

Construction Morphology

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1. Introduction

Morphology deals with the structure of words. Language users can assign internal structure to a word if there is a systematic correlation between its form and meaning, based on the comparison of two sets of words. Compare the following two sets of words:

- (1) a. dancer, fighter, singer, walker
- b. dance, fight, sing, walk

In the words in (1a), we recognize a verbal base (*dance, fight, sing, walk*) followed by the suffix *-er*, and a corresponding systematic meaning pattern ‘one who Vs’, where V stands for the meaning of the verb. This recognition is based on a systematic form difference between the words in (1a) and those in (1b) that correlates with a systematic meaning difference: the words in (1a) have the additional form component *-er*, and the additional meaning component ‘Agent of’. Therefore, the nouns (1a) are considered deverbal agent nouns. Hence, we call these words complex, and assign an internal structure to them: $[V\text{-}er]_N$. On the other hand, there is no reason to assign internal structure to nouns like *brother* and *father* that end in the same sequence $/\text{ər}/$, because we cannot correlate these nouns to verbs like *to broth*, *to fath*, etc. In other words, assignment of word structure is based on systematic paradigmatic relationships between sets of words.

Another example of a set of complex words are the English adjectives in *-less* that denote the property of being without something:

- (2) airless, beerless, breadless, colourless, spineless, wineless, wireless

These adjectives stand in a paradigmatic relationship to the nouns *air, beer, bread, color, spine, wine*, and *wire* respectively. Hence, they can be assigned an internal word structure: $[[air]_N\text{less}]_A$, etc.

The form-meaning correlations that we observe in the words in (1a) and (2) can be represented as constructional schemas, schematic representations of morphological constructions, as in (3):

- (3) a. $\langle [x]_{Vi} \text{er} \rangle_{Nj} \leftrightarrow [\text{Agent of SEM}_i]_j$
 b. $\langle [x]_{Ni} \text{less} \rangle_{Aj} \leftrightarrow [\text{Property of being without SEM}_i]_j$

In these schemas, the double arrow indicates the correlation between form and meaning. By means of co-indexation the systematic relationship between form and meaning is specified. The index i in these examples serves to indicate that the meaning of the base word (SEM) recurs in that of the corresponding complex word. The index j indicates that the meaning of the construction as a whole correlates with the form as a whole. The angled brackets demarcate a constructional schema. This way of accounting for morphological patterns has been developed in the theory of Construction Morphology (henceforth CM) as outlined in Booij (2010), which is the topic of this chapter. The variables x in these schemas stand for the phonological content of the base word, and thus indicate an empty slot. When we fill this variable position with a concrete word, we get a complex word, for instance *facebook-er* based on the verb *to facebook*, or *facebook-less* based on the noun *facebook*. These words are hence instantiations of these schemas. We may refer to these fully concrete instantiations of constructional schemas as (morphological) constructs (Booij 2010).¹

Our discussion of these word formation patterns started with sets of concrete words. This is a fundamental point of the CM approach. Language users first acquire words, and only once they have acquired a sufficiently large set of words of a certain type can they conclude to abstract morphological patterns. Hence, this approach to morphology is usage-based, as the actual use of language is the basis on which this kind of knowledge develops, both within children and adult language users. We thus avoid the rule-list fallacy, the idea that having rules in the grammar excludes storing their outputs as well (Langacker 1987). For morphology, this idea has already been made explicit in Jackendoff (1975) who argues that word formation rules function as redundancy rules with respect to existing, listed complex words. This view does justice to the way language users acquire word formation patterns: first they come across individual complex words, and it is only after sufficient exposure to a number of types of a particular morphological pattern that the abstract morphological pattern can be discovered.

The form side of a construction comprises both morphosyntactic and phonological properties (in the schemas (3) these two levels have been conflated for ease of exposition). Therefore, the grammar of natural languages has a tripartite parallel architecture: phonology, morphosyntax, and meaning (Jackendoff 2002). The phonological representation of complex word is not necessarily isomorphic to its morphosyntactic representation, and concerns its phonological properties. For instance, the word *dancer* has the morphosyntactic structure $[[danc]_V \text{er}]_N$, and is a phonological word that consists of two syllables of which the first carries the main stress of the word: ($'d\epsilon:n.s\partial r$) ω (the ω indicates a syllable boundary, the ω stands for 'phonological word'). Note that the word-internal

syllable boundary does not coincide with the word-internal morphological boundary, which is located after the /s/: /dɛ:ns-ər/. The relation between the phonological and the morphosyntactic level is regulated by interface constraints. In this case, the interface constraint is that the suffix *-er* is a cohering suffix that forms one domain of syllabification with its verbal stem. Hence, the suffix boundary is ignored in syllabification. On the other hand, the word internal boundary of English compounds coincides with a syllable boundary, as can be seen in the compound *dance-act* [dɛ:ns.ɛkt], where the /s/ is not syllabified as the onset of the second syllable, because this compound consists of two phonological words: (dɛ:ns)_ω (ɛkt)_ω.

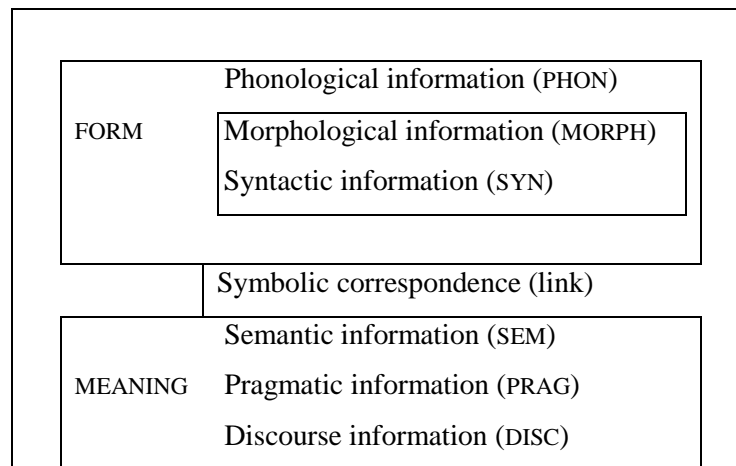
Phonological representations may also be correlated with specific morphological or syntactic constructions. For instance, in Ngiti, a language spoken in Congo, the plural forms of nouns that denote inalienable possession are always characterized by the tone pattern Mid-High, whatever the tone pattern of the singular forms (Kutsch Lojenga 1994: 135).²

Morphosyntactic properties are the word class of the complex word, and that of its base, inflectional properties for number, tense, and aspect, agreement properties such as gender, and morphological properties such as inflectional class. For instance, the gender of a complex word may be determined by the kind of suffix it ends in, as is the case for German deverbal nouns in *-ung* that always have feminine gender.

The meaning side of a construction comprises more than one aspect: not only semantic properties (conceptual structure), but also pragmatic properties and discourse properties. That is, the level of meaning in a parallel architecture comprises various sublevels. A classic example of a morphologically expressed pragmatic property is that diminutive words may be used for expressing endearment, as in *doggy* and *pussy*. Discourse properties relate to text and style. For instance, Bauer et al. (2013: 235) observe that “[t]he suffix *-ster* [as used in *dealster* ‘dealer, trader’, GB] is more colloquial than *-er*. It appears frequently in journalistic writing, often with a jocular tone. In novel forms it often carries an undertone of admiration or approval”. Another type of morphology that has to do with the pragmatics of communication is evidentiality, the grammatical marking of the source of evidence. For instance, in Tariana, an Arawak language from north-west Amazonia, the suffix *-naka* is added to the verbal form of a sentence when the source of information of the speaker is visual, but the suffix *-mha* when the source of information is non-visual, for instance smell (Alexandra Aikhenvald, lecture University of Leiden 21 Feb. 2014, see also Aikhenvald 2011).

This array of levels of information for constructions is summarized in (4) (Croft 2001: 18):

(4) Constructions as pairings of FORM and MEANING



Morphological construction schemas have two roles: they indicate how new words or -in the case of inflection- word forms of a certain type can be formed, and they have the function of motivation with respect to the set of existing complex words of a language, the conventional lexicon. Motivation means reduction of the degree of arbitrariness between form and meaning. In a simplex word like the verb *sing* the relation between form and meaning is completely arbitrary, but this is not the case for *singer*, whose meaning can be motivated on the basis of the meaning of its base verb and the meaning contribution of the word formation schema.

The creation of a new complex word can be formalized as the unification of the relevant word formation schema and the base word(s). When we unify schema (3b) with the noun *beer*, we get the adjective *beerless* with the meaning ‘without beer’. Creating a new complex word is possible when a schema is productive, which is the case for the schemas (3): it is easy to coin a new noun in *-er* (*facebooker*, *skyper*, *whatsapp*) or a new adjective in *-less*, as an internet search will reveal, where we find recently coined adjectives such as *ageless*, *airless*, *beerless*, *bosomless*, *captionless*, *dairyless*, *spineless*, *visionless* and *wineless* (some examples are from Bauer et al. 2013).

When a schema is not productive, it can still have the function of motivation for the properties of a set of existing complex words. We therefore need to assign a productivity index to schemas. The issue of productivity is a complex one, and cannot be dealt with in any detail in this chapter. The degree of productivity of a schema correlates with the number of types by which it is instantiated, and in particular with the occurrence of new types of a low frequency. This gives the language user a cue that a morphological pattern can be used productively (Barðdal 2008).

2. Holistic properties of morphological constructions

One of the motivations for using the notion ‘construction’ in morphological analysis is that constructions, as envisaged in Construction Grammar (Hoffmann and Trousdale 2013), may have properties that do not derive from their constituents, that is, are holistic in nature. This can be deduced from the fact that bound morphemes do not have a meaning of their own. For instance, the suffix *-er* in

(3a) does not carry a meaning of its own in isolation (note that there are also other bound morphemes *-er*, as in the comparative form of English adjectives). It is the constructional schema as a whole, that is *-er* in combination with a verb that evokes the agent meaning.

Reduplication, the repetition of words, is a prototypical example of a construction with a holistic property. For instance, Spanish nouns can be reduplicated in order to express the meaning ‘real x, as in *café café* ‘coffee-coffee, real coffee’ and *lana lana* ‘wool-wool, real wool’ (Feliu Arquiola 2011). Similar facts can be found in English (Ghomeshi et al. 2004), e.g. *salad-salad* ‘real salad’, and *book-book* ‘real book’, and in Dutch, e.g. *vakantie-vakantie* ‘holiday-holiday, real holiday’ and *leuk-leuk* ‘nice-nice, really nice’. This meaning contribution of reduplication can be accounted for in a constructional schema, as proposed in Feliu Arquiola (2011: 117) for Spanish:

(5) $\langle [N_i N_i]_{N_j} \leftrightarrow [\text{Prototypical interpretation of SEM}_i]_j \rangle$

A second example of a holistic property in word formation is the use of reduplication of verbs in Romance languages for the creation of action nouns that express repeated or intense action (Italian) or instruments (French) (Thornton 2008):

(6) *Italian*
fuggi-fuggi ‘run.away-run.away, stampede’
pigia-pigia ‘push-push, stampede’
French
coupe-coupe ‘cut-cut, machete’
pousse-pousse ‘push-push, rickshaw’

There are two holistic properties involved here. First, the category of the complex word (V) is different from that of its base words (N). Hence, the lexical category of these reduplicated nouns cannot be derived from its constituents, and is a property of the reduplication construction itself. We therefore call it an exocentric construction. Secondly, the meaning of intense activity in the Italian words, and that of repeated activity in the French words is a type of meaning often evoked by reduplication, and cannot be derived from one of the constituents: it is the copying configuration as such that carries the meaning of intensity or repetition. Therefore, reduplication can be accounted for by schemas of the following type, in which the form consists of two identical constituents (that carry the same index), and the meaning is specified on the right hand side of the schema:³

(7) $\langle [V_i V_i]_{N_j} \leftrightarrow [\text{Intensive/Repetitive Action of SEM}_i]_j \rangle$

Exocentric compounding implies the presence of a holistic constructional property. In Italian, for instance, we find compounds such as *porta-lettere* ‘carry-letters, postman’ and *carica-batteria* ‘charge-battery, battery charger’ that consist of a verbal stem followed by a noun, and function as (agent or instrument) nouns (Von Heusinger and Schwarze 2013). It is not the case that the noun constituent is the head of the compound from which its nominal character can be derived since there is no head: *porta-lettere* is not a subtype of *lettere* ‘letters’. Similar exocentric compound constructions occur in most other Romance languages (Scholz 2012) and there are also many exocentric compounds in Mandarin Chinese (Ceccagno and Basciano 2007) and Japanese (Kageyama 2010).

Holistic properties of a construction can be observed in type coercion effects. An example is the possibility to construct comparative and superlative form of Dutch adjectives that do not denote a gradable property in their standard interpretation. For instance, the adjective *dodelijk* ‘deadly, fatal’ is normally used in an absolute sense, as in *een dodelijk ongeluk* ‘a fatal accident’. However, it is also used in the superlative form as in:

- (8) De twintigste eeuw is een van de dode-lijk-ste eeuwen uit de geschiedenis
 The 20th century is one of the dead-li-est centuries from the history
 ‘The 20th century is one of the deadliest centuries of history’

Since superlative forms are only available for gradable adjectives, the adjective *dodelijk* is forced to be interpreted here as a gradable property: centuries can be put on a scale of deadliness. Thus, the superlative construction imposes the interpretation of ‘gradable property’ on the adjective *dodelijk*. The same applies to English, as in (Bauer et al. 2013: 105):

- (9) [...] Mr. Jeremy looked deader than any of them
 The more pregnant that I got, the worse the beatings got

Another example of type coercion in English is the prefixation of *un-* to stative verbs like *to see* and *to have*. In the [*un-V*]_V construction, these verbs are coerced to denote telic achievements, as observed in Bauer et al. (2013: 375):

- (10) And once you’ve seen it, you can never unsee it
 The other big difference is once you have AIDS, you can’t unhave it

Again, it is the construction as a whole that imposes this interpretation of telic achievements on these *un-*verbs.⁴

3. Schemas and subschemas in a hierarchical lexicon

As we saw in section 1, complex words can be seen as instantiations of abstract morphological schemas. The relation of instantiation is expressed by vertical links between the schema and the individual instantiations:

$$(11) \quad \begin{array}{cccc} <[x]_{Vi} er>_{Nj} \leftrightarrow [Agent\ of\ SEM_i]_j > & & & \\ | & | & | & | \\ [[danc]_V er]_N & [[fight]_V er]_N & [[sing]_V er]_N & [[walk]_V er]_N \end{array}$$

The individual words are form-meaning correspondences, and inherit the information specified in the schema, thus making parts of the information contained in the lexical entries for these words redundant. This does not mean that the predictable information is omitted, but that it counts as non-independent (predictable) information. Apart from this vertical link, the verbal bases of these nouns will be co-indexed to the corresponding lexical entries for these verbs, which also motivate part of the meanings of these agent nouns. The issue of inheritance and its relation to motivation is discussed in more detail in Booij (2015).

The representation of word formation patterns by means of schemas makes it possible to express generalizations about subsets of the complex words involved, by means of subschemas, in between the most general schemas and the individual words. The need for such subschemas can be illustrated by certain facts concerning Dutch compounds. All Dutch compounds are right-headed, hence the general schema for Dutch compounds is the following:

$$(12) \quad <[X_i Y_j]_{Yk} \leftrightarrow [SEM_j\ with\ some\ relation\ to\ SEM_i]_k >$$

This schema specifies that Dutch compounds are right-headed, as the lexical category variable Y (for N, A, or V) is the same for the right constituent and the compound as a whole. As to the semantic side, the meaning of a compound is the meaning of its head, modified by the meaning of the left hand constituent.

One subclass of these compounds are the NN compounds (where both X and Y have the value N). This subset is extremely productive, and these compounds can be recursive in that both the left-hand and the right-hand noun can be compounds in their turn. This does not apply, however, to another subset, AN compounds (with X=A and Y=N), where the A has – with a few exceptions - to be simplex. If the head is a V, the pattern is unproductive, as new verbal compounds cannot be coined in Dutch. Therefore, we need at least the following subschemas of (12) for Dutch compounds, in which these differential properties are specified:

$$(13) \quad <[N_i N_j]_{Yk} \leftrightarrow [SEM_j\ with\ some\ relation\ to\ SEM_i]_k > \quad \text{Productive, recursive}$$

- $\langle A_i N_j \rangle_{YK} \leftrightarrow [\text{SEM}_j \text{ with some relation to } \text{SEM}_i]_k >$ Productive, A = simplex
 $\langle [X_i V_j]_{YK} \leftrightarrow [\text{SEM}_j \text{ with some relation to } \text{SEM}_i]_k >$ Unproductive

A word formation schema may also have subschemas in which one of the slots is filled by a lexical item, because the use or meaning of the general schema may be conditioned by the presence of specific word constituents. If a schema contains both open and lexically filled positions, we call it a constructional idiom. In Japanese, various word formation patterns depend for their use on the presence of specific lexical items. Complex verbs can be formed by combining a verbal noun with the verb *suru* ‘to do’ (Kageyama 1999). Complex adjectives can be formed by combining a noun with the adjective *na* ‘null, without’, as in (Kishimoto and Booij 2014):

- (14) *otonage-na-i* *darasi-na-i*
 adult-null-PRES tidiness-null-PRES
 ‘childish’ ‘untidy’

The use of these word formation patterns depends on the presence of a specific lexical item. Hence, for the construction of the negative adjectives in (14), the following schema, a constructional idiom, is required:

- (15) $\langle [[X]_{Ni} [na]_{Aj}]_{Ak} \leftrightarrow [\text{WITHOUT}_j \text{SEM}_i]_k >$

A second example of the role of specific lexical items in the use of word formation schemas comes from Russian. In present-day Russian there is an increase of the use of right-headed NN compounds (a Germanic type of complex words), on the condition that one of the constituents is a borrowing from English (the native Russian equivalent of these compounds is an NP consisting of a noun and a relational adjective). Hence, we find productive subpatterns of the following types that are used to give a modern cosmopolitan flavour to the entities denoted by these compounds (Kapatsinski and Vakareliyska 2013):

- (16) $[art[N]_N, [N[bar]]_N, [N[kafe]]_N, [N[klub]]_N, [N[servis]]_N$

In other words, the productive use of the NN compound pattern depends on the presence of specific lexical items borrowed from English. Thus, it does not suffice to postulate an abstract NN compound pattern for Russian, as this will not specify when the pattern can be used for coining new NN compounds.

The necessity of subschemas is also shown by the phenomenon that constituents of compounds may have a specific meaning that is bound to the compound construction, and yet can be

used productively (Booij 2005). For instance, in English compounds of the form $[[top]N]_N$, the noun *top* has the specific meaning ‘of the highest level’, as in *top-achievement*, *top-experience*, and *top-secret*. The Dutch word *hoofd* ‘head’, as in *hoofd-probleem* ‘main problem’ has acquired the bound meaning ‘main’ in compounds. This use of *hoofd* is productive, and this is expressed by the following subschema for Dutch NN compounds:

$$(17) \quad \langle [[hoofd]_{N_i} [x]_{N_j}]_{N_k} \leftrightarrow [Main_i SEM_j]_k \rangle$$

Because of their bound meaning such compound constituents are referred to as affixoids: they are not affixes, as they occur as independent words, but they are similar to affixes in having a morphologically bound meaning. Such affixoids can be the source of new affixes. For instance, the German equivalent of Dutch *hoofd*, the noun *Haupt* has developed into a prefix with the meaning ‘main’ and the meaning of ‘head’ is now expressed by the noun *Kopf*. Another example of a word constituent that developed into an affix is the English adverb *out* which has acquired a specific meaning ‘to surpass in’ when combined with a verb, as in *outdance* ‘to surpass in dancing’ and *outperform* ‘to surpass in performance’. This bound meaning of *out-* has become productive with adjectives and nouns as well, as shown in Bauer et al. (2013: 343):

- (18) He didn’t out-smart himself
 She soon out-Cosmoed even ‘Cosmo’.

The category-changing, verbalizing power of this use of *out* suggests its having become separated from the adverb *out*, and having acquired the status of a prefix.

An example from Japanese of this kind of language change is given in Namiki (2010). The original meaning of the noun *hoodai* is ‘being free and selfish’. In present-day Japanese it has acquired the compound-specific meaning ‘at will’, as in *tabe-hoodai* ‘to eat at will’ and *katte-hoodai* ‘to do what you want’. Hence, we have to assume that Japanese has or had a subschema for XN compounds with the N slot filled by *hoodai*. Some grammarians of present-day Japanese therefore treat this word as a suffix, as it is no longer used as a word by itself.

The English word *bar* ‘drinking place’ has been borrowed in Chinese as the word *bā*. It occurs as the right-hand constituent of many Chinese compounds, and has acquired the more abstract meaning ‘place where some service is provided’ (Arcodia 2011). Hence, we need a specific schema

$$(19) \quad \langle [N_i-bā]_{N_j} \leftrightarrow [Place\ for\ SEM_i]_j \rangle$$

to account for this productive more abstract meaning of this word.

The necessity of subschemas for compounds is confirmed by the phenomenon of elative compounds (Booij 2010: Chapter 3, Hoeksema 2012) in which the first N functions as an intensifier, with negative or positive evaluation. Here are some Dutch examples of nominal (20a) and adjectival compounds (20b):

- (20) a. tering-wijf ‘consumption-wife, bitch’, kanker-wijf ‘cancer-wife, bitch’
 b. reuze-leuk ‘giant-nice, very nice’, bloed-serieus ‘blood-serious, bloody serious’

The modifier nouns in these compounds do not carry their literal meaning, but a more abstract meaning of intensification, which has to be specified in subschemas for Dutch compounds, because the intensifier use of these nouns is often productive. The word *reuze* is a combination of the Dutch word for giant, *reus*, followed by a linking element *-e*. In compounds, this word has acquired the more abstract meaning ‘very’ in combination with adjectives of positive evaluation. This has led to the emergence of a new adjective *reuze* that can be used as an adjective of positive evaluation (Van Goethem and Hiligsmann 2014).⁵

4. Schema unification

The use of a word formation schema for coining a complex word may depend on the simultaneous use of another word formation process. The Dutch negative prefix *on-* is attached to all kinds of adjectives including those ending in *-baar*. However, for quite a number of Dutch negative adjectives of the form *on-V-baar* there is no existing base adjective of the form *V-baar*. This is the case for adjectives such as:

(21)	<i>negative adjective</i>	<i>base verb</i>
	on-aantast-baar ‘un-assail-able’	aantast ‘assail’
	on-afwend-baar ‘un-avert-able’	af-wend ‘avert’
	on-uitstaan-baar ‘un-bear-able’	uitstaan ‘bear’
	on-verslijt-baar ‘in-destruct-ible’	verslijt ‘wear out’

Adjectives such as *aantastbaar* ‘assailable’ are not ungrammatical, but they have not been coined. The same observation can be made for English adjectives of the form *un-V-able*: in quite a number of cases there is no corresponding adjective of the form *V-able*. This applies to adjectives such as *unputdownable* and *uncomeatable*: the positive adjectives *putdownable* and *comeatable* are well-formed but do not belong to the established English vocabulary.

CM provides a straightforward account of such facts: schemas can be unified, and these unified schemas can give rise to a multiply complex word without the intermediate step being

necessarily available as an existing word. The form parts of the two schemas involved here can thus be unified:

$$(22) \quad [on-[A]_A + [V-baar]_A] = [on [V-baar]_A]_A$$

The amalgamated complex schema can give rise to this type of adjectives directly, and we are not forced to assume a discontinuous affix *on ... baar* in addition to the prefix *on-* and the suffix *-baar*. A similar schema can be assumed for English adjectives of the type *un-V-able*. This analysis also holds for verbs of the type *de-caffein-ate* and *de-stalin-ize* where both the prefix *de-* and the suffix *-ate* or *-ize* are used simultaneously to create a multiply complex word, as there are no verbs *caffein-ate* and *stalin-ize*.⁶

5. Paradigmatic relationships and second order schemas

As observed in section 1, the English deverbal nouns in *-er* (1a) stand in a systematic paradigmatic relationship to the corresponding base verbs:

$$(23) \quad \text{dancer-dance, fighter-fight, singer-sing, walker-walk}$$

The words in these pairs differ in their degree of morphological complexity, as the base words have one morphological constituent less than the corresponding derived words. However, words may also be related paradigmatically when they have the same degree of complexity. For instance, *walker* is also related to *walking*: they belong to the same word family and share a constituent *walk*. They have the same degree of morphological complexity: stem + suffix. Paradigmatic relationships are the source of paradigmatic word formation, in which a word is formed by replacing one of its constituents. For instance, English has the word family *impress, impression, impressive*. The derived noun and adjective share the verbal base *impress*. Given this word family, a language user might also assume that the *-ive* adjective has been created by replacing the suffix *-ion* with *-ive*, a morphological shortcut in establishing morphological relations between words. Given this option, (s)he may also relate *aggressive* to *aggression* in the same way, and this is in particular an option for those users of English who do not have a verb *to aggress* in their individual lexicon. Similarly, since we have triples of the type *walk-walker-walking*, we may also assume a direct relation between a noun in *-er* and a noun in *-ing*. This may give to paradigmatic word formation as in *crowd-butch-ing* ‘buying the meat of one identifiable cow together from a butcher’ based on a relationship with *butcher* and recent compounds like *crowd-funding*. This formation is possible even though there is no verb *to butcher* in English with the relevant meaning, once *butcher* has been analyzed as *butch-er*. Another example is the Dutch compound *huisman*, coined on the basis of the following set of words:

- (24) vrouw ‘wife’ huis-vrouw ‘house-wife, wife without outdoor job’
 man ‘husband’ huis-man ‘house-man, husband without outdoor job’

In this example, the second constituent of *huis-vrouw* has been replaced with *man*, thus producing the specific interpretation of the compound *huis-man*.

This kind of paradigmatic word formation is pervasive in the non-native stratum of the English lexicon. Consider the following set of non-native adjectives and nouns:

- (25) altru-ism altru-ist
 aut-ism aut-ist
 fasc-ism fasc-ist
 solips-ism solips-ist

Note that the roots of these words do not exist as words by themselves in English. An English language user does not know what *altru*, *aut*, *fasc*, or *solips* mean in isolation. It is only the meaning of words as a whole that is accessible. However, once you know what fascism is, you also know what a fascist is, namely an adherent of fascism. Words in *-ism* denote a philosophy, ideology, disposition, etc., and words in *-ist* denote the corresponding person with a relation to this philosophy, ideology or disposition. The relationship also holds in the inverse direction: autism is what an autist suffers from, fascism is the ideology of a fascist, etc. Hence, there is a systematic correspondence between the schema for words in *-ism* and those in *-ist* (Booij 2010: 33).

- (26) $\langle [x\text{-ism}]_{N_i} \leftrightarrow \text{SEM}_i \rangle \approx \langle [x\text{-ist}]_{N_j} \leftrightarrow [\text{person with property Y related to SEM}_i]_j \rangle$

This schema is a second order schema (Neset 2008, Kapatsinski 2013), as it is a schema of schemas. The symbol \approx denotes this paradigmatic relationship.

We thus see that the lexicon is a complex web of relations between words and morphological schemas: words are instantiations of schemas and may contain other words as building blocks, they are paradigmatically related in word families, and belong to morphological classes (like deverbal nouns in *-er*), schemas can be instantiated by subschemas, and there are second order schemas as well. This makes the lexicon a well structured whole of words and classes of words.

Second order schemas also serve to account for bracketing paradoxes, mismatches between the form and meaning of complex words. This can be illustrated by nominalization of particle verbs in Dutch. A number of Dutch simplex verbs have an irregular form of nominalization (the regular form is suffixation of the verb with *-ing*). Particle verbs usually have the same type of irregular nominalization as their base verbs. Hence, from the formal point of view the nominalization of a particle verb is the

combination of the particle and the nominalized form of its base verb. Semantically, however, it is the nominalization of a particle verb, which often has an idiosyncratic meaning. For instance, the meaning of the particle verb *aan-val* ‘to attack’ cannot be derived from the meaning of *aan* ‘at’ and that of *val* ‘to fall’. This idiosyncratic meaning recurs in the corresponding nominal. There is a bracketing paradox here, as the formal structure of these nouns is not isomorphic to their semantic structure. This pattern is illustrated in (27):

(27)	<i>verb</i>	<i>nominalized form</i>
a.	val ‘to fall’ aan-val ‘to attack’	val ‘fall’ aan-val ‘attack’
b.	kom ‘to come’ aan-kom ‘to arrive’	kom-st ‘arrival’ aan-kom-st ‘arrival’
c.	bied ‘to offer’ aan-bied ‘to offer’	bod ‘offer’ aan-bod ‘offer’
d.	slaan ‘to hit’ op-slaan ‘to store’	slag ‘hit’ op-slag ‘storage’
e.	geef ‘to give’ uit-geef ‘to publish’	gav-e ‘gift’ uit-gav-e ‘publication’
f.	zien ‘to see’ toe-zien ‘to survey’	zicht ‘sight’ toe-zicht ‘surveyance’

The examples (27) show that the idiosyncratic meaning of the particle verb recurs in the corresponding nominalization, even though the particle verb as such is not a formal constituent of these nominalizations. The mismatch can be taken care of by assuming a second order schema that specifies the relationship between particle verbs and particle + deverbal noun compounds:

$$(28) \quad \langle [\text{Part}_i \text{V}_j]_k \leftrightarrow \text{SEM}_k \rangle \approx \langle [\text{Part}_i [\text{V}_j\text{-x}]_N]_{Nm} \leftrightarrow [\text{NOM} [\text{SEM}_k]]_m \rangle$$

In the schema on the right, NOM stands for the semantic effect of nominalization. This second order schema thus specifies that the meaning of the particle verb is a subpart of the particle + nominalized base verb, even though Particle and Verb do not form a formal constituent in these nominalizations.

6. Morphological and syntactic constructions (periphrastic word formation)

A basic idea of Construction Grammar and CM is that there is no sharp demarcation of grammar and lexicon. The lexicon contains both words and the abstract schemas that they instantiate. However, it does not suffice to only have constructional schemas for words, because various type of phrasal

continue writing', etc. The notion of 'constructional idiom' introduced in section 3 for subpatterns of compounding is also appropriate here. For instance, the *door-V* pattern is accounted for by the following subschema for particle verbs in which the particle position is filled with the word *door*:

(31) <[[*door*]_{PART} [x]_{vi}]_{vj} ↔ [Continue SEM_i]_j>

The formation of particle verbs has been characterized as periphrastic word formation (Booij 2002), because it performs the same task as affixation: it creates complex verbal predicates. Moreover, it often stands in a relation of competition with prefixation. In English, for instance, the restricted use of prefixation for coining new complex verbs has to do with the very productive use of the particle verb option for that purpose. Prefixes may derive diachronically from particles. For instance, German *unter-* 'under' is being used both as a particle and a prefix, and the particle use is the oldest one.

(32) particle verb *unter-halten* 'to keep under'
 prefixed verb *unter-halten* 'to maintain'

In many languages, phrases consisting of an adjective and a noun serve as lexical items. These word sequences often have a conventionalized meaning or use. Here are some examples:

(33) English A + N *dark room*
 French A + N *moyen âge* 'Middle Ages'
 Italian A + N *terzo mondo* 'Third World'
 Greek A + N *psychros polemos* 'cold war'
 Polish N + A *kuchenka mikrofalowa* 'lit oven microwave-SUFF_A, microwave'

In all examples except the English one the phrasal nature of these word sequences can be deduced from the fact that the adjectives agree in number and gender with the head noun of these phrases, and therefore carry specific endings. For instance, the Italian adjective *terzo* ends in *-o* because the head noun is masculine singular, and hence requires the ending *-o* on the adjective. The principle of Lexical Integrity excludes agreement from applying to constituents of complex words.

More examples of phrasemes are given in various European languages are given by Masini (2009). These conventionalized multi-word units of various sizes are stored in the memory of language users, and this type of knowledge is an important precondition for full mastery of a language (Wray 2002). Such phrases in their turn can also feed word formation, as is the case for Russian where they are abbreviated into so-called stump compounds, for instance (Benigni and Masini 2009: 173):

(34) *gorodskij sovet* 'city-_{ADJ} council' > *gorsovet* 'city council'

These observations imply that phrasal constructional schemas are listed in the grammar, in combination with those instantiations of these schemas that form conventionalized lexical items. For instance, the phrasal schema [A N]_{NP} of English is instantiated by many lexical units of the type *dark room*, *red flag*, and *yellow fever*. Thus, the lexicon becomes a ‘constructicon’, as it contains both phrasal and morphological constructions, together with their conventionalized instantiations.

7. Inflectional schemas

So far, this chapter focused on the CM approach to word formation patterns. Since morphology also comprises inflection, the question is now how inflection should be accounted for. Let us take a simple case of inflection, the pluralization of English nouns. The default option is suffixation with /-z/ (a suffix with three allomorphs, [s], [z], [ɪz]). The default form part of the schema for plural nouns is therefore:

$$(35) \quad \langle [(x_i-z)_{\omega-j} \leftrightarrow [N_i, +pl]_j \leftrightarrow [PLU [SEM_i]]_j] \rangle$$

The schema in (35) specifies the phonological form, the morphosyntactic form (word class and the morpho-syntactic feature value for number [+pl(ural)]), and the meaning of plural nouns. Recall that we need at least two formal levels of representation, the phonological level and the morphosyntactic level (Jackendoff’s tripartite parallel architecture). At the phonological level we find a prosodic word ω that consists of the string x of the stem followed by /z/. The semantic correlate of the feature [+pl] is represented here as the semantic operator PLU, which might be interpreted as ‘more than one’. However, this is an oversimplification: in certain syntactic contexts the operator PLU may receive a generic interpretation. Consider the following dialogue:

$$(36) \quad \text{Do you have children? Yes, one.}$$

The answer in this dialogue makes clear that the question is not whether the addressee has more than one child. If the answer had been *No, one*, this would have coerced the default meaning ‘more than one’ of PLU. There are also English nouns like *scissors* and *trousers* that have a plural form and trigger the selection of plural verb forms in subject-verb agreement, but do not receive a semantically plural interpretation. Similar observations can be made for the semantic interpretation of tense features of verbs. For instance, [present tense] does not always mean ‘at the moment of speaking’, as it can also be used in a story about the past, the so-called praesens historicum, in order to achieve a certain liveliness and dramatic style in one’s narrative.⁸

In most cases, a noun has a singular form. In English, this form has no overt morphological realization. Hence, the schema for singular nouns is as follows:

$$(37) \quad \langle [(x_i)_{\omega-j} \leftrightarrow [N_i, +sg]_j \leftrightarrow [SING [SEM_i]]_j] \rangle$$

This schema expresses that the stem form of English nouns (x_i) also functions as sg (= singular) form. Again, the SING property may require further interpretation, as it may also refer to a category of entities, not just to a single entity, in generic statements such as:

$$(38) \quad \text{A thing of beauty is a joy for ever}$$

The correlation between singular and plural forms is expressed by a second order schema, a combination of the schemas (35) and (37).

$$(39) \quad \langle [(x_i)_{\omega-j} \leftrightarrow [N_i, +sg]_j \leftrightarrow [SING [SEM_i]]_j] \rangle \approx \\ \langle [(x_i-z)_{\omega-j} \leftrightarrow [N_i, +pl]_j \leftrightarrow [PLU [SEM_i]]_j] \rangle$$

The assumption of a schema for plural nouns is motivated by the fact that plural nouns of sufficient frequency are stored in the mental lexicon, even if they are fully regular, as has been shown for Dutch and Italian (Baayen et al. 1997, Baayen et al. 2003). That is, storage does not imply that these plural nouns are irregular, and they will be linked to schema (35). This plural schema also has a motivating role with respect to pluralia tantum, nouns that only have a plural form, such as (*the*) *Alps*, *darts*, and *measles*. Some of these nouns trigger plural agreement on verbs, other do not. For instance, *linguistics* is a plural form but selects singular verb forms, whereas *measles* requires a plural verb form. That is, such plural forms may not possess all the properties predicted by the relevant schema. They will be linked to that schema, but we assume that default inheritance applies, that is, the individual plural nouns inherit all properties from the schema unless specified otherwise in the relevant lexical entry for that plural noun.

Just like word formation schemas, inflectional schemas possess holistic properties. This can be concluded from type coercion effects. Pluralization presupposes that the noun involved is a count noun. Mass nouns, abstract non-count nouns, and proper nouns can be coerced to be interpreted as count nouns by means of pluralization:

- (40)
- a. cheeses, rices, wines
 - b. Romanticisms, Englishes
 - c. We have four Mary's in our family

In (40a) we coerce the meaning ‘type of’, in (40b) the plural form implies that there are different varieties of Romanticism and English, and in (40c) we coerce the proper name *Mary* which normally has a unique referent in a specific discourse to be interpreted as ‘person with the name *Mary*’. These forms of type coercion thus support a constructional analysis of inflectional patterns.

The concept of second order schemas is very useful for the treatment of inflection because the choice of a specific ending may depend on the choice of an ending for another form of the same word. This can be illustrated by the way in which Italian nouns are pluralized. The basic patterns are as follows (*x* is a variable for the phonological content of the stem):

(41)	<i>singular</i>	<i>plural</i>	<i>example</i>
a.	x-a	x-e	porta ‘door’ porte ‘doors’
b.	x-o	x-i	amico ‘friend’ amici ‘friends’
c.	x-e	x-i	sede ‘seat’ sedi ‘seats’

This means that there are three inflectional classes of nouns, as far as pluralization is concerned. These three inflectional classes can be identified by their singular forms. Hence, we do not need arbitrary indices for these classes in order to select the right pluralization process for a noun, if we assume the following second order schemas for Italian nouns (with omission of the semantic level, for ease of exposition). These schemas reflect the way in which the morphology of Italian nouns is taught in second language education:

(42)	a.	$\langle (x_i\text{-}a)_{\omega\text{-}j} \leftrightarrow [N_i, +\text{sg}]_j \rangle \approx \langle (x_i\text{-}e)_{\omega\text{-}j} \leftrightarrow [N_i, +\text{pl}]_j \rangle$
	b.	$\langle (x_i\text{-}o)_{\omega\text{-}j} \leftrightarrow [N_i, +\text{sg}]_j \rangle \approx \langle (x_i\text{-}i)_{\omega\text{-}j} \leftrightarrow [N_i, +\text{pl}]_j \rangle$
	c.	$\langle (x_i\text{-}e)_{\omega\text{-}j} \leftrightarrow [N_i, +\text{sg}]_j \rangle \approx \langle (x_i\text{-}i)_{\omega\text{-}j} \leftrightarrow [N_i, +\text{pl}]_j \rangle$

The necessity of second order schemas for the domain of inflection is obvious in the Word-and-Paradigm approach to inflection (Blevins 2006). In this approach, the forms in the cells of an inflectional paradigm are not computed on the basis of an abstract stem to which the inflectional endings are added. Instead, these forms are computed on the basis of principal parts of the paradigm. A schoolbook example is the way in which Latin noun declensions work. The nominative plural of *rex* ‘king’, for instance, is computed by starting from the genitive singular form *reg-is* which is the revealing form: we compute the correct form *reges* ‘kings, nominative, pl.’ by replacing *-is* with *-es*.

A particular inflectional form may play two different roles in accounting for the construction of inflectional forms. First, particular inflectional forms or a combination thereof may be used to identify the inflectional class to which a word belongs (Finkel and Stump 2007, Finkel and Stump 2009). For instance, the genitive singular form of the Latin noun *rex* ‘king’, *reg-is*, identifies this noun as belonging to the 3rd declension. That is, *reg-is* is a ‘principal part’ of the inflectional paradigm of

rex. Secondly, an inflectional form may be used to compute the form of other cells in the same inflectional paradigm (Ackerman et al. 2009, Blevins 2006). For instance, the Saami first declension nouns exhibit a pattern based on two principal parts, the genitive singular and the nominative singular. These noun forms are subject to gradation, a phonological alternation between strong and weak forms. If the nominative singular form is strong, and hence has a geminate, the illative singular and the essive form are also strong. In that case, the genitive singular has a weak form, with a single consonant (as in *bihttá* vs *bihta* ‘piece, nom. sg./gen. sg.’). Conversely, if the nominative singular form is weak, the corresponding illative sg. and the essive are weak as well, whereas in that case the genitive singular form is strong (as in *bargu* vs *barggu* ‘work, nom.sg./gen.sg.’ (Blevins 2006: 546). In other words, morphological generalizations about such paradigms can only be made in terms of systematic paradigmatic relationships between cells of these paradigms. The relations between the nominative sg., the illative sg., and the essive can be expressed as paradigmatic correspondence relations between morphological schemas (given here in a simplified form), that is, a second order schema:

$$(43) \quad [x-\acute{a}]_{\text{NOM.SG}} \approx [x-\acute{a}i]_{\text{ILLATIVE.SG}} \approx [x-\acute{a}n]_{\text{ESSIVE}}$$

If the variable x stands for a strong stem with a geminate consonant, as in *bihttá*, this geminate consonant will be predicted to recur in all three forms. Inversely, if x stands for a weak stem, as in *bargu*, it is predicted that this weak stem also shows up in these three inflectional forms. That is, these mutually implicative relationships between paradigm cells can be expressed straightforwardly by making use of schemas for fully specified inflectional forms and paradigmatic relationships between such schemas.

Inflectional schemas are also extremely helpful in dealing with the phenomenon that in many cases there is no one-to-one correspondence between form and meaning in inflectional morphology. One ending may express more than one property (= feature value), the phenomenon of cumulative exponence, and schemas can express this straightforwardly, because a form with a specific ending can be specified as corresponding to a multiple set of morpho-syntactic features, for instance a combination of a case property and a number property. Inversely, in the case of extended exponence one morpho-syntactic property is expressed by more than one word constituent. In the Latin verb form *amavi* ‘I have loved’, for instance, the property of perfect tense is expressed both by the v , and by the choice of i as the 1st person singular ending. This can easily be expressed in a schema:

$$(44) \quad \langle (x_i-v-i)_{o-j} \leftrightarrow [V_i, \text{perfect}, 1^{\text{st}} \text{ pers. sg}]_j \rangle$$

The schematic representation of inflectional forms of word can also be used to deal with the phenomenon that a combination of inflectional elements may carry a different meaning than they have in isolation. For example, in Totonac, a language spoken in Mexico, the prefix *ik-* indicates 1st pers.

sg. subject, and the suffix *-w* the 1st person plural inclusive subject. However, together they indicate another grammatical category, the 1st person plural exclusive (Beck and Mel'cuk 2011). This can be expressed by assuming an inflectional subschema for this combination of inflectional affixes of the form:

$$(45) \quad [ik-[V-ASPECT]_{i-w}]_{Vi} \leftrightarrow [SEM_i, 1st\ pers\ pl.\ exclusive\ subj]_j$$

The phenomenon of inflectional periphrasis also throws light on the architecture of the grammar and the form of grammatical generalizations. In many languages with inflection, some inflectional categories are expressed by word combinations rather than by words. In English the category of perfect tense is a periphrastic category, as it is expressed by the combination of an auxiliary (a form of *to have*) and a past participle. Similarly, passive voice is expressed by the combination of a form of *to be* and a past participle. Similar phenomena can be observed for most Germanic and Romance languages. Auxiliaries are words that may have an independent existence as lexical verbs, but have a specific grammatical meaning in a periphrastic construction. For instance, the verb *to have* means 'to possess' when used as a lexical verb, but carries the grammatical meaning of perfect tense when combined with a past participle. The perfect meaning is a property of the construction as a whole, as it is neither derivable from the auxiliary as such nor from the past participle (which combines with present tense as well, in the passive construction with *to be*). Hence, we need schemas such as the following for the English perfect tense:

$$(45) \quad <[[have]_{Vi} [x-ed]_{Vj-Past\ Part}]V'_k \leftrightarrow [Perf [SEM_j]]_k>$$

This schema illustrates that words may have meanings bound to specific phrasal constructions, just as was the case of certain words as parts of compounds. Schema (45) is again a constructional idiom because it contains both a lexically filled slot, and an open slot for the lexical verb.¹⁰ The English progressive form is another example of a periphrastic constructional idiom, in which the verb *to be* combines with a word of the form *[V-ing]* in order to express progressive aspect. In this constructional idiom the suffix *-ing* plays a specific role, different from that in gerunds (Lee 2007). The Dutch progressive form has the form of a PP, with the slots for the P and the Determiner fixed, followed by the infinitival form of the verb (Booij 2008, 2010: Chapter 6):

$$(46) \quad \begin{array}{l} \text{Mijn broer is aan het fiets-en} \\ \text{My brother is at the cycle-INFINITIVE} \\ \text{'My brother is cycling'} \end{array}$$

These examples all show that phrasal constructional idioms serve to express periphrastic inflectional patterns.

8. Summary and conclusions

In this chapter we have seen how the notion ‘construction’, as it has been developed in the framework of Parallel Architecture (Jackendoff 2002) and Construction Grammar (Goldberg 2006, Hoffmann and Trousdale 2013) is a very fruitful concept for an insightful analysis of morphological phenomena. The model of morphological analysis developed here, that of Construction Morphology (Booij 2010), appears to be able to do justice to generalizations across words of various degrees of abstraction. The model is in accordance with the requirement of ‘graceful integration’ (Jackendoff 2011), i.e. the requirement that grammatical models should be in harmony with findings in related domains such as language acquisition, language change, and psycholinguistics.

This chapter also pointed out that morphological and syntactic structures can be quite similar, and accounted for by constructional schemas. This does not mean that we give up the difference between syntax and morphology. We do need a distinction between word level constructions and phrase level constructions for an adequate account of the data (Booij 2009). The similarities suggest that the acquisition mechanism for syntax and morphology may be in essence the same: abstraction based on an increasing number and range of inputs. The notion of a hierarchical lexicon with subschemas also provides insight into how new affixes may emerge from compound constituents. The development of particles into prefixes shows how syntactic constructions can develop into morphological ones.

CM also does justice to psycholinguistic findings concerning the balance and relationship between computation and storage. Human lexical memory has vast storage capacities, and storage does not compete with computation. On the contrary, the computational competence of language users and hence their creativity is strengthened by their having a rich and well structured construction.

In sum, CM offers an interesting and fruitful avenue of research into the structure of the lexicon, the architecture of the grammar, and the nature of linguistic generalizations.

Notes

1. However, some Construction Grammarians call an individual complex word type also a 'construction', and reserve the term 'construct' for individual tokens of these types (Traugott and Trousdale 2013), or for instantiations of a word formation schema that do not (yet) form part of the conventional lexicon (Hilpert 2014).
2. This also holds for syntactic constructions. For instance, in Dogon, tonal patterns mark specific syntactic constructions, the phenomenon of 'tonosyntax' (Heath and McPherson 2013).
3. See Caballero and Inkelas (2013), Khanjan and Alinezhad (2010), Lúis (2014), Orié (2012) for further discussion of reduplication as a doubling configuration in CM.
4. More examples of type coercion in English morphology are given in Bauer et al. (2013: 557-562).
5. Detailed studies of affixoids in some Germanic languages can be found in Ascoop and Leuschner (2006), Leuschner and Decroos (2008), and Van Goethem (2008). In Hilpert (2013), Traugott and Trousdale (2013: chapter 4), Booij and Hüning (2014), and Hüning and Booij (2014) the diachronic dimension of affixoids and the relation with grammaticalization and lexicalization are discussed.
6. More examples of schema unification can be found in Booij (2010: 41-50).
7. A more detailed treatment of Dutch and English particle verbs can be found in Los et al. (2012). This book also refers to the literature on particle verbs in other Indo-European languages.
8. This point is also discussed in Bauer et al. (2013: 122-123), in Booij (2012: 215), and in Spencer (2013: 219-249).
9. See also Harris (2009) for a CM analysis of an interesting case of exuberant exponence in Batsbi, a Nakh-Dagestanian language.
10. For more discussion of the implications of periphrasis for the architecture of grammar, see Ackerman and Stump (2004), Chumakina and Corbett (2013), and Sadler and Spencer (2001).

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