The construction of words

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1. Introduction: constructional schemas for complex words

An essential part of the linguistic competence of native speakers of a language is their potential awareness of the systematic correspondence between the form and meaning of complex words. Consider the following four pairs of related English words:

(1)   answer   answerable
         bake   bakeable
         abridge   abridgeable
         archive   archiveable

The difference in form between the words in the left column and those in the right column correlates systematically with a difference in meaning: all words in *-able* have the meaning 'can be V-ed', where V stands for the meaning of the corresponding verb on the left. There is also a difference in syntactic class: the words on the left are verbs, and those on the right are adjectives. English feature hundreds of such adjectives, and this set can be easily extended. For instance, as there is a verb *to skype*, we may coin the adjective *skypable*. Therefore, users of English can conclude to a generalizing schema for the construction of adjectives ending in *-able*, based on their actual experience with a number of such adjectives. This schema is a constructional schema: it accounts for the systematic pairing of form and meaning in a set of words. Constructions are pairings of forms and meanings, and constructional schemas express the systematicity in this pairing of form and meaning. We may thus assume the following constructional schema for English:

(2) $< [[x]_{V_i} able]_{A_j} \leftrightarrow [\text{can be Patient of SEM}_i]_{\text{PROPERTY}_j} >$

The schema is demarcated by angled brackets. The double arrow denotes the correspondence between the form on the left and the meaning on the right. The indices specify correlations between form parts and meaning parts. The index *i* of the verbal base corresponds with a meaning component of the

adjectives, SEM$_i$, where SEM stands for Semantics. In other words, the meaning of the verb is a part of the meaning of the corresponding adjective. The index *j* correlates the form and the meaning of these adjectives as a whole. The variable *x* stands for the phonological form of the base verb.

Speakers of English have stored lots of such adjectives in -*able* in their lexical memory, but will differ in which adjectives exactly are stored. Constructional schema (2) has two functions. On the one hand, it has the function of 'motivation' with respect to stored exemplars of this word formation pattern. This means that the meaning of such adjectives is not completely arbitrary, unlike that of phonologically similar simplex words such as *table* and *cable*. On the other hand, this schema serves to understand the meaning of adjectives of this form that one came never across before, and to enable a language user to coin new ones oneself. This type of abstract knowledge of language is usage-based: the language user has to be exposed to a sufficient number of use of different types of such deverbal adjectives before (s)he can develop the corresponding abstract schema.

The use of schemas for the representation of linguistic knowledge is a characteristic feature of cognitive linguistic approaches, and in particular for the various models of Construction Grammar. This approach contrasts with the rule-based approach of classical generative grammar. An important difference between these two is that schemas are output-based, and can express directly that linguistic knowledge is based on observed language use. Below, we will encounter more detailed arguments why schemas are better than rules for the representation of linguistic knowledge, in particular lexical knowledge. In section 2, I sketch a model of the architecture of grammar in which morphology finds its proper place. Section 3 discusses the nature of the lexicon, and its hierarchy of schemas and subschemas. Section 4 argues that constructional schemas for complex words can account for mismatches between the form and meaning of complex words. In section 5 I show how the use of morphological schemas, both inflectional and derivational ones, may depend on syntax. In section 6 it is argued that constructional schemas have the optimal format for expressing generalizations concerning inflectional systems. Section 7 summarizes our findings concerning the proper analysis of the construction of complex words.

2. The architecture of grammar

How does 'the grammar of words' fit into a general model of the architecture of grammar? In order to answer this question, we have to reflect on the types of information involved in lexical representations. A word is usually a combination of phonological, morphosyntactic, and semantic information. Therefore, schemas for complex words have to contain these three types of information. Note that the form part on the left-hand side of schema (2) above is in fact a conflation of information on two different tiers: phonological information and morphosyntactic information. We can decompose it as follows:

(3) $<(x_i \; [\text{əbəl}]_k)_{\omega j} \quad \leftrightarrow \; [V_i - \text{SUFFIX}_k]_{Aj} \leftrightarrow [\text{can be Patient of SEM}_i]_{\text{PROPERTY}j}>$

The leftmost part of (3) states that words in *-able* are prosodic words (symbolized by ω) ending in the phonological sequence /əbəl/ preceded by a number of segments (*x*) which corresponds with the phonological string of the base verb. The middle part of this schema states that these words are adjectives derived from verbs. Schema (3) thus expresses the correspondence between information on three different levels of representation. This is referred to as the 'tripartite parallel architecture of grammar' (PA) (Jackendoff 2002, Booij and Audring 2016; to appear). The model of morphological analysis within PA is referred to as Construction Morphology (abbreviated as CxM), and is outlined in detail in Booij (2010).

In radical versions of cognitive grammar one finds the claim that schemas express a direct correspondence between phonological form and meaning, without an intervening level of morphosyntactic information, also at the word level (Taylor 2002: Chapter 14; 2015). For instance, the English morpheme /s/ is claimed to be linked directly to the meaning PLURAL. In my view this is inadequate. For instance, the morphosyntactic property [plural] does not only express "a plurality of entities" (Taylor 2002: 267), but requires a more complicated set of semantic interpretation rules. For example, in the question *Do you have children?* the answer can be *Yes, one*, whereas the answer *No, only one* is odd. That is, plural forms of nouns may receive a generic interpretation. On the other hand, the use of plural forms does not depend on the specific phonological form of the plural marking. Dutch features two competing suffixes for plural marking, *-s* and *-en*. The choice between these two suffixes is governed by phonological output conditions, and morphological conditions as well (Booij 2002: 21-32). That is, the morphosyntactic feature [plural] is the feature that mediates between phonological forms on the one hand, and a range of semantic interpretations on the other. Therefore, a grammar with three tiers, as also assumed in Croft and Cruse (2004: 254-56), is to be preferred.

The level of semantics should be given a broad interpretation, also comprising the pragmatic dimension, because morphological constructions may have specific pragmatic properties. In many languages diminutive morphology may also express endearment, and this has a specific pragmatic or stylistic value. Another example of the pragmatic role of morphology is that the infinitive form of Dutch verbs can be used as the predicate of simplex sentences as an imperative, as in:

(4)   Oppass-en (jij) 'Be-INF careful (you)!'
       Opet-en die appel 'Eat-INF that apple'

Hence, it does not suffice to specify the morphosyntactic properties of the Dutch infinitive (form: stem + *-en*, non-finite, can function as neuter noun). In addition, the potential for imperative use illustrated in (4) must be specified for this inflected form of Dutch verbs. Therefore, the term 'semantic tier'

should be replaced with the more general term 'conceptual tier' which comprises pragmatic and discourse properties as well (Jackendoff 2002: Chapter 12).

German complex verbs in *-eln* (*-n* is the infinitive ending) illustrate how semantic and pragmatic properties of morphological constructions can be intertwined. These verbs can be derived from verbal, nominal, and adjectival stems. Here are some examples:

(5)   hüst-eln 'cough slightly and repetitively'   < husten 'to cough'

            füß-eln 'play footsie'   < Fuß 'foot'

            fremd-eln 'be scared of strangers'   < fremd 'strange'

These verbs have an expressive or evaluative, more specifically attenuative meaning. This attenuative meaning has both semantic aspects such as low intensity and repetition, and pragmatic aspects such as contempt, affection, euphemism, or trivialization. These semantic and pragmatic properties have to be specified on the tier of conceptual structure. A detailed CxM account of these properties in terms of constructional schemas can be found in Weidhaas and Schmid (2015).

A basic insight of Construction Grammar is that constructions may have holistic properties that cannot be derived from properties of their constituents. A straightforward example from the domain of morphology is full reduplication, in which a word is doubled. The doubling configuration as such has specific semantic values, depending on the language and the word class, for instance, 'plural' for reduplicated nouns, and 'intensity' or 'repetition' for reduplicated verbs. These meanings are not derivable from one of the (identical) constituents of such compounds, but are evoked by the copying configuration as a whole. Constructional schemas can express such holistic properties. For instance, the plurality meaning of noun reduplication can be accounted for as follows (PLUR stands for the semantic operator of plurality):

(6) $<[N_i \; N_i]_{Nj} \leftrightarrow [\text{PLUR SEM}_i]_j>$

In the case of exocentric compounds (compounds without a head constituent) such as the Greek compound *filo-sofos* 'lit. love-wisdom, lover of wisdom, philosopher' (Ralli 2013), with the formal structure $[V \; N]]_N$, a certain meaning component (in this example the Agent of the action) is not expressed by one of the constituents of this compounds, but evoked by the compound structure.

Semantic coercion is another indication of the holistic semantic properties of morphological constructions. For instance, the deadjectival suffix *-ness* creates words to denote properties. Hence, when we coin a word like *Britishness* 'the state or quality of being British, or of embodying British characteristics', the relational adjective is coerced into a qualitative adjective that denotes the prototypical or characteristic properties of British people. The same holds for the prefix *un-*, as in *un-British* 'not characteristic of or consistent with British customs, habits, or traditions', which contrasts

with *non-British*, in which the relational meaning is preserved. Another example is the use of the English prefix *un-* with other base words than inchoative or causative verbs. The attachment of *un-* to such verbs coerces a change of the semantic class of the base: "*un-* can take a stative, activity or other kind of verb and force it into a causative/inchoative verb that implies a reversible result" (Bauer et al. 2013: 374). Examples are the verbs *un-inhabit, un-grow, un-see, un-have*, and *un-hit*. These examples show that morphological constructions have the power to trigger semantic overrides, and this implies that the constructions themselves have specific semantic properties.

A construction may have holistic properties on the phonological level as well. In other words, there is construction-specific phonology, as shown with lots of examples in Inkelas (2014). For instance, in Turkish the place name-forming suffix *-iye* triggers lengthening of the vowel /a/ in stem-final open syllable, as in *Murad* (name) /murad/ - *Murad-ije* (place name) [mura:dije] (Inkelas 2014: 33). This vowel lengthening is the exclusive property of the morphological construction with the suffix *-iye*. Another example is that in English compounds it is normally the first constituent that carries the main stress (the Compound Stress Rule). This implies the existence of a stress pattern that is specific for compounds, hence a property that is specific for this morphological construction.

3. The hierarchical lexicon and the role of subschemas

A basic idea of Construction Grammar is that the grammar of a language of a language is to be conceived as a multidimensional network of constructions of varying degrees of abstractness. As far as morphology is concerned, the lexicon comprises a hierarchy of constructional schemas and subschemas. These schemas dominate the individual existing complex words by which they are instantiated.

The necessity of subschemas, in between the most abstract schemas and the individual words is illustrated here by a set of Dutch NN compounds. Consider the following compounds of Dutch, all found through an internet search (20.07.2015):

(7)   pracht-baan 'great job'
        pracht-dag 'great day'
        pracht-cadeau 'great gift'
        pracht-kerel 'great guy'
        pracht-professor 'great professor'
        pracht-stad 'great city'

In all these (right-headed) compounds the noun *pracht* 'splendour, beauty' expresses a positive evaluation of the referent of the head noun.[1] This use of *pracht* as an evaluative expression can also be

observed in a phrasal evaluative construction, the Dutch equivalent of the English *an X of a Y*-construction:

(8)   een pracht van een meid 'a splendour of a girl, a beautiful girl'
        een pracht van een baby 'a splendour of a baby, a beautiful baby'

What we observe here is that the noun *pracht* has acquired a productive, more abstract meaning of very positive evaluation in the morphological construction of N + N compounds (and also in the *an X of a Y*-construction). Hence, compound constituents may acquire productive, yet construction-bound meanings. At first sight, this extension of the use of the bound meaning 'great' for *pracht* may look as a case of analogy, in which this use is extended from one established compound to another, new one. A clear example of such an analogical extension is the coinage of the German compound *Mundwerker* (Vater 2010):

(9)   Hand-werker 'manual labourer, who uses his hands to make a living'
        Mund-werker 'oral labourer, who uses his mouth to make a living'

However, in the case of *pracht*, there is no specific compound that can be designated as the source of the other ones. Hence, we are justified to conclude that the grammar of Dutch has acquired the following constructional schema:

(10) $<[[pracht]_{Ni} [x]_{Nj}]_{Nk} \leftrightarrow [great_i SEM_j]_{SEMk}>$

This schema may give rise to new compounds of this type, without a particular established compound with *pracht* being the source.

Construction (10) is a subcase of the $[N+N]_N$ compound construction of Dutch. Like all $[N+N]_N$ compounds, the *pracht*-compounds are right-headed. This generalization can be expressed in a hierarchical lexicon, in which abstract constructional schemas are instantiated by subschemas that generalize over subsets of compounds. The individual compounds are instantiations of these subschemas. Thus we get the following hierarchy for *pracht*-N compounds, with *prachtbaan* as one of the many established instantiations:

(11) $<[[y]_{Ni} [x]_{Nj}]_{Nk}$ $\leftrightarrow$ $[SEM_i SEM_j]_{SEMk}>$
                          | |
         $<[[pracht]_{Ni} [x]_{Nj}]_{Nk}$ $\leftrightarrow$ $[great_i SEM_j]_{SEMk}>$
                          | |
         $<[[pracht]_{Ni} [baan]_{Nj}]_{Nk}$ $\leftrightarrow$ $[great_i job_j]_{SEMk}>$

This example also serves to illustrate how language users develop morphological knowledge. The starting point is the words they encounter in language use, and which are stored in lexical memory. Recurrent patterns in the set of stored complex words can be recognized, and will lead to the construction of schemas of various degrees of abstraction, some still partially lexically specified. "Repeated analogical extensions may over time lead to the emergence of a general schema […], which invites further additions to the range of expressions occurring in this now partly schematic idiom" (Hilpert 2013: 471). The repeated occurrence of various types of compounds in language use will bring the language user to store such compounds, and to construct compound schemas of various degrees of abstractness which are linked in hierarchies of the type exemplified in (11). In short, there are various levels of schematicity in usage-based approaches to morphology: micro-, meso- and macro-constructions (Barδdal 2011, Traugot 2008). This also relates to productivity, as pointed out by Barδdal (2008; 2011) [..] who has claimed that the productivity of abstract constructions can be seen as an inverse correlation of type frequency and semantic coherence, with highly abstract macro-constructions only arising if the underlying meso-constructions have a high type of frequency and a high degree of variance in semantic distribution" (Hoffmann 2013: 315).

Another example of this type of morphological patterning comes from Sranan Tongo, an English creole language spoken in Surinam. In this language the English borrowing *man* 'man' has acquired the more abstract meaning of agent, as illustrated by the following examples:

(12)   borgu 'guarantee'   borgu-man 'money-lender'
        siki 'illness'   siki-man 'patient'
        strafu 'punishment'   strafu-man 'prisoner'
        wroko 'work'   wroko-man 'labourer'

The word *man* as part of a compound has lost its male meaning component as well, as it can also be used in words denoting females, which confirms its more abstract 'agent' meaning:

(13)   nai 'to sew'   nai-man 'seamstress'
        was 'to wash'   was-man 'laundress'
        yepi 'help'   yepi-man 'midwife'

The hypothesized general design features of language that underlie this model of the lexicon are the following three (Beekhuizen et al. 2013):

(14)   a. experience: storage effects, frequency, conventionalization;

b. heterogeneity; both concrete language constructs and schemas of various degrees of abstraction; small pieces and big pieces are stored;

c. redundancy: predictable information may be stored.

This model of lexical knowledge does justice to the dialogic relationship between the competence of individual language users (I-language) and the language use (E-language) that they are exposed to (Booij 2014, Taylor 2012).

The use of *pracht* as an evaluative modifier within compounds is similar to the use of evaluative prefixes, the difference being that prefixes are always bound, whereas the noun *pracht* can also be used as an independent word. Words with a construction-bound meaning are referred to as affixoids, as they are functionally similar to real affixes. The historical sources of prefixes and suffixes are words with a bound meaning, occurring as the left and right constituent of compounds respectively. For instance, the use of *wise* as a suffix, as in *money-wise,* derives historically from the noun *wise* 'manner' (Dalton-Puffer and Plag 2010). This diachronic observation is important, as it is an additional criterion for the adequacy of linguistic models that they should provide a sound basis for the understanding and explanation of processes of language change (Jackendoff 2011).[2]

Constructional schemas as exemplified in (10) and (11) have two roles. On the one hand, they have the function of motivation. A linguistic sign is motivated to the extent that the relationship between its form and its meaning is not completely arbitrary. The meaning of the established Dutch *pracht*-compounds is not arbitrary, but predictable, and hence motivated, on the basis of schema (10), and the meanings of their head nouns which are listed in the lexicon. That is, these compounds inherit their formal and semantic properties from the schema that dominates them and from their head words. Similarly, schema (10) inherits properties such as right-headedness and syntactic category from the highest schema in (11). Inheritance of formal and semantic properties is therefore a basic ingredient of CxM and the notion 'hierarchical lexicon' (Booij 2016). On the other hand schemas serve to express how new complex words can be understood and formed. However, there are degrees of productivity: not all possible words (as defined by the set of morphological schemas) can be actualized easily. Some processes are marginally or semi-productive, and this is a kind of knowledge that language users possess and have intuitions about, based on their experience with actual language use such as the occurrence of hapaxes (Baayen 1992; 2009), and it has also to do with the register used (Plag et al. 1999). The actual use of a morphological construction may also be hampered by blocking effects, the existence of synonymous words in the conventional lexicon of the language that impedes the coinage of a new complex word with the same meaning (Rainer 2013).

4. Mismatches between tiers

Form-meaning incongruities are important test beds for the adequacy of models of the architecture of grammar (Frances and Michaelis 2003). Morphological construction schemas provide the means for accounting for mismatches between the form and meaning of complex words. Above I mentioned the Greek exocentric compound *filosofos* 'philosopher'. In this compound, the meaning component 'actor' (the person who loves wisdom) has no corresponding formal constituent, and this meaning component has to be specified as a property of the compound as a whole. Almost all Romance languages also feature a productive pattern of exocentric $[VN]_N$ compounding, here illustrated by Italian $[VN]_N$ compounds with an instrumental meaning (Von Heusinger and Schwarze 2013).

(15)   apri-porta 'lit. open-door, door-opener'
          tergi-cristallo 'lit. wipe-windshield, windshield wiper'
          trita-carne 'lit. grind-meat, meat-grinder'

The instrumental meaning can be specified on the conceptual tier of a constructional schema:

(16) $<[[x]_{Vi}[y]_{Nj}]_{Nk} \leftrightarrow$ [Instrument of SEM$_i$ on SEM$_j$]$_{SEMk}$

Hence, exocentric compounds are a case of systematic mismatch between the morphosyntactic tier and the conceptual tier which finds readily expression in the schema format.

Mismatches between the phonological tier and the morphosyntactic tier abound in the inflectional systems of Indo-European languages, which exhibit many cases of violation of the one form-one meaning ideal. For example, the Dutch verbal suffix -*t*, as in (*hij*) *werk-t* '(he) work-s' expresses four properties: 3rd person, singular number, present tense, indicative mood. Inflectional case endings on nouns usually express both a specific case property, and a value for number, as in Latin *mens-am* 'table, accusative singular'. These are two examples of the general phenomenon of cumulative exponence, the expression of more than one morphosyntactic or morphosemantic property by the same morpheme.

In derivational morphology we find empty morphemes that do not express a meaning of their own. For instance, a number of Polish denominal adjectives has an empty morph -*ow*- between the nominal stem and the adjectival suffix -*ski* (Szymanek 2010: 253):

(17)   *noun*   *corresponding adjective*
          kat 'hangman'   kat-ow-ski
          szpieg 'spy'   szpieg-ow-ski
          tchórz 'coward'   tchórz-ow-ski

        hrabi-a 'count'   hrabi-ow-ski

The constituent *ow* is not a part of the final suffix, as *-ski* is also used without *ow*, as in *amerykan-ski* 'Americ-an'. The presence of this empty morph can be specified in the formal part of the relevant constructional schema, and there will be no semantic component co-indexed with this morpheme *ow*.

      This example underlines that it is not the morpheme, but the word that is the primary symbolic unit of form-meaning correspondence in the lexicon. Morphemes in the Bloomfieldian sense of 'minimal meaning-bearing units' are just a subset of the morphological constituents into which complex words can be decomposed. There are various types of subconstituents of words without a meaning of their own, which only contribute information through their being embedded in a complex word.

      Bracketing paradoxes are another case of form-meaning mismatch. In English derived nouns such as *diner-out, hanger-on, looker-on, passer-by*, and *picker-up* the deverbal nominalizing suffix *-er* is not attached at the right periphery of the corresponding particle verbs *dine out, hang on, look on, pass by* and *pick up* respectively, but to the verbs themselves. Hence, there is a mismatch between the formal structure and the semantic structure of these derived nouns, as the suffix *-er* has semantic scope over verb and particle together. A *diner-out*, for instance, is someone who dines out. This semantic interpretation pattern is specified in (18): a combination of a particle and a nominalized verb is interpreted as the nominalization of the corresponding particle verb.

(18) $<[[V_i\text{-er}]_{Nj} \text{Particle}_k]_{Nl} \leftrightarrow [\text{Actor of SEM}_m]_l \approx <[V_i \text{Particle}_k]_{V'm} \leftrightarrow [\text{SEM}_i \text{SEM}_k]_{SEMm}>$

(the symbol $\approx$ is used here for presentational purposes to indicate the paradigmatic relationship). The meaning of particle verbs, denoted here by SEM_m is to be specified by constructional schemas for the various types of particle verb, as discussed in detail in Los et al. (2012). In (18) we specify the relationship between two schemas by means of co-indexation. A set of schemas linked by means of co-indexation of constituents is a second order schema, a schema of schemas. Such second order schemas serve to express the systematic paradigmatic relationships between constructions.

      The action nominalization of Dutch particle verbs provides similar evidence for a systematic paradigmatic relationship between phrasal constructions and morphological constructions. Dutch particle verbs are lexical items, but not morphological constructions (just like English particle verbs). They are phrasal constructions, because the particle and the verb are separated in main clauses (Booij 2010, Los et al. 2012). Nominalizations of particle verbs should not be seen as derived words, but as nominal compounds consisting of a particle and a nominalized verb. For instance, the nominalization of the particle verb *aan-komen* 'to arrive' has the form *aankomst* 'arrival'. This word should be analyzed as a nominal compound, with *komst* as its head: $[[aan]_{Prt} [[kom]_V\text{-}st]_N]_N$. This contradicts the structural analysis one might have expected from a semantic point of view, i.e. $[[aan\text{-}kom]_V \text{-}st]_N$,

because *aankomst* means 'event of arriving'. The relevant generalization is that Dutch particle verbs mirror the nominalization type of their corresponding base verbs, whether the nominalization is productive or not. This is illustrated in (19), data from Booij (2015):

(19) a. *default: suffixation with -ing*
   zend 'to send'   zend-ing 'mission'   uit-zend 'to broadcast' uit-zending 'broadcast'
   b. *no formal change (conversion)*
   val 'to fall'   val 'a fall'   aan-val 'to attack'   aan-val 'an attack'
   c. *with vowel change*
   grijp 'to seize'   greep 'grip'   in-grijp 'to interfere' in-greep 'interference'
   d. *stem change and/or suffixation*
   gaan 'to go'   gang 'going'   af-gaan 'to fail'   af-gang 'failure'
   kom 'to come'   kom-st 'coming'   aan-kom 'to arrive'   aan-kom-st 'arrival'
   slaan 'to hit'   slag 'hit'   aan-slaan 'to touch'   aan-slag 'a touch'
   zien 'to see'   zich-t 'sight'   aan-zien 'to view'   aan-zich-t 'view'

The compound analysis predicts this pattern. Unproductive types of deverbal nouns must be listed in the lexicon, and hence, they are available for functioning as heads in compounds with a particle as modifier constituent. Thus, it is correctly predicted that the nominalization of particle verbs feature unproductive types of nominalization. This analysis implies a second order schema that expresses the systematic relationship between particle verbs and their nominalizations in Dutch, similar to the second order schema in (18) (V-NOM stands for the class of verbal nominalizations):

(20) $<[\text{Particle}_k [V_i\text{-NOM}]_{Nj}]_{Nl} \leftrightarrow [\text{Event of SEM}_m]_l \approx <[\text{Particle}_k V_i]_{V'm} \leftrightarrow [\text{SEM}_k \text{SEM}_i]_{SEMm}>$

The shared indexes of the two schemas express that these schemas are paradigmatically related, and form a second order schema. More examples of the necessity of such second order schemas are given in Booij and Masini (2015). Paradigmatic relationships between different types of complex words thus require constructional representations of the relevant sets of complex words.

Second order constructional schemas also provide the right format to account for various types of non-concatenative morphology, that is, morphology that makes use of other means than the concatenation of words and affixes for the formation of words. For instance, vowel alternations are used in Germanic languages both for inflection and word formation. In English, nominalization of quite a number of mainly non-native disyllabic verbs can take place by means of stress shift: disyllabic nouns that are trochees (Bauer at al. 2013: 204-5):

(21)   *verb (iamb)*   *noun (trochee)*
       accént   áccent

discóunt	díscount
escórt	éscort
tormént	tórment

Such morphological relationships can be expressed in a second order schema that paradigmatically links two constructional schemas by means of co-indexation. The second order schema for nominalization by stress shift can be represented as follows:

(22) $<[(x)_{\sigma w}(y)_{\sigma s}]_{Vi} \leftrightarrow SEM_i> \approx <\ [[(x)_{\sigma s}\ (y)_{\sigma w}]_{Vi}]_{Nj} \leftrightarrow [Action/Result\ of\ SEM_i]_{SEMj}>$

where σ_s and σ_w stand for 'strong syllable' and 'weak syllable' respectively.

The necessity of schemas, which define output forms rather than rules that operate on input forms, is confirmed by the phenomenon of word truncation. In many languages, nicknames and abbreviations are formed by means of truncation of the original long forms (Downing 2006: 58-64). Whatever the phonological shape of the long form, the truncated form usually has a defined shape. For example, German truncated nicknames consist of a disyllabic foot that ends preferable in the vowel /i/:

(23)   Alkoholiker ´alcoholist´   Alki

        Amerikaner ´American´   Ami

        Ost-Deutscher ´East-German´   Ossi

        West-Deutscher ´West-German´   Wessi

        Waldemar ´boy´s name´   Waldi

        Gabriele ´girl´s name´   Gabi

        Trabant ´car make´   Trabi

        Gorbatsjov ´idem´   Gorbi

This form of truncation can be expressed as a paradigmatic relation between two types of nouns:

(24) $<[\ x\ y\ z]_{Ni}\ \leftrightarrow\ SEM_i> \approx <[(x)_{\sigma}\ (y\ \text{-}i)_{\sigma}]_{Nj} \leftrightarrow\ [EVAL\ [SEM_i]]_{SEMj}>$

where x, y and z are phonological variables, and EVAL stands for the semantic operator of evaluation (which may take the more specific value of endearment). In the case of *Waldemar*, for instance, x = *wal*, y = *d*, and *z = emar*. This results in the phonological form of the endearment word *Waldi* [$(wal)_{\sigma}$ $(di)_{\sigma}$].

5. Construction-dependent morphology

An important observation on the interaction of morphology and syntax, with implications for what the architecture of grammar should look like, is that the use of morphology may be dependent on specific syntactic construction, and hence be construction-specific. This applies to both inflection and derivation.

Let us first look at an example from the domain of inflection. Dutch used to have a case system in which dependent nouns in NPs and PPs were marked as genitives. The ending -*s* was used to mark genitive case on singular masculine and neuter nouns. In present-day Dutch the case system has disappeared. Yet, the genitive marking has been preserved in a number of syntactic constructions (Booij 2010: chapter 9). Examples of the use of the 'trapped' old genitive -*s* in Dutch are the following (data from an internet search, 27 July 2015):

(25)   a.   Het is niet de-s dominee-s om zo met publiciteit om te gaan
              It is not the-*s* reverend-*s* to so with publicity deal
              It is not proper for a reverend to deal with publicity in that manner'
       b.   Dat door-praten is zeer de-s vrouw-s
              That on-talking is very much the-*s* woman-*s*
              'That going on talking is very characteristic of a woman'

What we observe here is the use of the construction [*des* N-*s*]$_{NP}$ with the constructional meaning 'characteristic of N'. This NP is used as a predicate, and often in combination with the negative adverb *niet* 'not'. The article *des* is the old gen.sg form of the masculine and neuter definite articles *de* and *het*. The use of *des* in present-day Dutch is restricted to idioms. What is remarkable here is that the use of the genitive marker -*s* on masculine and neuter nouns, and the use of the inflected masculine/neuter definite article *des,* has been extended to feminine nouns, as shown in (25b), and that this construction is productive in modern Dutch. The genitive markers on the determiner and the noun have been reinterpreted as markers of a specific construction. This diachronic development shows that the notion 'syntactic construction' is essential for a proper interpretation of this change, and for a proper synchronic account of this use of inflectional morphology. The relevant constructional schema is given in (26):

(26)   <[*des* [[x]$_{Ni}$-*s*]$_{Nj}$]$_{NPk}$ ↔ [characteristic/proper for SEM$_i$]$_k$>

This schema illustrates once more that schemas may contain both variables and fixed lexical items or morphological constituents of lexical slots.

Syntactic constructions also play a role in derivational morphology because they may require derived words of a particular morphological form. An example is the Dutch PP-construction [*op het* [A-*e*]_N *af*] (examples from Booij and Audring (to appear) which expresses the idiosyncratic meaning 'almost A':

(27) a. dun op het anorectisch-e af
          thin on the anorexic off
          'so thin that it is almost anorexic'
      b. op het briljant-e af 'almost brilliant'
          op het gemen-e af 'almost mean'
          op het knapp-e af 'almost handsome'
          op het lullig-e af 'almost silly'
          op het onbehoorlijk-e af 'almost indecent'

The noun in this PP-construction is always a nominalized adjective, derived by means of the suffix -*e*. This nominalization pattern is also used outside this construction.

(28) a. Het gemen-e is dat …
          The mean-e is that
          'The mean thing is that ...'
      b. Ik waardeer het briljant-e van deze redenering
          I appreciate the briljant-e of this reasoning
          'I appreciate the brilliance of this reasoning'

The crucial observation is that only this type of derived noun can be used in the noun-slot of the [*op het* [A-*e*]_N *af*] construction. For instance, the following PPs are ill formed:

(29) a. *op de [[smerig]_A-heid]_N af
          on the dirti-ness off
          'almost dirty'
      b. *op de smerige eigenschap af
          on the dirty property off
          'almost dirty'

The construction *op het A-e af* is the unification of two independent constructions, the syntactic construction [*op het* N *af*]_{PP} (exemplified by *op het doel af* 'to the goal off, towards the goal') and the morphological construction [A-*e*]_N, and hence it inherits most of its properties from these two source

constructions. This unified construction has acquired the specific meaning 'almost A', and has thus acquired a life of its own. The use of this construction boosts the productive use of deadjectival nominalization with the suffix *-e*. This makes it a case of 'embedded productivity': word formation processes becoming (more) productive in specific morphological or syntactic constructions (Booij 2010: 47-49).

A theoretical consequence of this analysis is that the internal morphological structure of words may have to be visible to syntax, because the noun slot can only be filled by nouns derived by means of the nominalizing suffix *-e*. Morphological constructions and syntactic constructions may be intertwined, and thus, there is no sharp boundary between morphology and syntax.

This confirms the conclusions concerning the principle of Lexical Integrity in Booij (2009). Lexical Integrity defines the criteria for the demarcation of morphological and syntactic constructs, that is, the criteria for wordhood of a linguistic construct. Syntactic rules cannot manipulate word-internal structure, such as movement of word constituents in syntax. What it should not exclude is that syntactic rules or constraints may require access to information on the morphological composition of words. This is also desirable for semantic analysis. For instance, in a noun phrase like *scientific researcher* the semantic scope of the adjective *scientific* is not the whole word *researcher*, but only the nominal base word *research*. Hence, the morphological structure of *researcher* should be accessible for a proper semantic interpretation of this NP.

6. Inflection in Construction Morphology

The idea of paradigmatically related constructional schemas argued for above for the domain of word formation is also relevant for inflection. The necessity of paradigmatically related 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 declinations 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 plural form *reg-es* 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 belong (Stump and Finkel 2013). For instance, the genitive singular form of the Latin noun *rex* 'king' *reg-is* identifies this noun as belonging to the 3rd declension class. 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 first declension nouns of Saami exhibit a

pattern based on two principal parts, the genitive singular and the nominative singular. These noun forms are subject to gradation. 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 gen.sg 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 the form tiers of morphological schemas for Saami nouns that share the variable *x*:

(30) $[\text{x-á}]_{\text{NOM SG}} \approx [\text{x-ái}]_{\text{ILLATIVE SG}} \approx [\text{x-án}]_{\text{ESSIVE}}$

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.

Since Construction Morphology allows for both morphological schemas and their instantiations to be listed, it is possible to list inflectional forms that are completely regular, because the inflectional schemas will indicate their predictable properties. This is necessary because inflectional forms may function as principal parts, and because the form of one paradigm cell may be predicted from another. The possibility of storage of inflectional forms is also welcome from a psycholinguistic point of view. It has been shown, for instance, that regular plural nouns in Dutch and Italian exhibit a frequency effect in lexical decision tasks. This implies the lexical storage of these plural nouns (Baayen et al. 1997).

This sketch of the role of paradigmatic relations in inflectional morphology is in line with recent findings on the allomorphy of genitive forms of German nouns (Feheringer 2011). Some nouns have two genitive forms, for instance *Ort* 'place'(*Orts* or *Ortes*). If one of the forms is strongly preferred, this pattern recurs in the genitive form of compounds with these nouns as their heads. For instance, *Spiel* 'game' strongly prefers *-s*, and this strong preference recurs in compounds such as *Fußballspiel* 'soccer game': the gen.sg form *Fußballspiel-s* is the most frequently taken option. This effect is explained by the assumption that these genitive singular forms are stored (otherwise there cannot be a frequency effect), and that they can be paradigmatically related to corresponding heads of compounds.

7. Summary and conclusions

In this chapter a number of arguments have been presented for a constructionist approach to morphology: the holistic properties of morphological constructions, the need for schemas and subschemas instead of rules in order to account for regularities and subregularities in a hierarchical lexicon, the necessity of output-based schemas for various forms of non-concatenative morphology, and the role of systematic paradigmatic relationships between words, and between morphological and phrasal constructions. Although the focus of this chapter was on word formation, the concepts introduced appeared to be relevant for a proper analysis of inflection as well. The model of Construction Morphology briefly presented starts from the assumption that morphological knowledge is based on language use, and on awareness of lexical relatedness among stored words (Spencer 2013). Thus, this model fits very well into the broader enterprise of cognitive approaches to the architecture of grammar.

Notes

1. An additional, related use of *pracht* can be found in the nomenclature of biologists for particular species of plants and animals, as in *pracht-anjer* 'lit. splendour-carnation, dianthus superbus' and *prachtschildpad* 'lit. splendour-turtle, rhinoclemys pulcherrima'.

2. Detailed studies of affixoids, both synchronically and diachronically, can be found in Booij and Hüning (2014), Hüning and Booij (2014), Norde and Van Goethem (2014), Van Goethem (2008; 2010), Namiki (2000), and Namiki and Kageyama (2016).

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