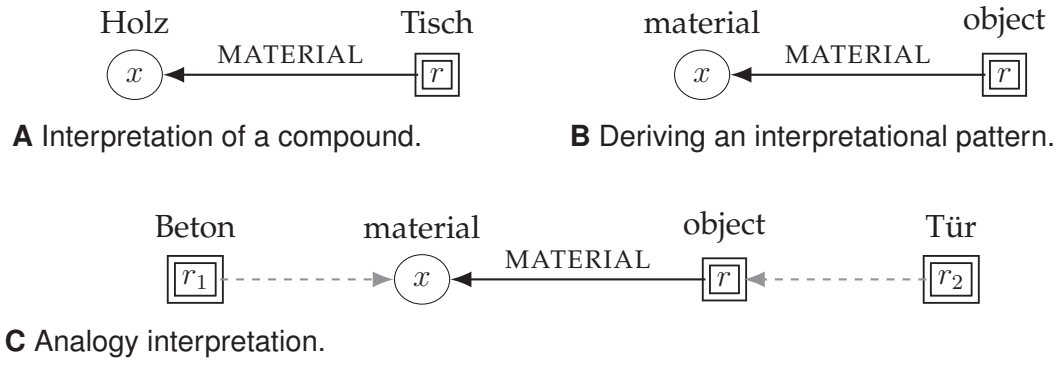
Figure 5.23 Frame analysis of a possessive compound with compound-internal metonymy shift.

tation of new compounds is subject to strategies of conceptual combination resulting in the meanings of compounds. Afterwards, the meaning relations can be derived from these meanings, stored in the lexicon, and used for the interpretation of analogous compounds. In the following, I will briefly propose a frame-theoretic method to model how relations are derived from already existing compound meanings and how they can be used for interpreting new compounds.[34] Since this thesis does not deal with experimental data, I am not able, however, to contribute to psycholinguistic aspects of compounding.

Let us consider the compound *Holz* 'wood,' *Tisch* 'table' >> *Holztisch* 'wooden table' that was analyzed in terms of frames. Its frame structure is repeated in Figure 5.24A. Based on this, the conceptual relation on which the meaning of *Holztisch* 'wooden table' is based can be extracted from its frame representation by a simple abstraction process: the values of the nodes are generalized to the original domains of the attribute involved. The result is shown in Figure 5.24B. From a frame-theoretic viewpoint, the original compound and the compound resulting from the abstraction process are related via subsumption in that the latter frame subsumes the former.

The frame in Figure 5.24B can be stored in the lexicon as an interpretational pattern. Based on this interpretational pattern, further compounds can be interpreted by specifying the underspecified nodes. Consider Figure 5.24C where the

[34] The general idea of the following approach is already inherent in Schulzek et al. (2012).



A Interpretation of a compound.

B Deriving an interpretational pattern.

C Analogy interpretation.

Figure 5.24 Deriving interpretational patterns from compound meanings.

compound *Beton* 'concrete,' *Tür* 'door' >> *Betontür* 'concrete door' is interpreted based on the interpretational pattern derived from *Holztisch* 'wooden table.' I refer to such interpretations as *analogy interpretations*. They seem to be very close to what Gagne (2002) considers as the interpretation of compounds based on sets of relations, where the original compound *Holztisch* 'wooden table' from which the interpretational pattern is derived results from a combination of concepts that is close to the concept-linking approach of Wisniewski (1997). Thus, the frame approach is able to integrate both the concept-linking and the relation-set approach.

5.5 Summary

Löbner (2013: Chapter 12) approaches compounding in terms of frames. He proposes four types of compounds that differ in the extent to which their interpretation can be modeled in frames. In this Chapter, I have discussed a frame-theoretic approach to subordinate N-N compounds in German. I focused only on those compounds whose interpretation is compositional and that are not restricted to a single context (like the *Komawirt* example in Section 5.1.2). Such compounds can be frame-theoretically classified according to Löbner's distinction of compounds which differentiates between value compounds, argument compounds, synthetic compounds, and action frame compounds.

The frame-based classification of compounds interferes and overlaps with the classifications of Marchand (1969) and Ortner et al. (1991). Figure 5.25 points out which of their categories correspond to argument, value, and action frame compounds, respectively. Synthetic compounds are excluded from the synopsis because they are not explicitly addressed by Marchand (1969) and Ortner et al. (1991). Furthermore, the frame approach has been related to theories in cognitive psychol-

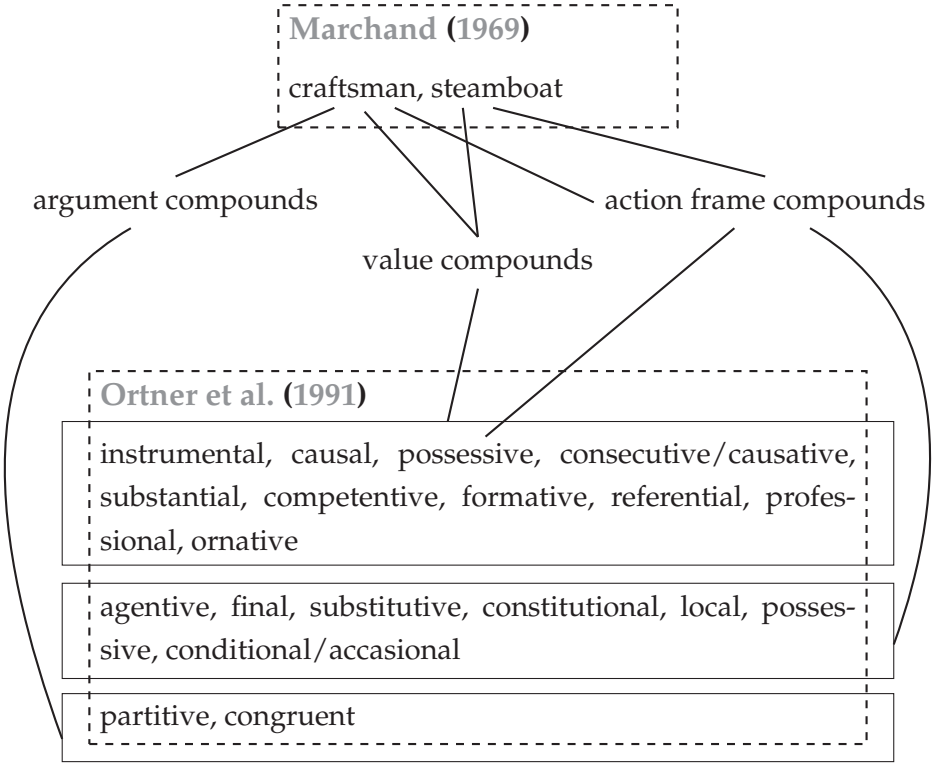


Figure 5.25 Overlapping of the frame-based categorization of compounds and the categories of Marchand (1969) and Ortner et al. (1991). Note that action frame compounds do not overlap with all of the categories of Ortner et al. (1991) in the first rectangle but only with the possessive meaning relations.

ogy on the interpretation of compounds. Beyond that, the frame analysis provides an insight into the frames of nouns. In particular, the analysis of examples for action frame compounds sheds light on which actions, or events, are associated with the referents of certain nouns because the meaning of these compounds is frame-theoretically established by deriving an action concept based on the compounds constituents; e.g., *coffee cup* 'cup for drinking coffee.'

From the perspective of concept-type theory, the analysis developed here points to some differences between Löbner's (2013) types of compounds. Value compounds are supposed to tend to inherit the concept type of their head noun. In the analyzed action frame compounds, the compound inherited the concept type of the head noun. The concept types of argument compounds arise compositionally, following the same compositional rules as possessive constructions (which are explicated in Table 2.1). How the concept types for synthetic compounds arise depends on whether the modifier specifies the value of an argument or a nonargument attribute. The concept type is fixed similar to argument compounds in the former case and similar to value compounds in the latter.

6

Final remarks and outlook

In this thesis, I have used a frame approach to analyze metonymy, deverbal *-er* and *-ung* nouns in German, and German N-N compounding. The approach has been developed by Petersen (2007), Petersen & Osswald (2012), and Löbner & Naumann (2014) who build on the basic ideas of Barsalou's (1992b) frame theory, according to whom human thinking is organized in attribute-value structures, and relate these ideas to Löbner's (2011) theory of concept types. By consistently representing metonymies as well as the meanings of deverbal nouns and compounds in frames, light was shed on both: on the linguistic phenomena as such and the frame model. In the following, I will summarize the frame-related as well as the linguistic results and will point to potential future research questions.

6.1 Frame-related results

The analyses provide an insight into the operations for the modification and combination of frames. From a frame-theoretic point of view, the linguistic phenomena investigated in this thesis can be modeled by means of two operations. The first operation is subject to the decompositional and the second to the compositional aspects of concepts. The first operation applies to metonymy and deverbal *-er* and *-ung* nominalization. These phenomena were analyzed as one-place operations on noun and verb meanings, respectively. This operation causes a shift of the central node. In the case of metonymy, the shift always follows the direction of an attribute. This also holds for most of the deverbal nouns that I analyzed in this thesis. However, there was also an exception where the central node is shifted against the direction of an attribute (see the analysis of the *Berichtigung* 'correction' example analyzed in Figure 4.17). The second operation applies to compounding. The meanings of subordinate N-N compounds result from unifying frames. Since the interpretation of subordinate N-N compounds always builds on the frames of the constituents of the compounds, it is a two-place operation on frames. This also holds for frame compounds, in which the unification applies on a third frame because the third frame is not represented on the linguistic surface but derived from the frame of the constituents of the frames. Thus, the input for interpreting frame compounds are two

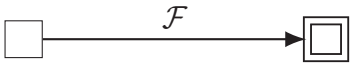


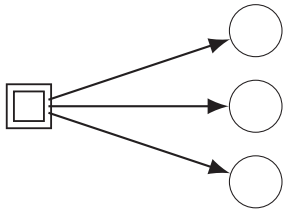
Figure 6.1 Frame structure for functional concepts. $\mathcal{F}$ stands for the represented functional noun which functions as attribute label.

frames, namely the frames of the constituents of a N-N compound. Furthermore, the operations of central-node shifts and unification can also occur in combination as is the case for possessive compounds. The meaning of these compounds results from shifting the central node in the frame of the head noun and unifying the modified frame with the frame of the modifier afterwards.

Furthermore, the analyses in this thesis offer the possibility to infer certain attributes that frames potentially contain. This is important insofar as Barsalou (1992b) leaves open which kinds of relations attributes represent. Several attributes have been inferred in the context of metonymy (see the summary in Section 3.4). Among other things, I provided evidence that nominal frames may contain attributes that specify the origin or the purpose of the entities to which the nominal frames potentially refer. Further evidence for these attributes was provided by the analysis of deverbal nouns because the meanings of result readings are caused by shifting the central node of the base verbs in the direction of these attributes. Moreover, the analysis of metonymy suggests a three-fold distinction of attributes, depending on the knowledge based on which they are accessed. Core attributes are those attributes that are part of the lexical knowledge of a lexeme. During sentential interpretation, the lexical frames might be enriched with sentential-differentiation attributes. Finally, there are also attributes that can be added to the frame due to situational aspects. I referred to these attributes as contextual attributes. The attribute distinction is orthogonal to the classification of Löbner (2013: 309) who distinguishes four types of attributes, namely part, property, correlate, and event attributes. These categories were able to subsume the attributes inferred during the analyses.

Regarding the frame-theoretic characterizations of concept types, I propose two modifications of Petersen's (2007) approach. She assumes that the concept type of a noun can be identified based on the structure of its frame. The characterizations Petersen (2007) provides have been summarized in Postulate 2.7 to 2.9. According to Postulate 2.8, the frames of functional nouns are structured as exemplified in Figure 6.1: there is an attribute that links the possessor node to the central node where the attribute carries the represented functional noun as label. This structure is supposed to be valid because it is immediately implied by the correspondence between functional nouns and attribute labels, as was explicated in Section 2.2.4.

However, I do not agree with Postulates 2.7 and 2.9 that state characteristic struc-



A Frame structure proposed by Petersen (2007). The central node does not have ingoing arcs.

B Possible structure frame for sortal concepts. V_E stands for an event type as introduced in Chapter 4.

Figure 6.2 Characteristic structure of frames representing sortal concepts.

tural properties for frames of sortal and relational concepts. Following Petersen (2007), the central nodes of sortal frames do not have ingoing arcs (see Figure 6.2A). However, I provided examples that suggest that this assumption is too strong. It seems to be possible that the central nodes in frames of sortal concepts may have ingoing arcs if the preimage of the attribute represented by the ingoing arc is not able to uniquely identify the value of the central node. This is, for instance, the case for nodes representing types of events. In Chapter 4, I marked the label of such nodes with the index E. These nodes represent events that may occur not at all, once, or multiple times (see Figure 6.2B). Since there are different agents that are potentially involved in the single events, the AGENT attribute of those nodes does not determine the referent of the central node uniquely.

According to Postulate 2.9, the frames of relational concepts always have a bridging frame node that relates the possessor node not directly but only immediately to the central node (see Figure 6.3A). I argued that an attribute can also link the central node to the possessor node. The relationality is motivated insofar as the specification of the possessor node restricts the preimage of the attribute where the restriction is not strong enough to determine the preimage to exactly one element. Thus, frame structures like the one in Figure 6.3B also seem to be possible for frames of relational concepts. Since frames of sortal nouns might also have this structure, it is suggested that it is impossible to characterize the frames of different concept types based on structural properties. Instead, it seems to be necessary to mark arguments explicitly, as proposed by Petersen & Osswald (2012).

6.2 Linguistic results

The attempt to model metonymy, deverbal *-er* and *-ung* nouns, and compounding in frames provides new insights into these phenomena as such. With respect

A Frame structure according to Petersen (2007).

B An alternative frame structure for relational concepts.

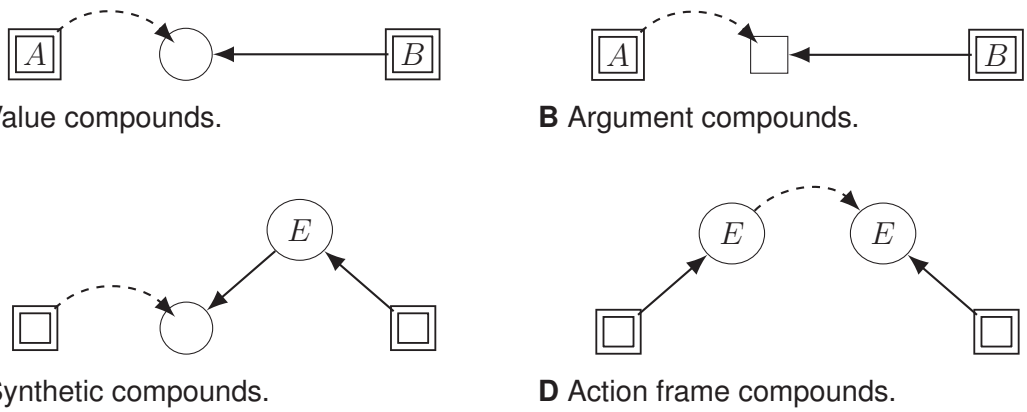
Figure 6.3 Structures of frames representing relational concepts.

to metonymy, it has been explained that metonymy is a semantic meaning modification that operates independently from type shifts. The frame approach offers the possibility to explicitly decompose these processes. Presumably, this also holds for further processes of meaning modifications like mass-count shifts and metaphors, which are supposed to operate independently from metonymy. To explicate this in frames, however, it is necessary to look to solutions that model mass-count shifts and metaphors in frames. Pragmatically, I motivated the target concept as uniquely determined by the source concept based on an aspect that is relevant in the (sentential or utterance) context in which the metonymy occurs. This condition has already been noted by Lakoff & Johnson (1980). What the author leaves open, however, is a semantic motivation for this condition.

In addition, Löbner (2013) proposes a stronger necessary condition for metonymy according to which the target concept also uniquely corresponds to the source concept. I referred to this hypothesis as *bidirectionality*. However, I have not found a proper motivation for this hypothesis, although it is confirmed by most of the examples investigated in this thesis. Beyond that, I present evidence that the uniqueness identification of the source concept by the target concept is not necessary (see the *campus* example modeled in Figure 3.13). Thus, it is questionable whether bidirectionality is a necessary condition at all. Rather, it is suggested that only the unique identification of the target concept by the source concept is necessary.

I pointed to a similarity between deverbal nominals and metonymy because the meaning of both arises by a simple shift of the original referent. Furthermore, I explicated with respect to several examples the extent to which the concept type of the nominal depends on the base verb. Whether a deverbal noun is unique or relational is determined by the relations the meaning of the base verb introduces between its arguments. Beyond that, I proposed a slightly varied notion of eventivity that is based on the episodic vs. generic distinction in terms of Carlson (2011). The notion of eventivity is purely conceptual and does not take referential criteria into account.

Finally, I applied the frame-based distinction of compounds developed in Löbner



A Value compounds. **B** Argument compounds.

C Synthetic compounds. **D** Action frame compounds.

Figure 6.4 Prototypical unification processes for the compound types distinguished in Chapter 5. A and B stand for the frames of the modifier and the head noun, respectively. E stands for a single-event or an event-type node.

(2013: Chapter 12) to several examples of German compounding. This approach distinguishes between four types of compounds, namely value compounds, argument compounds, synthetic compounds, and action frame compounds. In terms of value and argument compounds, the frame of the modifier specifies an attribute in the frame of the head noun. The compound types differ in that the modifiers of argument compounds specify an argument of the relational head noun, whereas the modifiers of value compounds specify a nonargument (compare Figures 6.4A and 6.4B). The head nouns of synthetic compounds are deverbal nouns; the modifier specifies a value in the frame of their base verb (see Figure 6.4C). Last, action frame compounds are those compounds where the frames of the constituents are related via a bridging event frame (see Figure 6.4D).

Based on several examples, I illustrated the extent to which these four classes subsume several types of subordinate N-N compounds that are postulated in rival classification of compounds. I argued that the argument saturation in argument compounding follows the same compositional principles that underlie the interpretation of the corresponding genitive constructions by which the compounds can be paraphrased. Additionally, I demonstrated that synthetic compounds can be divided into two subtypes: In the first type, the deverbal head noun is relational; its argument is saturated by the modifier. In the second type, by contrast, the modifier specifies a nonargument of the deverbal head noun. Thus, the former type is similar to the interpretation of argument compounds, whereas the latter is close to the interpretation of value compounds. Moreover, I exemplified the variety of actions underlying the interpretation of action frame compounds. Also, I pointed to the fact that possessive compounds may underlie internal or external metonymic modifi-

cations. In the case of internal meaning modifications, the compound allows only a possessive interpretation, whereas in the case of external meaning modifications, the noun can be interpreted possessively as well as nonpossessively.

6.3 Future research

In this thesis, I analyzed the metonymic use of nouns in terms of frames. As already mentioned in Chapter 3, there are also metonymically used verbs. Thus, the frame analysis could be extended to those uses. Similarly, the analysis of deverbal nouns could be applied to further suffixes in German or other languages. In particular, the analysis of metonymically used verbs would require a deeper analysis of verb meanings. Such a decomposition has not been approached so far and seems to be a promising field of future research.

In Chapter 4, I mentioned that it is a typical research question to formulate which readings of deverbal nominals are allowed by certain classes of verbs and which readings are excluded. Addressing that question requires a deeper frame-theoretic decomposition of verb meanings than has been possible so far. If such a decomposition was developed, it would be possible to investigate the necessary and sufficient conditions for different readings of deverbal nominals in terms of frames more deeply.

In addition, the analysis of compounds was restricted to subordinate N-N compounds that are noncontiguous in the sense of Kanngießer (1987); i.e., their interpretation is not restricted to a single situation. The analysis could be expanded to further types of compounds, including contiguous and coordinate compounds, among others. Beyond that, in Chapter 5, two rival theories on the interpretation of compounds, which have been developed in cognitive psychology, were related to the frame approach. Certainly, this could motivate experimental studies on the interpretation of compounds.

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