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Geert Booij

12. Word-formation in construction grammar

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Abstract

The notion 'construction' that plays a central role in Construction Grammar, is an indispensable notion for the analysis of word-formation patterns. In the study of word-formation, we investigate the systematic correspondences between form and meaning at the word level. Constructional schemas provide an adequate format for expressing these systematic correspondences. Moreover, they are part of a hierarchical lexicon in which both complex words and morphological patterns of various levels of abstraction can be specified.

An important advantage of the Construction Morphology approach is that it can express the relevant similarities between morphological and phrasal lexical expressions, and the paradigmatic relations between morphological and phrasal schemas. Thus, lexical knowledge is characterized as a complicated network between words and phrasal expressions on a range of levels of abstractions, varying between individual words and completely abstract patterns.

1. Introduction

Word-formation is the domain of linguistics in which systematic correspondences between the form and meaning of complex words are studied. Consider the following sets of English adjectives:

- (1)
- | | |
|-------------|---------------|
| steady | unsteady |
| social | unsocial |
| suitable | unsuitable |
| stressed | unstressed |
| sympathetic | unsympathetic |

The meaning of the adjectives in the column on the right can be circumscribed as ‘not A’, where A is the meaning of the corresponding adjective in the column on the left. That is, there is a systematic correspondence between the presence of *un-* and the meaning component ‘not’. Therefore, we consider the adjectives in the rightmost column as complex words, with the word structure $[un[x]_A]_A$, where x is a variable for a phonological string. Thus, we assign morphological structure to words on the basis of systematic paradigmatic relations with other words.

The structure $[un[x]_A]_A$ is part of the following constructional schema in which the correspondence between form and meaning of a morphologically defined class of words is specified:

(2)

$$\langle [un[x]_{A_i}]_{A_j} \leftrightarrow [NOT SEM_i]_j \rangle$$

The angled brackets demarcate a constructional schema. The correlation between form and meaning is expressed by the double-arrowed symbol \leftrightarrow . The meaning contribution of the base word on the right of the arrow is co-indexed with the relevant part of the formal structure on the left of the arrow. The schema thus represents the meaning of these *un-*adjectives as a compositional function of that of their base words. The format of these schemas derives from the Parallel Architecture framework, as developed in work by Ray Jackendoff (Jackendoff 2002; 2009; 2010; 2011). The meaning (SEM) of the base words is specified independently in the lexicon, whereas the meaning contribution of affixes is specified in constructional schemas, since their meaning is not accessible outside of the morphological structure in which they occur. Note, moreover, that the meaning of *un-* depends on the kind of morphological structure it occurs in. In the structure $[un[x]_N]_V$ for instance, the meaning of *un-* is ‘reversative action’, as in the denominal verbs *un-cork* and *un-root*. Hence, the meaning of the prefix *un-* cannot be specified in isolation of the morphological structure of which it forms a part.

Word-formation patterns can thus be considered constructions at the word level, and the individual complex words that instantiate these patterns are (morphological) constructs. The constructional schema in (2) differs from the format of the Word-Formation Rule as used in traditional generative morphology (Aronoff 1976) in that it is neutral as to production or perception. This schema is a declarative statement that characterizes a set of existing English complex adjectives, and at the same time indicates how new adjectives of this type can be formed. This type of morphological knowledge can be used both in language perception and in language production, and therefore, it is quite appropriate for morphological regularities to be expressed in declarative form.

The notion ‘construction’ has been shown to be essential for a proper characterization of the syntax of natural languages, and this theoretical stance is referred to as Construction Grammar (Goldberg 2006). The use of the notion ‘construction’ in the domain of morphology has been argued for in my monograph *Construction Morphology* (Booij 2010). In this article I will present a number of arguments in favour of a Construction Morphology approach to word-formation. In section 2 the concept of the hierarchical lexicon is introduced. In section 3 holistic properties of complex words are shown to be an argument for constructional schemas at the word level. Section 4 argues that there is no sharp boundary between lexicon and grammar, a basic idea of Construction Grammar, and that constructional schemas can be used in order to express the parallelisms between morphological and syntactic constructs. In section 5 we will see that we need the concept of paradigmatic relationships between constructional schemas in order to account for form-meaning asymmetries in complex words. Section 6 presents a summary of the argumentation for a Construction Morphology approach to word-formation.

2. The hierarchical lexicon

The acquisition of word-formation patterns is based on knowledge of memorized complex words. Once a pattern has been discovered, this can be expressed in a constructional schema that dominates the individual instantiations of this schema. The schema and its instantiations co-exist, as the discovery of a schema will not lead to removal from one’s memory of the set of complex words that formed the basis of the constructional schema. This insight can be expressed in a hierarchical lexicon, in which abstract schemas dominate their instantiations. For instance, the following substructure can be assumed for the English lexicon:

$$(3) \quad \langle [un[x]_{Ai}]_{Aj} \leftrightarrow [NOT SEM_i]_j \rangle$$

compounds. An example from Dutch is the use of the noun *dood* ‘death’ as a modifier in NA compounds, with the meaning ‘very, to a high degree’ as in:

- (5) dood-gewoon ‘very normal’
- dood-moe ‘very tired’
- dood-simpel ‘very simple’
- dood-stil ‘very quiet’

This productive use of the bound meaning ‘very’ of the noun *dood* can be expressed in a subschema for NA compounds that is dominated by the NA compound schema that in its turn is dominated by the general schema for adjectival compounds:

- (6) $\langle [[dood]_{Ni} [x]_{Aj}]_{Ak} \leftrightarrow [very_i SEM_j]_k \rangle$

In this schema one of the slots is lexically specified, and hence this is a constructional idiom (Jackendoff 2002). The semantic specification for *dood* in (6) overrules the literal meaning ‘death’ of *dood* when used as an independent word.

Words with bound meanings are often referred to as affixoids, as they are similar to affixes in having bound meanings. By making use of the concept of ‘constructional idiom’ we can avoid introducing a new morphological category for word constituents besides words and affixes. A constructional idiom is a constructional schema in which at least one slot is lexically fixed, and at least one slot is open.

We need this type of constructional schema for another form of boundedness as well. Consider the German word *Macher* ‘maker’, discussed in detail in Joeres (1995). Joeres’ observation is that *-macher* with the regular meaning ‘maker’ is a very productive constituent of compounds, whereas it has a lexicalized meaning when used as an autonomous lexeme, namely ‘strong personality who achieves a lot’. Hence, Joeres (1995: 151) concluded that *-macher* can be qualified as a ‘Halbsuffix’, that is, an affixoid. Note, however, that that *macher* is not one morpheme, as was the case for the affixoids discussed above, but consists of two, the verbal stem *mach-* ‘make’ and the agentive suffix *-er*. Examples of this type of compounding in German are:

- (7) *with A as first constituent:*
- Fit-macher ‘fit-maker’
- Krank-macher ‘ill-maker’

Wach-macher ‘awake-maker’
with N as first constituent:
 Baby-macher ‘baby-maker’
 Eis-macher ‘ice-maker’
 Programm-macher ‘program-maker’

Different from what is at stake with the noun *dood*, the meaning of *macher* in these words is completely regular: it has the meaning ‘entity that causes or creates something’. This meaning, however, is only productive within compounds, and not available for the word *Macher* in isolation, which only has the lexicalized meaning mentioned above. In order to account for its bounded productivity, we may assume the following constructional idioms for this class of compounds:

- (8) <[[A_i [*mach*]<sub>v_j]_v *er*]_{N_k} ↔ [who [CAUSE TO BE]_j SEM_i]_k
 <[[N_i [*mach*]_{v_j]_v *er*]_{N_k} ↔ [who [CREATE]_j SEM_i]_k}</sub>

These structures presuppose that the *-er*-nouns are derived from potential but non-existing verbal compounds of the type AV and NV respectively. For instance, *Fit-macher* can be seen as a derivation from *fit machen* ‘to make fit’. Thus, it is predicted that in these complex words, *macher* has the expected, fully regular meaning of causer or creator. The schemas in (8) will be dominated by the general schema for deverbal nouns in *-er* in German.

The schema format proposed here makes it possible to account for the co-occurrence of word-formation patterns. In (8) we saw a case of the productive co-occurrence of verbal compounding and deverbal *-er*-derivation in German. Normally, verbal compounding in German is unproductive. That is, this is a case of ‘embedded productivity’ (Booij 2010: Ch. 3). Language users may use more than one word-formation process at the same time, in order to construct a multiply complex word. There are, for example, quite a number of English *un*-adjectives listed in Van Dale’s *English-Dutch dictionary* for which the base adjective in *-able* is not listed as well, for instance:

- | | | |
|-----|-----------------|-------------------|
| (9) | <i>listed</i> | <i>not listed</i> |
| | un-beat-able | beat-able |
| | un-comment-able | comment-able |
| | un-crush-able | crush-able |

un-say-able

say-able

We can account for the formation of *un-V-able* adjectives from verbal bases without the intermediate word, a deverbal adjective in *-able*, being in existence, by assuming that word-formation schemas can be unified and have ‘a life of their own’. The following unified schema accounts for the adjectives in the left column of (9):

(10) $[un[V-able]_A]_A$

To conclude, the schema format is an appropriate format for characterizing word-formation processes and sets of complex words as parts of a hierarchical lexicon.

3. Holistic properties of word structure

One of the motivations for construction grammar is that constructions may have holistic properties that cannot be reduced to properties of their individual constituents. This applies to morphological constructions as well. A clear example is that reduplication structures often indicate some form of increase of a semantic property denoted by the base word. For instance, in Malay the plural forms of nouns is created by adding a full copy of the base noun (e.g. *buku* ‘book’ – *buku-buku* ‘books’). The meaning of plurality does not derive from one of the constituents *buku*, but is evoked by the copying configuration as such.

An example from Dutch is the semantic interpretation of numerals discussed in detail in Booij (2010: Chapter 8). The numeral *drie* ‘3’ and *honderd* ‘100’ can be concatenated in both orders, but with different interpretations: *drie-honderd* ‘300’, *honderd-drie* ‘103’. Hence, the nature of the semantic relation between the two numeral constituents (multiplication or addition) is determined by the order in which the lower and the higher numeral appear. That is, the semantic interpretation is partially a holistic property of the complex numeral as a whole.

A prototypical example of holistic properties in word-formation is the interpretation of nominal VN compounds in Romance languages, which denote agents, instruments, or both, and sometimes other semantic categories such as events. Here are some examples from Italian:

- (11) *apri-concerto* ‘open-concert, opening act’ (event)
apri-scatole ‘open-cans, can opener’ (instrument)
lancia-fiamme ‘throw-flames, flame thrower’ (instrument)

lava-piatti ‘wash-dishes, dish washer’ (agent or instrument)
 spazza-neve ‘plough-snow, snow plough’ (instrument)
 porta-bagagli ‘carry-luggage, luggage carrier / roof rack’ (agent or instrument)

The semantic component of these VN compounds that is not expressed by either of their constituents is the meaning ‘agent / instrument / event’. It is this meaning that is evoked by the morphological configuration as a whole. Note that the lexical category N of these compounds is also a holistic property as these compounds are exocentric, and the N constituent is not the head of the compound, neither formally nor semantically. These holistic properties can be captured by a constructional schema of the following type:

$$(12) \quad \langle [V_i N_j]_{N_k} \leftrightarrow [\text{Agent/Instrument/Event of ACTION}_i \text{ on SEM}_j]_k \rangle$$

This schema specifies a meaning component for which no explicit constituent is available.

In conclusion, holistic properties of word-formation constructions support the Construction Morphology approach to word-formation.

4. Phrasal and phrase-based lexical items

An important argument for Construction Morphology is that it is able to express the parallelisms between complex words and phrasal expressions with similar functions. A class of phrasal lexical items that is very relevant for a proper analysis of the syntax-morphology interaction is formed by particle verbs in Germanic languages (Los, Blom, Booij, Elenbaas and van Kemenade 2012). These particle verbs function as names for verbal concepts (events, actions). They are phrasal in nature since the particle can be separated from the verb. In German and Dutch, for instance, root clauses have a word order in which the finite verb appears in second position, whereas the particle appears at the end of the clause. Particle verbs are therefore phrasal lexical units, but similar in function to prefixed verbs. An example is the class of Dutch particle verbs with the particle *door*. These verbs express continuative aspect:

(13)	<i>verb</i>	<i>phrasal verb</i>
	eten ‘to eat’	door eten ‘to continue eating’
	fietsen ‘to cycle’	door fietsen ‘to continue cycling’
	zeuren ‘to nag’	door zeuren ‘to continue nagging’

The crucial observation is that the word *door* has a productive, yet bound meaning when combined with a verb into a phrasal verb, namely that of continuative aspect. The following constructional schema expresses this semantic property:

$$(14) \quad \langle [\text{door}_i \text{V}_j]_k \leftrightarrow [\text{continue}_i \text{SEM}_j]_k \rangle$$

This schema specifies redundant properties of existing particle verbs with *door*, and how new particle verbs of this type can be coined. The schema in (14) is a good example of a constructional idiom (Jackendoff 2002), a schema with both variable and lexically filled positions.

In probably all European languages we find phrases with coordination that are semantically transparent, but have a fixed order, such as English *salt and pepper*, *father and son*, *ladies and gentlemen*. These conventionalized expressions have to be listed because of the fixed order in which the two words appear. On the other hand, they instantiate regular and productive phrasal patterns, and we should express this in our description. Therefore, the syntactic coordination schema $[\text{N and N}]_{\text{NP}}$, which is a sub-case of English coordination, dominates its instantiations, phrases such as *salt and pepper*. The only non-redundant information concerning these *N and N* phrases is that they exist (that is, are conventionalized), and the order in which the two words appear. Thus, there is no principled difference between complex words and phrases with respect to the division of labour between storage and computation. There is massive empirical evidence for prefabs, word combinations stored in memory (Erman and Warren 2000; Kuiper, Egmond, Kempen and Sprenger 2007; Sprenger 2003; Sprenger, Levelt and Kempen 2006; Tremblay and Baayen 2010; Wray 2002; 2008).

Romance languages use various types of phrases as names for concepts. For example, in French the patterns *N à N* and *N de N* (as in *moulin à vent* ‘windmill’ and *salle de bains* ‘bathroom’ respectively) are used for constructing names for entities. This means that French NPs with the form $[\text{N} [\text{à/de N}]_{\text{PP}}]_{\text{NP}}$ have a lexical status, and function as constructional idioms (Booij 2009).

A correct prediction of the position that both words and phrases are stored as lexical units is that we will find competition and blocking effects between synonymous phrases and words. For instance, the existence of the Dutch AN compound *zuur-kool* ‘sour-cabbage, Sauerkraut’ impedes using the AN phrase *zure kool* ‘sour cabbage’ for this type of cabbage, and inversely, the existence of the AN phrase *rode kool* ‘red cabbage’ impedes the coinage of the AN compound *rood-kool*. Related languages may differ in the choice between synonymous but structurally

different options. For instance, whereas German is characterized by a very frequent use of AN compounds, Dutch speakers tend to prefer AN phrases (as in German *Rotwein* ‘red wine’ versus Dutch *rode wijn* ‘red wine’ (Booij 2002; Hüning 2010)). Interestingly, it has been shown that the choice between AN compound and AN phrase in German for a new concept depends on the family of related expressions. For instance, since there are many AN compounds with *milch* ‘milk’ as their head, a new AN expression for a new kind of milk will most probably be a compound (Schlücker and Plag 2011). This shows that new AN expressions are made on analogy to constituent families, the sets of existing AN compounds or phrases that share a constituent.

In Polish, nouns followed by a denominal relational adjective are used extensively, where English would have NN compounds (Szymanek 2010):

- (15) a. kość [[słoni]_N-ow]_A-a
bone elephant-ADJ-FEM.SG ‘elephant bone’
b. sok [[jabłk]_Now]_A-y
juice apple-ADJ-MASC.SG ‘apple juice’

Lexically stored collocational restrictions between A and N in AN phrases may also affect inflection. In Dutch, the prenominal adjective that is normally inflected and ends in the suffix *-e /ə/*, may be used without ending when the AN phrase is a lexicalized name, as in *het stoffelijk overschot* ‘the mortal remains’, where the expected schwa ending is omitted (Speelman, Tummers and Geeraerts 2009).

The consequence of these observations is that there is no sharp boundary between grammar and lexicon. Both at the level of the word and the level of the phrase, the grammar contains schemas that dominate their lexicalized instantiations. Thus, the lexicon becomes a ‘construction’.

The absence of a sharp boundary between lexicon and syntax is also manifested by the fact that phrases may feed word-formation. It is in particular compounding that appears to be permissive in this respect. As far as Dutch is concerned, it is far less common to use phrasal units as bases of derivation, although this is possible for a few suffixes, such as denominal *-er* ‘-er’ and denominal *-achtig* ‘like’. The denominal suffix *-er* in Dutch combines easily with classifying phrases:

- (16) [[derde klass]_{NP} er]_N ‘third form pupil’
[[17^{de}-eeuw]_{NP} er]_N ‘person living in the 17th century’

[[doe-het-zelv]_S er]_N ‘do it yourself-er’

In the linguistic literature one finds an extensive debate on the consequences of phrasal compounds for our view of the architecture of the grammar (Meibauer 2007). Wiese claimed that “a mechanism such as quotation must be held responsible for the existence of phrasal compounds” (Wiese 1996). Meibauer (2007) objected to this claim, and noted that often the use of phrases within compounds has an expressive function, and does not always lead to conventionalization into lexical units. Expressiveness is not, however, a formal precondition for using phrases as building blocks of words, as we will see below.

The expressive function of this type of word-formation is dominant when sentences are embedded in compounds, as in the following English examples:

- (17) Don’t tell, don’t ask policy (US army way of dealing with gay soldiers)
One-size-fits-all-education (*Boston Globe* 6 March 2010)
I understand the whole ‘live it up, you’re only in college once’ thing (*Tufts Daily* April 7, 2010)
The eat-your-spinach-approach to education (*Boston Globe* 13 March 2010)

The sentential constituents in these compounds can be characterized as ‘fictive interaction’ (Pascual and Janssen 2004), and they have indeed a strong expressive character. Some of these compounds with a sentential constituent are conventionalized, as is the case for the following Dutch compounds:

- (18) God-is-dood-theologie ‘God is dead theology’
blijf-van-mijn-lijf-huis ‘lit. stay away from my body-house, house for threatened women’

Not all phrasal compounds possess the property of expressiveness, however. What one may expect is that when a particular phrasal pattern is used systematically for the purpose of classification (that is, for naming concepts), the resulting type of phrasal compound will be quite normal, and will not carry a particular expressive value. This is indeed the case for right-headed phrasal compounds with AN phrases as their left constituent, as is illustrated here for Dutch:

- (19) [[blinde_Adarm_N]_{NP}[ontsteking]_N]_N ‘blind intestine inflammation, appendicitis’
[[centrale_A verwarmings_N]_{NP}[monteur]_N]_N ‘central heating technician’

[[derde_A wereld_N]_{NP} [land]_N]_N ‘third-world country’
 [[ronde_A tafel_N]_{NP} [conferentie]_N]_N ‘round table conference’
 [[vrije_A tijds_N]_{NP} [kleding]_N]_N ‘free time clothing, casual dress’
 [[warme_A golf_N]_{NP} [stroom]_N]_N ‘warm gulf stream’

In these examples, the AN phrase is a conventional lexical unit. However, it is not the case that Dutch AN phrases can only feed compounding when they are conventional names for concepts. The crucial property of AN phrases as parts of compounds is that they can function as classifiers. Hence, there are also phrasal compounds in which the left AN constituent is not a conventional lexical unit by itself. This is the case for the following Dutch phrasal compounds:

- (20) [[drie_{NUM} sterren_N]_{NP} [hotel]_N]_N ‘three stars hotel’
 [[lange_A afstands_N]_{NP} [loper]_N]_N ‘long distance runner’
 [[twee_{NUM} componenten_N]_{NP} [lijm]_N]_N ‘two components glue’
 [[vier_{NUM} kleuren_N]_{NP} [druk]_N]_N ‘four colours print’
 [[witte_A boorden_N]_{NP} [criminaliteit]_N]_N ‘white collars criminality’

For instance, there is no lexical unit *drie sterren* ‘three stars’ in Dutch. Crucially, these AN phrases embedded in compounds do not function as referring expressions, but specify the type of N, where N is the head of a compound. This is also why the NP modifier in these compounds cannot contain a determiner, as this would imply a referential interpretation of the modifying NP. It is revealing to compare this absence of a determiner to the use of AN combinations such as *blinde darm* ‘blind gut’ when not embedded in a compound. Since *darm* ‘intestine’ is a count noun, it must be preceded by a determiner, and the determinerless phrase *blinde darm* is therefore ill-formed, unless it is embedded in a word. Yet, these AN sequences are phrases, since the adjective is inflected. The ending *-e* in *blinde*, for instance, is required since *darm* is a singular common noun, and Dutch adjectives agree in gender and number with their head noun. Agreement is a clear indication of phrasal status, since there cannot be agreement between parts of words, as this would go against Lexical Integrity, the defining property of wordhood.

We thus observe that a particular type of word structure, compounding, licenses a particular type of phrasal structure: AN phrases headed by count nouns but without determiners. This once more underscores the point that schemas for morphological structure and those for phrasal structure are interdependent in the formation of lexical units.

5. Form-meaning asymmetries

In section 4 we saw that phrases can feed word-formation. This strengthens the position that morphology and syntax cannot be completely separated. But what happens if a word-formation process does not take phrases as bases for affixation? Consider the following examples from Italian:

- | | | |
|------|--------------------------------------|--|
| (21) | chitarra elettrica ‘electric guitar’ | chitarrista elettrico ‘electrical guitarist’ |
| | flauto barocco ‘baroque flute’ | flautista barocco ‘baroque flute player’ |
| | tennis da tavolo ‘tennis table’ | tennista da tavolo ‘table tennis player’ |

The word sequences on the left and the right are NPs of the form A + N or N Prep N. The phrase *chitarrista elettrico* denotes someone who plays the electric guitar. However, the phrase *chitarra elettrica* ‘lit. guitar electric, electric guitar’ is not the formal base for the attachment of *-ista*, a suffix that is used in Italian to create personal names. This is clear from the word order (the suffix is not attached at the right edge, **chitarra elettricista*), and from the fact that the adjective *elettrico* agrees in number and gender with the masculine noun *chitarrista*, and not with the feminine noun *chitarra*. This asymmetry between form and meaning (‘bracketing paradox’) is the same as that in the famous English example *transformational grammarian* discussed in Spencer (1988). In the case of English, one might consider the suffix *-ian* to be formally attached to the phrase *transformational grammar*, an option that is available due to English word order and the poor inflection of English. Such an analysis is obviously impossible in the case of Italian, which only allows for a phrasal interpretation:

- (22) [[chitarr-ista]_N [elettrico]_A]_{NP}

This suggests that the adjective *elettrico* has semantic scope over a part of the complex phrasal head *chitarrista*, and that the internal morphological structure of the modified head word is accessible. In example (22), the adjective *elettrico* modifies the nominal base of the head noun. In the following examples AN phrases used as modifiers are turned into AA sequences, in order to fit the canonical phrase structure of Italian (examples provided to me by Daniele Vergilitto):

- | | | |
|------|-------------------------------|---|
| (23) | energia solare ‘solar energy’ | impianto _N energetico _A solare _A ‘solar power plant’ |
|------|-------------------------------|---|

chirurgia_N estetica_A ‘aesthetic surgery’

intervento_N chirurgico_A estetico_A
‘aesthetic surgery invention’

The same type of bracketing paradox has been observed for Polish. In Polish relational adjectives follow the head noun. Hence, the structural paradox is the same as for Italian (Szymanek 2010):

- (24) chirurgia plastyczna ‘plastic surgery’ chirurg plastyczny ‘plastic surgeon’
praca fizyczna ‘manual work’ pracownik fizyczny ‘manual worker’

In these examples the post-nominal relational adjectives agree in gender with the preceding head noun. Hence the variation in form of the relational adjectives *plastyczn-* and *fizyczn-*.

Let us look at these facts from the perspective of how to encode meaning. When an Italian speaker knows the lexical phrase *guitarra elettrica*, and (s)he wants to construct the lexical unit for denoting a person playing an electric guitar, the suffix *-ista* that is used for creating personal names cannot be attached to the phrase *guitarra elettrica* because this suffix is attached to words only: the noun **guitarra-elettric-ista* is ill formed. The alternative is a phrase with a form-meaning mismatch in which the (stem forms of the) relevant lexemes (*guitarra* and *elettrico*) that form a lexical collocation, are inserted in the available slots in a schema that complies with the restriction that *-ista* does not accept phrasal bases. This is the schema $[[N\text{-ista}]_N A]_{NP}$. The semantic property to be specified is that the Adjective has semantic scope over the base-N only.

Productive patterns with this kind of asymmetry can be accounted for by specifying a paradigmatic relationship between two phrasal schemas (Booij 2010), where \approx denotes a paradigmatic relationship:

- (25) $\langle [N_j A_k]_{NP_i} \leftrightarrow SEM_i \rangle \approx \langle [[N_j\text{-ista}]_N A_k]_{NP_i} \leftrightarrow [PERSON \text{ with relation } R \text{ to } [SEM_i]]_i \rangle$

Another example of form-meaning asymmetries is formed by words derived from particle verbs in Scandinavian languages. In the Mainland Scandinavian languages Danish, Norwegian, and Swedish, the particle follows the verb, as is the case for English. However, the particle precedes the verb in past and present participles which have both verbal and adjectival properties, and in deverbal nouns (Allan, Homles and Lundskaer-Nielsen 1995; Faarlund, Lie and Vannebo 1992; Holmes and Hinchcliffe 2003). Here are some examples of participles of particle verbs in these three languages:

(26)	<i>particle verb</i>	<i>past participle</i>
	<i>Danish</i>	
	fælde ned ‘fall down’	ned-faldne (æbler) ‘windfall (apples)’
	<i>Norwegian</i>	
	bring ud ‘deliver’	Posten bliver ud-bragt ‘The mail is being delivered’
	<i>Swedish</i>	
	köra om ‘overtake’	den om-körda lastbilen ‘the overtaken lorry’
	ring up ‘phone’	upp-ringd ‘phoned’

In the following deverbal nouns in Norwegian (Faarlund, Lie and Vannebo 1992), we see again the reversal effect:

(27)	<i>particle verb</i>	<i>nominalization</i>
	binde inn ‘to bind (a book)’	inn-bind-ing ‘book cover’
	rydde opp ‘to tidy up’	opp-rydd-ing ‘tyding up’
	skrive av ‘to copy’	av-skrif-t ‘copy’
	trekke opp ‘to pull up’	opp-trekk-er ‘cork screw’

The deverbal suffixes cannot be attached to the particle since it is not a verb, or part of a verb. If the suffix were attached to the verb, we would get forms like *bind-ing-inn*. As there are no particle nouns, particles cannot occur after a noun. And since Norwegian compounds are right-headed, *bind-ing-inn* cannot be interpreted as a compound. Therefore, the nominalizations have the form of a compound, consisting of a particle followed by the deverbal head noun. Hence, the formal base of these nominalizations is not the particle verb as such, even though the meaning of these nominalizations is a compositional function of the (often idiomatic) meaning of the corresponding particle verb. In the nominalizations, the lexical collocation of the particle and the verb is preserved, but inserted in the reverse order, in the slots of the available compound type [X N]_N, which is the general template for nominal compounds in Germanic languages. There is a form-meaning asymmetry, since the particle verb is not a (non-discontinuous) subconstituent of the nominalization. Yet, the meaning of these nominalizations is regular and transparent as they relate in a systematic, yet paradigmatic way to the corresponding particle verbs.

The same explanation can be invoked for the reversal effect in participles of particle verbs. Since participles are adjectives, the only possible shape of adjectival forms of particle forms is that of a right-headed adjectival compound.

The following form-meaning asymmetries have been observed in relation to particle verbs in English, Dutch, German, and Italian (Booij 2010: 189):

- (28) a. English particle verbs may carry the suffixes *-er* and *-ing* on their verbal head: *look-er-on*, *runn-er-up*, *digg-ing up*, *switch-ing off the lights*;
- b. the past participle of Dutch particle verbs is formed by prefixing *ge-* and suffixing *-t/-d/-en* to the stem form of the verbal head: *aan-val* ‘to attack’ - *aan-ge-vall-en*, *op-bellen* ‘to phone up’ - *op-ge-bel-d*); *ge-*nominalization also applies to the head: *rond-spring* ‘jump around’ - *rond-ge-spring* ‘jumping around’;
- c. when German particle verbs undergo nominalization with the affix combination *ge-e*, this affix combination is attached to the verbal head of the particle verb: *herum-hops-en* ‘to jump around’ - *Herum-ge-hops-e* ‘jumping around’ (Müller 2003; 2006);
- d. in Italian, nominalizing suffixes are attached to the verbal head (Francesca Masini, pers. comm.): *venire giù* ‘to come down’ - *la venuta giù* ‘the coming down’, *mangiare fuori* ‘to eat out’ - *la mangiata fuori* ‘the meal at a restaurant’;

In all cases, canonical morphological forms are used for creating denominal forms of particle verbs. Note that, since Italian has left-headed compounds, the particle can appear after the deverbal noun, unlike what is the case for Germanic languages such as Norwegian, where a compound like $[[bind-ing]inn]$ is ill-formed. The relevant patterns can be accounted for in terms of paradigmatic relations between schemas. For example, the relation between German *herumhopsen* and *Herumgehops*e in (28c) can be expressed by a paradigmatic relationship symbolized by the sign \approx between two schemas:

$$(29) \quad \langle [Part_i V_j]_k \leftrightarrow [SEM]_k \rangle \approx \langle [Part_i [ge-V_j-e]_N]_{NI} \leftrightarrow [NOM SEM_k]_I \rangle$$

NOM stands for the semantic operator of event nominalization. The structure $[Part_i [ge-V_j-e]_N]_N$ in (29) is a right-headed compound structure of the type $[XN]_N$, in which the head is a deverbal noun with the discontinuous affix *ge..e*. What is special about the structure of these compounds is that its semantic correlate requires reference to the semantics of a paradigmatically related structure, that of particle verbs. In (29) we specify that this event nominalization of German

particle verbs is formally a head operation: it is the verbal head that is nominalized, but the nominalizing element has semantic scope over the particle verb as a whole.

In conclusion, the flexibility in encoding lexical units for denoting concepts is greatly enhanced by allowing for certain types of asymmetries between form and meaning, mismatches that can be resolved by the language user on the basis of paradigmatic relationships between (morphologically or syntactically) complex expressions. These observations also show that the internal structure of a lexical unit is not by definition opaque as an effect of storage: conventional lexical units may preserve their formal and semantic transparency.

6. Conclusions

The notion ‘construction’ that plays a central role in Construction Grammar, is indispensable for the analysis of word-formation patterns as well. In the study of word-formation, we investigate the systematic correspondences between form and meaning at the word level. Constructional schemas provide an adequate format for expressing these systematic correspondences. Moreover, they are part of a hierarchical lexicon in which both complex words and morphological patterns of various levels of abstraction are specified.

An important advantage of the Construction Morphology approach is that it can express similarities between morphological and phrasal lexical expressions, and the paradigmatic relations between morphological and phrasal schemas. Thus, lexical knowledge is characterized as a complicated network between words and phrasal expressions at a range of levels of abstractions, varying between individual words and completely abstract patterns.

7. References

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Geert Booij, Leiden (Netherlands)