Usage-based construction grammar

Holger Diessel

1. Introduction

The general goal of research on grammar in cognitive linguistics is to develop a framework for the analysis of linguistic structure that is grounded in general cognitive processes, i.e. processes that are not only involved in language, but also in other cognitive phenomena such as vision, attention, and abstract thought. The cognitive approach to the study of grammar contrasts sharply with the generative theory of grammar in which the core of the language users' grammatical knowledge (i.e. competence) is assigned to a particular faculty of the mind including innate categories and constraints that are exclusively needed for language (Pinker and Jackendoff 2005). In the cognitive approach there is no particular language faculty and grammatical knowledge is derived from linguistic experience. On this view, grammar is an "emergent phenomenon" (Hopper 1987) shaped by general psychological mechanisms such as categorization, analogy, and entrenchment (see Chapters 1 to 9 of this volume; see also Diessel 2011a for a review).

Early research in cognitive linguistics emphasized the importance of non-linguistic (spatial) concepts for the analysis of grammatical categories. Word classes, for instance, were described by means of conceptual primitives such as "boundedness" (e.g. count nouns and telic verbs are 'bounded' vs. mass nouns and activity verbs are 'unbounded'), and complex sentences were analyzed in terms of the figure-ground segregation, which gestalt psychologists proposed for the analysis of visual perception (Langacker 1982; Talmy 1978, 1988). In this early research, linguistic structure is immediately based on conceptual structure; but soon it became clear that an important aspect is missing in this approach, namely usage and development.

There is good evidence that linguistic structure and conceptual structure are related; but the relationship between them is indirect—it is mediated by language development, which in turn is driven by language use. This view of grammar underlies the "usage-based approach"—a term that Langacker (1988) proposed to emphasize the importance of usage and development for the analysis of linguistic structure. The general idea of this approach may be summarized as follows (cf. Hopper 1987; Langacker 2008; Bybee 2010):

> Grammar is a dynamic system of emergent categories and flexible constraints that are always changing under the influence of domain-general cognitive processes involved in language use.

The usage-based approach challenges central assumptions of linguistic analysis that have influenced grammatical research throughout the 20th century:

- It challenges the rigid division between the language system and language use, or competence (i.e. langue) and performance (i.e. parole).
- It abandons the structuralist dictum that the study of (synchronic) linguistic states must be separated from the study of (diachronic) language change.
- And it rejects the common assumption that syntactic analysis presupposes a set of primitive categories such as subject and noun phrase, which in other grammatical theories are often used as a "toolkit" for linguistic analysis (Jackendoff 2002: 75).

If we think of grammar as a dynamic system of emergent structures and flexible constraints, we cannot posit the existence of particular syntactic categories prior to grammatical analysis. On the contrary, what we need to explain is how linguistic structures evolve and change, both in history and acquisition. This explains why cognitive grammarians have turned to the study of language acquisition (e.g. Goldberg 2006) and why cognitive research on grammar has formed such a close liaison with research on grammaticalization (e.g. Bybee 2010; Hilpert 2013; Traugott and Trousdale 2013; see also Diessel 2007, 2011b, 2012 for some discussion of the parallels between L1 acquisition and language change). In the structuralist paradigm, grammatical theory seeks to provide formal representations of linguistic structure; but in the usage-based approach, grammatical research is primarily concerned with the dynamics of the grammatical system. This does not mean, however, that grammar is completely unconstrained in this approach. Like any other grammatical theory, the usage-based model rests on particular assumptions about the nature of grammatical elements and the overall organization of the grammatical system. As I see it, there are two general principles that underlie or constrain the analysis of linguistic structure in this approach:

- First, linguistic structure can be analyzed in terms of complex signs, i.e. constructions, combining a specific structural pattern with a particular function or meaning.
- Second, all linguistic signs (i.e. lexical signs and grammatical signs) are connected with each other by various types of links so that grammar (or language in general) can be seen as a dynamic network of interconnected signs.

The first principle has been discussed extensively. There is a large body of research on the symbolic nature of grammar and the importance of constructions in the usage-based approach (see Croft 2007 and Fried 2010 for two recent reviews of this research); but the second principle has not yet been sufficiently described and will be in the focus of this chapter. Section 2 provides a short discussion of the notion of construction and the nature of linguistic signs; and the rest of the chapter is concerned with the general architecture of grammar in the usage-based approach.

2. Signs, constructions, and lexemes

2.1. Some basic definitions

The ability to use signs or symbols is a fundamental capacity of the human mind providing a prerequisite for disembodied cognition and language (cf. Deacon 1997; Tomasello 1999). The classic example of a linguistic sign is the word (or lexeme). According to Saussure ([1916] 1994: 67), a word is a "two-sided psychological entity" that combines a particular form, i.e. the 'signifier' (or 'signifiant'), with a particular meaning, i.e. the 'signified' (or 'signifié'). The English word *head*, for instance, consists of a specific sound pattern (i.e. [hɛd]) that is associated with a particular concept (or more specifically, with a network of related concepts, e.g. head as a body part, head of department, head of table; see Gries this volume).

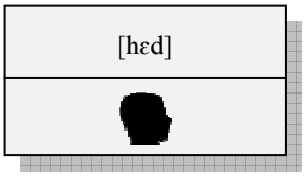

Figure 1. Linguistic sign

Traditionally, the notion of sign is reserved for lexical expressions; but in cognitive linguistics it has been extended to grammatical entities, notably to constructions. A construction is as a grammatical unit in which a particular structural pattern is associated with a specific function or meaning. Construction grammar has played an important role in the development of the usage-based approach. In fact, in the literature construction grammar is often described as an integral part of the usage-based approach to the study of grammar (cf. Bybee 2010; Goldberg 2006; Hilpert 2014; Langacker 2008; Tomasello 2003; see also Diessel 2004: chap 2); but the notion of construction grammar refers to a whole family of theories which are not all usage-based (see Hoffmann and Trousdale 2013 for a recent survey of different construction-based theories). Indeed, one of the earliest and most influential construction-based theories, i.e. the sign-based theory of construction grammar developed by Fillmore and Kay (1999), adopts the generative division between competence and performance and disregards usage and development (see also Michaelis 2013; Sag 2012). Other varieties of construction grammar, such as Cognitive Grammar (Langacker 2008) and Radical Construction Grammar (Croft 2001), take a dynamic perspective and have made important contributions to the usage-based approach (see also Bybee 2010; Goldberg 2006; Tomasello 2003; Steels 2011).

Constructions vary across a continuum of schematicity or abstractness. The term applies to both grammatical units that are associated with particular lexemes, e.g. idioms such as *kick the bucket* and prefabricated expressions such as *I don't know,* and grammatical units that are defined over abstract categories, or "slots", which can be filled by certain types of expressions. Consider, for instance, an imperative sentence such as *Open the door*, which is based on a "constructional schema" (Langacker 2008: 167) combing a particular syntactic configuration of linguistic elements with a particular function or meaning. In English, an imperative sentence includes an uninflected verb form at the beginning of the sentence, it usually lacks an overt subject, may include a postverbal element, e.g. a noun phrase or prepositional phrase, and functions as directive speech act. Imperative sentences can be analyzed as grammatical signs, i.e. constructions, that speakers use to express a particular illocutionary force (cf. Figure 2).

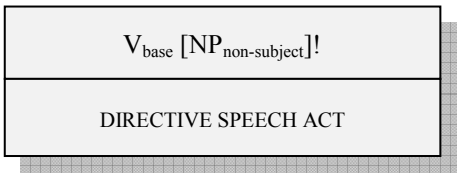

Figure 2. The imperative construction

Like lexemes, constructions can be polysemous, i.e. they can have multiple functions or meanings. The imperative construction, for instance, can express a command, a request, an instruction, a warning, a permission, or good wishes (cf. 1-6) (cf. Stefanowitsch 2003; see also Searle 1979 for a general discussion of this point).

(1)	Open the door!	Command
(2)	Please pass me the salt.	Request
(3)	Melt the butter in the saucepan.	Instruction

(4) Uh yeah go on there. Permission
(5) Just be careful! Warning
(6) Have a great birthday! Good wishes

The notion of construction has a long history in linguistics. Traditionally, the term applies to particular clause types and phrases, e.g. imperative sentences, relative clauses, complex NPs including genitive attributes. However, in construction grammar the term has been extended to all grammatical patterns including highly productive clause types (e.g. transitive clauses) and phrases (e.g. ordinary PPs) (see below).

Note that in some of the usage-based literature, the notion of construction is not only used for grammatical patterns but also for lexical expressions (cf. Goldberg 1995; Croft and Cruse 2004: chap 9). Both constructions and lexemes are signs, i.e. conventionalized form-function pairings; however, given that the parallels between lexemes and constructions are already captured by the notion of sign, there is no need to extend the notion of construction to lexical expressions. I will therefore restrict the notion of construction to grammatical units consisting of at least two elements (e.g. two lexemes or two categories) and will use the notion of sign as a cover term for both lexemes (i.e. lexical signs) and constructions (i.e. grammatical signs).[1]

2.2. Some general aspects of constructions

While construction grammarians have emphasized the importance of constructions for syntactic analysis, generative linguists have questioned the usefulness of this term. In fact, in Minimalism, i.e. the most recent versions of generative grammar, the notion of construction has been abandoned in favour of a fully compositional approach in which all syntactic structures are derived from atomic primitives and combinatorial rules (cf. Chomsky 1995: 4). Cognitive linguists do not deny the compositionality of linguistic structure. In fact, if we restrict the notion of construction to grammatical patterns, i.e. if we exclude single lexemes from the notion of construction (see above), constructions are generally divisible into particular components that contribute to their meanings. However, compositionality is a matter of degree, and constructions are also associated with holistic properties, i.e. properties that are linked to the entire grammatical pattern rather than to particular components.

The best evidence for this comes perhaps from structures such as imperative sentences, which have always been analyzed as constructions. In traditional grammar (and early versions of generative grammar) these structures were described by means of construction-particular rules (or "transformations" in the "aspect model" of generative grammar; cf. Chomsky 1965), i.e. rules that are exclusively needed to derive a particular morphosyntactic pattern from atomic primitives. However, in Minimalism all construction-particular rules are eliminated and replaced by general syntactic operations such as "Move alpha" (Chomsky 1995). In contrast to Minimalism, usage-based construction grammar is a surface-oriented theory in which construction-particular properties are seen as an important aspect of grammar that cannot be explained by general rules (i.e. rules that are independent of particular constructions).

Take, for instance, a passive sentence such as *The door was opened by Peter*, which involves a particular configuration of grammatical elements: a clause-initial NP encoding the subject, a particular verb form consisting of the past participle of a transitive verb and the auxiliary *be*, and optionally a *by*-phrase denoting a semantic argument, i.e. the agent of the activity expressed by the verb. While passive sentences share important properties with other clause types (e.g. word order, subject-verb agreement), this configuration of syntactic elements is unique and associated with a particular meaning or function (i.e. a particular

[1] Morphologically complex words consisting of multiple morphemes (e.g. *armchair, untrue*) can be seen as particular types of constructions, i.e. as "morphological constructions" (cf. Langacker 1987: 83-85).

perspective on a causative event and a particular information structure, cf. Langacker 1991: 200-7). One way of analyzing this mixture of general and idiosyncratic properties is to assume that passive sentences are licensed by a constructional schema (cf. Figure 3).

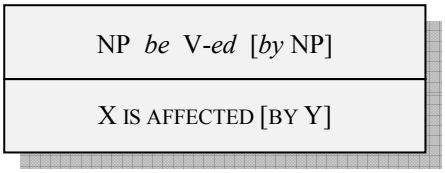

Figure 3. The passive construction

The holistic properties of the passive are reminiscent of idiosyncratic properties of idiomatic expressions. In the generative approach, idioms are analyzed as irregular expressions that are stored together with words in the mental lexicon. But in the cognitive approach, idioms are analyzed in the same way as non-idiomatic grammatical expressions, i.e. constructions. On this view, there is no principled difference between a passive sentence such as *The door was opened by Peter* and an idiom such as *Where are you headed?* Like the passive, this idiom shares certain properties with other grammatical entities: It has the same word order as ordinary content questions and the auxiliary is inflected as in any other sentence type; but the meaning of the verb is of course idiosyncratic and cannot be derived by means of general (semantic) rules.

Idioms have played an important role in the development of construction grammar (cf. Fillmore, Kay, and O'Connor 1988; Nunberg, Sag, and Wasow 1994). There is a wide range of idiomatic expressions that overlap to different degrees with regular grammatical patterns. Semantically, most idioms are unpredictable (e.g. *kick the bucket*); but some idiomatic expressions are semantically transparent in that their meaning can be derived by means of pragmatic principles (e.g. *answer the door*) (cf. Nunberg, Sag, and Wasow 1994). Similarly, while some idiomatic expressions are syntactically irregular (e.g. *all of a sudden*), most idioms share some of their morphosyntactic properties with non-idiomatic grammatical expressions (e.g. *Curiosity killed the cat* has the same structure as an ordinary transitive clause) (cf. Fillmore, Kay, and O'Connor 1988). What is more, some idioms include 'slots' like regular grammatical expressions. The comparative correlative construction (e.g. *The bigger, the better*), for instance, can be seen as a schematic idiom consisting of a lexically-specific frame, two comparative adjectives, and two slots that may or may not be filled by regular expressions (i.e. *The* ADJ_{er} __ *the* ADJ_{er} __).

Taken together, this research suggests that idiomaticity constitutes a continuum ranging from structures that are completely idiosyncratic and lexically particular to structures that share most of their semantic and syntactic properties with other grammatical patterns. On this view, there is no rigid division between idioms such as the comparative correlative construction, particular clause types such as the passive, and fully productive grammatical patterns such as basic declarative sentences. In fact, there is evidence that even the most productive and most variable clause types, e.g. the transitive SVO, have holistic properties, i.e. properties that are associated with the entire structural pattern.

2.3. The English transitive construction

In English, a (prototypical) transitive sentence consists of a clause-initial NP encoding the subject, a transitive verb denoting a causative event, and a postverbal NP encoding the object (e.g. *Peter closed the door*). In the syntactic literature, transitive sentences are commonly analyzed as fully compositional expressions formed from primitive categories by means of general rules; but research in psycholinguistics suggests that speakers of English conceive of

the NP-V-NP sequence (or SVO) as a holistic entity that is associated with a particular scene involving an actor (or experiencer) and undergoer (or theme).

In a seminal study on sentence processing and language acquisition, Thomas Bever (1970) showed that English-speaking children often misinterpret passive sentences as active transitive clauses if the active interpretation is compatible with the meaning of the words in a (given) passive construction. For instance, a passive sentence such as *The girl was kissed by the boy* may be interpreted as an active sentence, meaning 'The girl kissed the boy', despite the fact that the structure occurs with passive morphology. There is evidence from psycholinguistic research that in English word order provides a stronger cue for grammatical relations than morphology so that English-speaking children often ignore the morphological marking of passive sentences and interpret them as active transitive clauses (cf. Slobin and Bever 1982). Since this type of mistake also occurs with several other clause types involving the order NP-V-NP (e.g. cleft sentences, reduced relative clauses), Bever suggested that children interpret these sentences based on a grammatical "template", which he called the "canonical sentence schema" of English. Subsequent research revealed that the same type of mistake occurs in comprehension experiments with adult speakers when they are put under time pressure while processing passive sentences or reduced relative clauses (cf. Ferreira 2003; see also Townsend and Bever 2001). Bever interpreted the canonical sentence schema as a "pseudosyntactic" device that children (and adults) use in lieu of true syntactic rules, as described in generative grammar; but from the perspective of construction grammar, the canonical sentence schema is a construction combining a particular structural pattern, i.e. NP-V-NP, with a particular meaning (cf. Figure 4).

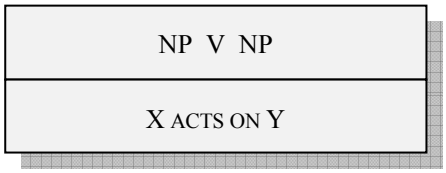

Figure 4. The transitive construction

2.4. The network architecture of language

In accordance with this view, cognitive research on grammar analyzes all clausal and phrasal patterns as constructions; i.e. as complex linguistic signs combining a particular structural pattern with a particular function or meaning. If grammar consists of grammatical signs, i.e. constructions, there is no principled difference between grammar and lexicon as in other theoretical approaches. This view of grammar has far-reaching implications for grammatical analysis. If linguistic structure consists of signs it is a plausible hypothesis that grammar is organized in the same way as the mental lexicon, which is commonly characterized as a network of related signs or symbols (cf. Figure 5).

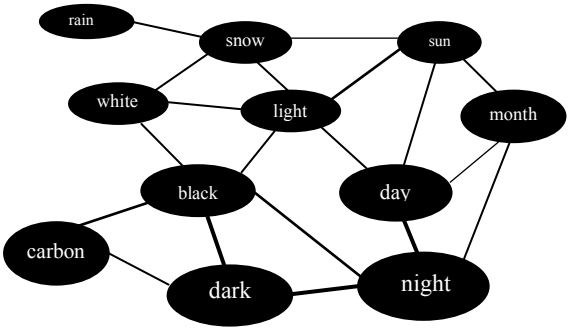

Figure 5. Lexical network

In accordance with this view, cognitive linguists think of grammar as a network of interconnected signs, or a "structured inventory" of "symbolic units" (Langacker 1987: 57), that are related to each other by various types of links reflecting overlapping aspects of their structure, function, and meaning (cf. Goldberg 1995; Croft 2001; Bybee 2010; see also Diessel 1997). In generative linguistics, grammar and lexicon are two strictly distinguished components (or "modules"); but usage-based construction grammar has abandoned the division between lexicon and grammar in favour of a network model in which all linguistic elements are potentially connected with each other.

Network models have a long tradition in cognitive science. There are many different types of network models—some theoretical, some computational— that vary with regard to a wide range of parameters (see Elman 1995 for an overview); but what all network models have in common is that they are designed to "process" data and to "learn" from experience through data processing. Network models are thus usage-based models by definition.

In the remainder of this chapter, I will consider four different types of links between linguistic elements that are important to understand the network architecture of grammar in the usage-based approach, namely the links between ...

- constructions at different levels of abstractness (taxonomic links)
- constructions at the same level of abstractness (horizontal links)
- constructions and syntactic categories (syntactic links)
- constructions and lexical expressions (lexical links)

3. Constructions at different levels of abstractness [taxonomic links]

The first type of link concerns the hierarchical organization of grammar. As argued in Section 2, constructions are schematic representations of linguistic structure that are instantiated in concrete utterances, sometimes referred to as "constructs" (cf. Fried 2010). The relationship between constructs and constructions is based on a process of schematization, which can be seen as a type of implicit learning (see Matthews and Baayen in this volume) (cf. Figure 6).

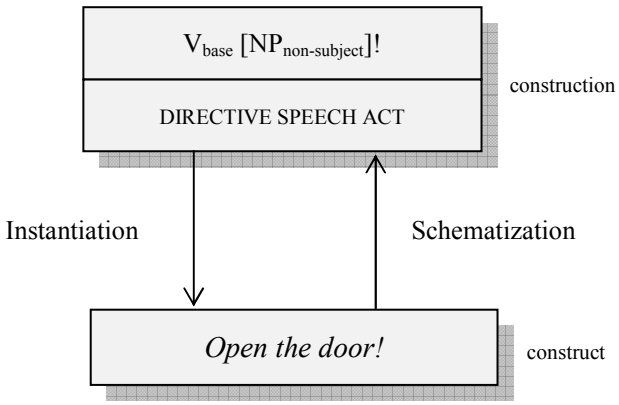

Figure 6. Constructions and constructions

Constructions emerge as generalizations over strings of concrete lexical expressions with similar forms and meanings. While this may happen at any time, most constructions are learned during childhood. The study of first language acquisition plays thus an important role in the usage-based analysis of linguistic structure (see Diessel 2013 for a recent review of usage-based research on the acquisition of constructions).

There is abundant evidence from psycholinguistic research that children are very good in detecting distributional regularities in strings of lexical expressions. For instance, in a series of studies Gómez and Gerken (1999) exposed 12-month-old infants to strings of monosyllabic nonce words (e.g. *VOT, PEL, JIC*) that appeared in different structural patterns, or constructions, defined by linear order and the number of words they include. Each word the children learned occurred in one or more constructions in particular structural positions (e.g. after the first word, at the end of the construction). After training, i.e. after the infants had been exposed to the constructions for a few minutes, they were tested under two conditions (cf. Table 1).

Table 1. Sample sentences of an artificial grammar, adopted from Gómez and Gerken (1999: 114)

Condition 1	Condition 2
VOT PEL JIC	PEL TAM RUD RUD
PEL TAM PEL JIC	VOT JIC RUD TAM JIC
PEL TAM JIC RUD TAM RUD	VOT JIC RUD TAM RUD
REL TAM JIC RUD TAM JIC	VOT PEL JIC RUD TAM
VOT PEL PEL JIC RUD TAM	PEL TAM PEL PEL PEL JIC

In condition 1, they listened to the same constructions as the ones they had heard during training, but with different words; that is, each word the children had learned during training was replaced by a novel nonce word with the same distributional properties. And in condition 2, the infants were exposed to others constructions (i.e. constructions involving other word orders and including different numbers of words), but with the same novel nonce words as in condition 1. Using the head-turn preference procedure, Gómez and Gerken found that the infants recognized the constructions to which they were exposed during training although they had not heard any of the words of the test sentences before, suggesting that children as young as one year of age are able to abstract beyond specific words and to acquire abstract syntactic categories or schemas (see also Marcus et al. 1999).

However, a number of studies have argued that children are conservative learners who tend to restrict syntactic generalizations to particular lexical expressions that are commonly used in a constructional schema (cf. Gerken 2006). This is consistent with the hypothesis that children's early constructions in speech production are organized around particular words (cf. Lieven, Pine, and Baldwin 1997; Tomasello 1992, 2000, 2003). In a classic study, Martin Braine (1976) suggested that children's early multi-word utterances are "pivot schemas" that are composed of specific "pivot words", i.e. relational terms, and "open slots" that can be filled by various expressions as long as these expressions are semantically compatible with the pivot word (cf. Table 2).

Table 2. Pivot constructions (Braine 1976)

Pivot word	More __	All __	No __
Examples	*More car*	*All broke*	*No bed*
	More cereal	*All clean*	*No down*
	More cookie	*All done*	*No fix*
	More fish	*All dressed*	*No home*
	More juice	*All dry*	*No mama*
	More toast	*All shut*	*No pee*

Building on this research, Tomasello (1992) characterized children's early pivot schemas as "verb-island constructions" because most of them are based on pivot verbs; but there are also pivot schemas that revolve around other types of words (cf. Lieven, Pine, and Baldwin 1997; Dąbrowska 2004). Children's early questions, for instance, are usually organized around particular question words.

Like verb-argument constructions, questions originate from fixed expressions (e.g. *What-s-this?*) and formulaic frames (e.g. *Where-s __?*). As children grow older, their

questions become increasingly more complex and variable. Consider, for instance, the sentences in (7) to (15), which illustrate the development of a particular type of question in the speech of a two-year-old child named Naomi (cf. Dąbrowska 2000).

(7)	What doing? (many times)	1;11.11
(8)	What's Mommy doing? (many times)	1;11.21
(9)	What's donkey doing? (4 times)	2;0.18
(10)	What's Nomi doing? (2 times)	2;0.18
(11)	What's toy doing?	2;0.18
(12)	What's Mommy holding?	2;0.26
(13)	What's Georgie saying?	2;1.19
(14)	What is the boy making?	2;11.17
(15)	What is Andy doing?	2;11.18

As can be seen, the development originates from a pattern consisting of the question word *what* and the verb *doing*, which Naomi used many times before *what* appeared in any other context. Later, the child inserted the noun *Mommy* into this pattern; but it was only after the second birthday that she began to produce questions with different types of nouns and a bit later also with different types of verbs. At the end of the analyzed period, Naomi recognized that the question word *what* and the auxiliary *is* are separate words and abandoned the contracted from *what's*, which only recurred after a few months. Note that the overall structure of the question did not change throughout the entire period. In all of these examples the question word functions as patient (or object) of the activity expressed by the verb providing a lexical frame for the utterance (see also Dąbrowska and Lieven 2005).

Such lexically particular constructions are characteristic of early child language (cf. Braine 1976; Lieven, Pine, and Baldwin 1997; Tomasello 1992, 2000, 2003); they provide a link between children's early holophrases and schematic representations of grammatical structure. The development involves a piecemeal, bottom-up process whereby children acquire increasingly more abstract syntactic patterns.

The emergence of grammatical schemas enriches the child's grammatical knowledge, but does not necessarily efface the memory of lower-level constructions and frequent strings of lexical expressions. In the generative approach, syntactic representations are maximally abstract and economical; but in the usage-based approach, linguistic information is often stored redundantly at different levels of abstractness (cf. Langacker 2000). What children eventually learn is a hierarchy of grammatical patterns reaching from prefabricated strings of lexical expressions to highly abstract constructional schemas. Figure 7 shows a simplified fragment of the taxonomy of WH-questions that one might extract from the analysis of Naomi's questions.

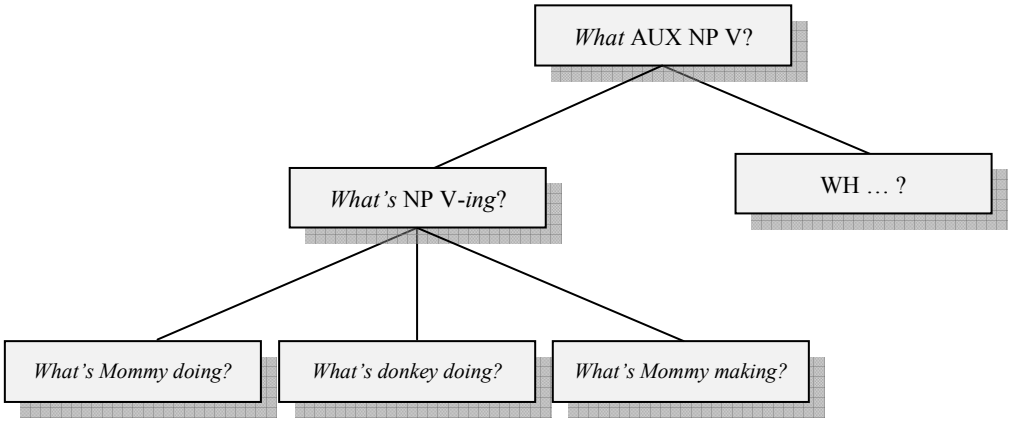

Figure 7. Emerging taxonomy of WH-constructions in child speech

4. Constructions at the same level of abstractness [horizontal links]

The second type of link concerns the relationships between constructions at the same level of abstractness. These horizontal links are similar to the associative links between lexical expressions in the mental lexicon. There is abundant evidence from psycholinguistic research on speech errors and lexical priming that lexemes are related to each other by various types of links that influence language comprehension and production (cf. Harley 2001). For instance, research on lexical priming has demonstrated that words are more easily accessible if they follow a prime, i.e. a word that shares some of its semantic and/or phonetic features with the target item (McNamara 2005).

Priming effects have also been observed in research on grammatical constructions (see Tooley and Traxler 2010 for a recent review). The classic example of constructional priming in speech production involves passive sentences. As first noted by Weiner and Labov (1983), one factor favoring the use of a passive sentence in language production is the presence of another passive sentence in the preceding discourse, suggesting that priming does not only affect words but also constructions (cf. Gries 2005; Szmrecsanyi 2006).

This hypothesis has been confirmed by experimental evidence. For instance, in a seminal paper Kathryn Bock (1986) showed that speakers of English are much more likely to describe a ditransitive scene, i.e. a scene depicting an act of transfer, by the *to*-dative construction (rather than the ditransitive) if they had heard or used the *to*-dative construction prior to the experimental task. Parallel results were obtained for the active-passive alternation and other related clause types. Interestingly, while this type of priming is especially powerful if it involves the same sentence types (i.e. *to*-dative primes *to*-dative), Bock and Loebell (1990) showed that priming effects can also be observed between distinct grammatical patterns that share some of their structural properties. For instance, in one of their studies they found that an active sentence with a locative *by*-phrase can prime a passive sentence with an agentive *by*-phrase and vice versa (cf. 16-17).

(16) The 747 was landing by the airport's control tower. [locative *by*-phrase]
(17) The 747 was alerted by the airport's control tower. [passive *by*-phrase]

Since these priming effects occur even if prime and target have different meanings, Bock and colleagues dubbed this phenomenon "syntactic priming"; but later studies showed that priming also occurs with semantically related sentence types (e.g. Chang, Bock, and Goldberg 2003; Hare and Goldberg 2000). For instance, Hare and Goldberg (2000) showed that a sentence such *John provided Bill with news* primes a semantically related sentence such as *John gave the ball to Pete* although these sentences have very different structures. If there are priming effects between semantically or structurally related constructions, it is a plausible hypothesis that structures with similar forms and meanings are associated with each other like lexical expressions with similar phonetic and semantic features in the mental lexicon.

In accordance with this hypothesis, research on L1 acquisition has shown that grammatical development is crucially influenced by structural and semantic similarities between constructions (cf. Abott-Smith and Behrens 2006; Diessel 2004; Goldberg 2006). For instance, Diessel and Tomasello (2005) argued that the acquisition of relative clauses involves a piecemeal process whereby children gradually acquire various types of relative clauses based on their prior knowledge of simple sentences (i.e. main clauses). In English, the primary syntactic device to indicate the function of the head in the relative clause is word order. As can be seen in (18) to (21), the different structural types of relative clauses are differentiated by different word order patterns.

(18)	The man who met Peter.	NP-*who*-V-NP	[subject RC]
(19)	The man who Peter met.	NP-*who*-NP-V	[direct-object RC]
(20)	The man who Peter sent the letter to.	NP-*who*-NP-V-NP-P	[indirect-object RC]
(21)	The man who Peter went to.	NP-*who*-NP-V-P	[oblique RC]

German has the same range of relative clauses as English; but instead of word order, German uses relative pronouns to indicate the function of the head in the relative clause (cf. 22-25).

(22)	Der Mann, der Peter getroffen hat.	*der*-NP …	[subject RC]
(23)	Der Mann, den Peter getroffen hat.	*den*-NP …	[direct-object RC]
(24)	Der Mann, dem Peter den Brief geschickt hat.	*dem*-NP …	[indirect-object RC]
(25)	Der Mann, zu dem Peter gegangen ist.	P-*dem*-NP …	[oblique RC]

Using a sentence repetition task, Diessel and Tomasello (2005) found (in accordance with much previous research) that subject relatives cause fewer difficulties for preschool children than non-subject relatives. However, while the children's responses to subject relatives were very similar in the two languages, English- and German-speaking children produced strikingly different responses to the various types of non-subject relative clauses. In German, direct-object relatives (cf. 23) caused fewer difficulties than indirect-object relatives (cf. 24) and oblique relatives (cf. 25), which is consistent with the fact that direct-object relatives are much more frequent in the ambient language than the two other types of non-subject relatives. However, in the English study all non-subject relatives caused the same amount of errors despite the fact that direct-object relatives are much more frequent than indirect-object relatives and oblique relatives. But how then do we account for the English results and the differences between the English and German studies?

Diessel and Tomasello argue that direct-object relatives, indirect-object relatives, and oblique relatives caused the same amount of errors in the English study because these relative clauses involve the same general word order pattern, i.e. NP (*who*) NP V, which the children of their English study frequently converted to the order NP (*who*) V NP, as in example (26):

(26)	a. TEST ITEM:	This is the girl [who the boy teased at school].
	b. Child:	This is the girl [who teased the boy at school].

Since non-subject relatives in German do not have a particular property in common (the relative clauses in 23 to 25 are marked by different relative pronouns), they were *not* treated as members of a common class, as indicated by the fact that in the German study direct-object relatives caused significantly fewer errors than indirect-object relatives and oblique relatives. Diessel and Tomasallo take this as evidence for their hypothesis that similarity between constructions plays an important role in grammatical development (see Diessel 2009 for additional data and discussion). What children eventually learn is a network of interconnected relative clause constructions. The development starts with subject relatives involving the same sequence of nouns and verbs as simple main clauses and it ends with genitive relatives (e.g. *the man whose dog was barking*), which are structurally and semantically distinct from all other types of relative clauses (cf. Figure 8).

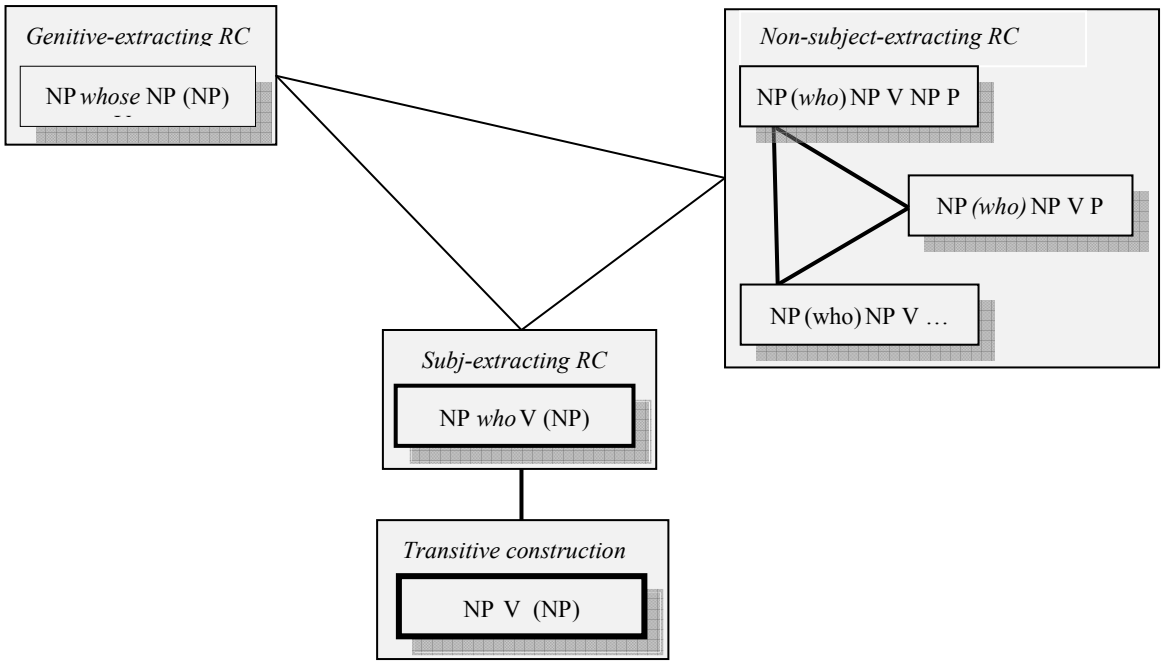

Figure 8. Partial network of (English) relative-clause constructions

5. Constructions and syntactic categories [syntactic links]

The third type of link concerns the relationship between constructions and syntactic categories (e.g. grammatical relations and word classes). Most grammatical theories presuppose a set of syntactic categories prior to syntactic analysis; but in the usage-based approach syntactic categories are emergent from the language users' experience with constructions. This is most forcefully expressed in Radical Construction Grammar, a usage-based variety of construction grammar developed by Croft (2001).

The starting point of Croft's analysis is the observation that syntactic categories vary across constructions and across languages. Let us consider grammatical relations to illustrate this point.[2] Grammatical relations define the syntactic functions of words and phrases in verb-argument constructions. In formal syntactic theories, grammatical relations are commonly defined as primitive categories; but Croft argues that grammatical relations are derived from particular constructions. Consider, for instance, the notion of subject.

In English, the subject is commonly defined as the nominal that immediately precedes the (finite) verb. However, while this may hold for basic declarative sentences, it does not generally hold for other sentence types. In (non-subject) questions, for instance, the subject occurs only after the auxiliary (cf. 27), and in sentences with preposed quotative clauses the (main clause) subject can follow the quotative verb (cf. 28).

(27) What did you say?
(28) "Good morning", said the young man with the red jacket.

In fact, even in simple declarative sentences, the subject does not always precede the verb. In the locative (inversion) construction, for instance, the position before the verb is occupied by

[2] Traditionally, syntactic analysis involves two major types of categories: (i) grammatical relations (e.g. subject, object) and (ii) word classes (e.g. noun, verb). In addition, phrases (e.g. NP, VP) can be seen as syntactic categories (cf. Croft 2001); but in this chapter I treat phrases as constructions and keep them separate from syntactic categories because they evolve in different ways (see Section 7).

an adverbial and the subject occurs only after the verb (cf. 29), and in constructions with negative inversion, the subject precedes the main verb and follows the auxiliary (cf. 30).

(29) Across the bridge lived an old man that was well-known in this region.
(30) Never would I talk to him about these things.

Another construction-particular property of grammatical relations is control. In complex sentences with non-finite complement clauses, for instance, the verb of the lower clause is usually controlled by the direct object of the higher clause (cf. 31); but if the main clause includes the verb *promise*, it is controlled by the matrix clause subject, i.e. the clause-initial NP (cf. 32).

(31) Peter convinced Sue to support his proposal.
(32) Peter promised Sue to support her proposal.

Similar construction-specific constraints have been observed in languages where grammatical relations are primarily expressed by morphological means, i.e. by case marking or agreement morphology (Croft 2001). In addition to such construction-particular properties, there are language-particular aspects of grammatical relations. Croft stresses that languages differ as to how they organize grammatical relations. There is an enormous amount of crosslinguistic variation in this domain, which typologists have analyzed in terms of three general semanto-syntactic roles: (i) the S role, which refers to the one participant that is entailed by an intransitive event, (ii) the A role, which refers to the most agent-like participant of a transitive event, and (iii) the P role, which refers to the most patient-like participant of a transitive event (e.g. Dixon 1994).

In English, the notion of subject subsumes the S and A roles, which are uniformly expressed by nominals that precede the finite verb (in basic declarative sentences); whereas the P role is encoded by a postverbal NP (cf. 33-34). Note, however, that in passive sentences the P role is promoted to subject and expressed by a preverbal nominal, whereas the A role is either omitted or demoted to an oblique (cf. 35).

(33) *The boy*$_{\text{AG}}$ kicked the ball$_{\text{PA}}$.
(34) *The man*$_{\text{AG}}$ is running.
(35) *The ball*$_{\text{PA}}$ was kicked (*by the boy*$_{\text{AG}}$).

Like English, many other languages encode S and A by the same word order or morphology; but this is not a universal strategy. It is well-known that in languages with ergative morphology, S and P are treated as a formal grammatical category (absolutive case) in contrast to A (ergative case), and that in languages with split-intransitive morphology the S role is divided into two categories: agent-like participants (e.g. *The man*$_{\text{AG}}$ is running) that are encoded in the same way as the A role of a transitive sentence, and patient-like participants (e.g. *The bomb*$_{\text{PA}}$ exploded) that are encoded in the same way as the P role. Moreover, there are languages in which the subject of a passive sentence occurs with the same case marker as the direct object (or an oblique), and there are other languages that differentiate between different P roles (see Bickel 2011 for a recent overview). Finally, the morphological marking of S, A and P does not always coincide with their syntactic functions. In fact, in most languages with ergative morphology, coordinate sentences and relative clauses are conjoined based on an S/A "pivot"; that is, most (morphological) ergative languages employ an S/A alignment pattern for the formation of complex sentences. Syntactic ergativity, i.e. occurrence of an S/P pivot, is a very rare phenomenon and always restricted to particular constructions (cf. Dixon 1994).

In general, there is an enormous amount of variation in the encoding of grammatical relations across languages and constructions. Most grammatical theories abstract away from this variation and define syntactic categories at a very high level of abstractness. In this approach, grammar includes a universal inventory of highly schematic categories that are defined prior to syntactic analysis. But this approach has been challenged by Croft (2001), who offers an alternative account in which syntactic categories are emergent from constructions:

> Constructions, not categories and relations, are the basic, primitive units of syntactic representation. [Croft 2001: 45-6]

Constructions are the basic units of grammar because in contrast to what is commonly assumed in linguistic theory, syntactic configurations are not derivable from atomic primitives. While Croft does not explicitly refer to usage and development, his analysis implies that syntactic categories are formed in the process of language acquisition and language change. On this view, syntactic categories are emergent from the language user's (unconscious) analysis of particular constructions and are therefore subject to change.

The relationship between constructions and categories is similar to that between constructions at different levels of abstractness. Constructions are generalizations over concrete utterances, i.e. constructs, and categories are generalizations over recurrent parts of constructions. If we accept this comparison, we can think of grammatical relations (and word classes) as emergent categories of linguistic structure that children acquire through the analysis of constructions and that continue to be reinforced and adjusted throughout speakers' lives as they interact with each other. Like constructs and constructions, categories and constructions are related to each other by taxonomic links that are part of our grammatical knowledge (cf. Figure 9).

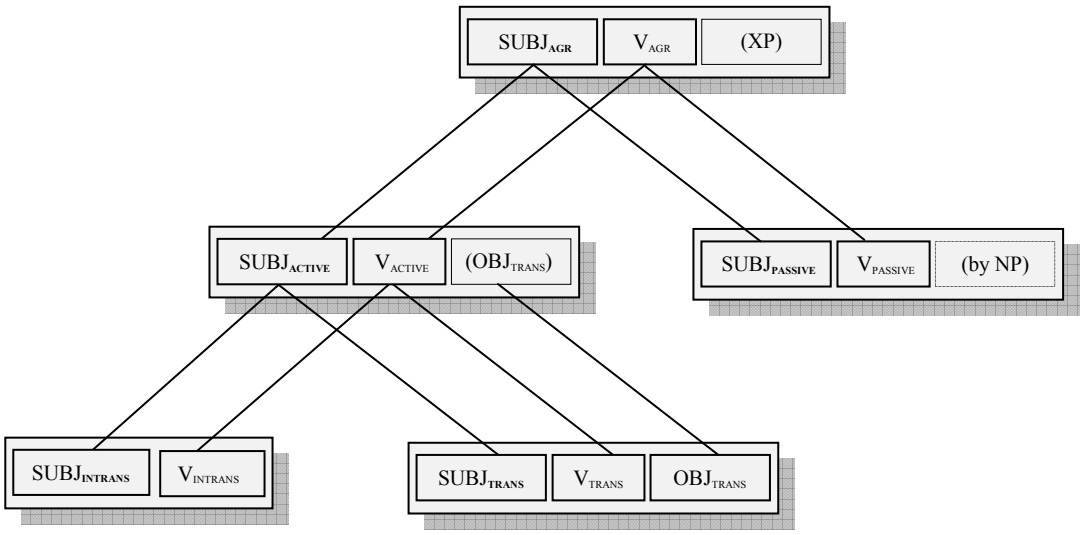

Figure 9. Partial network of grammatical relations and constructions

6. Constructions and lexemes

Finally, there are associative links between (schematic) constructions and (concrete) lexical expressions (see Geeraerts in this volume). In structuralist and generative linguistics, individual words are irrelevant for grammatical analysis; but in the usage-based approach linguistic structure is fundamentally grounded in the language user's experience with concrete lexical expressions. In fact, constructions are often immediately associated with particular

words (see Diessel forthcoming for a review of the relevant literature). This is perhaps most obvious in the case of closed-class function words. The comparative correlative construction, for instance, includes two grammatical morphemes, i.e. two instances of *the*, which only occur in this particular pattern (cf. 36).

(36) The bigger the house, the smaller the garden.

Other constructions that are associated with particular function words are the passive construction (cf. 37), the nominal extraposition construction (cf. 38), the existential *there*-construction (cf. 39), the *way*-construction (cf. 40), and the hortative construction (cf. 41). In all of these sentence types, there are particular words that are so closely associated with the structural pattern that they can only be analyzed as an integral part of the construction.

(37) Peter was struck by lightening.
(38) It's unbelievable the amount of food that he can eat.
(39) There was an old man who lived in a house in the woods.
(40) John found his way out of business.
(41) Let's have a beer.

The relationship between constructions and content words is more variable. In fact, in the construction-based literature it is commonly assumed that construction include 'open slots' for particular content words (see above); but these slots are usually associated with particular words by probabilistic links.

Stefanowitsch and Gries (2003) developed a corpus method, i.e. "collostructional analysis", to analyze the probabilistic links between lexemes and constructions. Let us consider the ditransitive construction to illustrate this approach. The ditransitive construction consists of a subject, a verb, and two noun phrases, which together denote an act of transfer between an actor and a recipient. The construction occurs with a wide range of verbs—*give, send, offer, show, teach*, to mention just a few. Most of these verbs can also appear in other grammatical contexts, in the *to*-dative, for instance, or in the transitive construction (cf. 42-44).

(42) Peter sent John a letter.
(43) Peter sent a letter to John.
(44) Peter sent a letter by mail.

What Stefanowitsch and Gries have shown is that individual lexemes are often more (or less) frequent in a particular construction than statistically expected if the relationships between lexemes and constructions were random. The verb *give*, for instance, is strongly attracted by the ditransitive construction and appears less frequently than expected in the *to*-dative; and for the verb *bring* it is the other way around (cf. Figure 10) (cf. Gries and Stefanowitsch 2004).

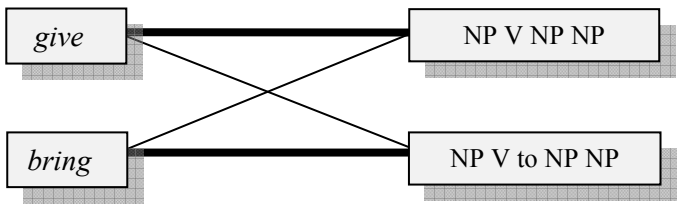

Figure 10. The relationship between verbs and constructions

Both the ditransitive and the *to*-dative denote an act of transfer, but have slightly different meanings. The *to*-dative implies a greater distance between actor and recipient than the

ditransitive and is therefore more strongly associated with activities involving motion (cf. Thompson and Koide 1987). This explains why the verbs *bring* and *take* are particularly frequent in the *to*-dative construction, whereas verbs such as *give* and *tell* are proportionally more frequent in the ditransitive (cf. Gries and Stefanowitsch 2004). In other words, verbs and constructions seem to "attract" (or "repel") each other based on their meanings: there is a tendency to use verbs that are semantically compatible with the constructional meaning (Goldberg 1995: 50 calls this the "Semantic Coherence Principle"); but the semantic fit is not the only factor influencing the relationships between lexemes and constructions.

Consider, for instance, the verb *donate*, which is semantically very similar to the verbs of transfer that are commonly used in the ditransitive and *to*-dative constructions; however, although *donate* is semantically compatible with both constructions, it is exclusively found in the *to*-dative (cf. 45) (in American English).[3] For most speakers, *donate* is unacceptable in the ditransitive construction (cf. 46); but not because *donate* would not fit the constructional meaning, but simply because *donate* has never been experienced in the ditransitive construction.

(45) Peter donated money to the Red Cross.
(46) *Peter donated the Red Cross money.

Similar semantically unmotivated restrictions have been observed for other verbs and other constructions, suggesting that the associations between verbs and constructions are not fully predictable from semantic criteria. In addition to the semantic fit, it is the language user's experience with an established pattern that influences the associative links between lexemes and constructions. Of course, the semantic fit affects the language users' linguistic behaviour, which in turn determines their experience, so that the two factors are likely to reinforce each other over time; but, as we have seen in the case of *donate*, the language users' linguistic experience does not always reflect the semantic fit between lexemes and constructions, suggesting that the two factors, i.e. semantic fit and frequency/entrenchment, are in principle independent of each other (see Diessel forthcoming for discussion of this point).

One can think of the relationship between lexemes and constructions as part of a probabilistic network shaped by language use. On this account, verbs (and other lexemes) and constructions are related to each other by connections with graded activation values that are determined by the combined effect of general semantic criteria and the language users' experience with particular lexical expressions and constructions (cf. Figure 11).

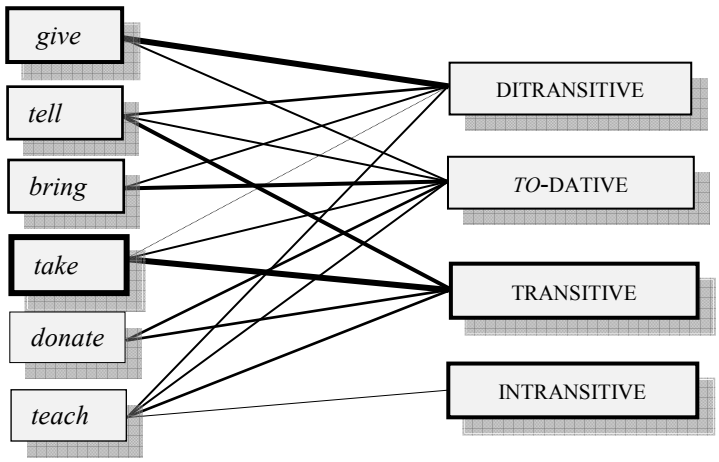

Figure 11. Partial network of verbs and constructions

[3] In British English, *donate* is sometimes used in the ditransitive construction (Ewa Dąbrowska p.c.).

7. Phrase structure

To summarize the discussion thus far, we have looked at four different types of links between linguistic elements, namely the links between (i) constructions at different levels of abstractness (taxonomic links), (ii) constructions at the same level of abstractness (horizontal links), (iii) constructions and syntactic categories (syntactic links), and (iv) constructions and lexemes (lexical links). What we have not yet considered is constituent structure, i.e. the hierarchical organization of clauses and phrases, which provides perhaps the best evidence for a compositional approach. In generative grammar, constituent structure is derived from a small inventory of discrete categories, e.g. NP, VP, PP, and S, that are combined to larger syntactic units by general phrase-structure rules (e.g. PP → P-NP). The resulting structures are commonly represented in phrase-structure graphs, as exemplified in Figure 12.

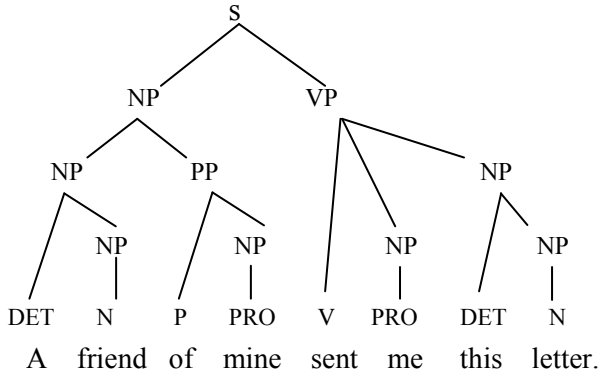

Figure 12. Phrase structure graph

Obviously, this analysis is not consistent with the dynamic nature of grammar in the usage-approach. If grammar is grounded in experience, we have to ask where do these structures come from and how do they change?

There is not much research on constituent structure in the usage-based approach; but Bybee (2002) and Langacker (2008) have made some interesting suggestions as to how constituency can be analyzed from a usage-based perspective. Specifically, Bybee argues that phrases, or phrasal constructions, are "processing units" that have evolved from frequent strings of linguistic elements. The development of these units is driven by two general aspects of language use, namely (i) semantic coherence and (ii) automatization or chunking.

In accordance with much previous research, Bybee argues that there is a general tendency to place semantically related elements next to each other. An early statement of this is Behaghel's 'first law':

> *Geistig eng Zusammengehöriges wird auch eng zusammengestellt*. 'Conceptually related entities are placed close to each other.' [Behaghel 1932]

The second factor that influences the emergence of constituency is frequency (see Divjak and Caldwell-Harris in this volume). Specifically, Bybee argues that frequency is the driving force behind a cognitive mechanism which she calls "chunking", though "automatization" seems to be a better term, considering the way these terms, i.e. chunking and automatization, are used in cognitive psychology (see Diessel forthcoming for discussion).

Automatization is a general psychological mechanism whereby controlled processes are transformed into automatic processes. Almost all sequential activities start off as controlled processes, but are then often transformed into automatic processes through repetition or practice. This is a very common cognitive phenomenon involved in many everyday tasks.

Automatization enables people to perform complex sequential activities with little effort, but is also a common source for certain types of mistakes, i.e. slips, that occur for lack of attention or lack of conscious control (cf. Logan 1988; Schneider and Chein 2003).

Language is a sequential medium that is crucially influenced by automatization; but language unfolds in time. All linguistic elements, e.g. phonemes, morphemes, words, categories, and constructions, occur in sequence and are therefore subject to automatization. If we repeatedly process the same string of linguistic elements within a particular period of time, automatization creates associative links between them. This can involve either strings of (concrete) lexical expressions or strings of (abstract) categories. The strengths of the associative links can be expressed in terms of transitional probabilities or other statistical measures that have been explored in corpus and psycholinguistic studies (cf. Figure 13).

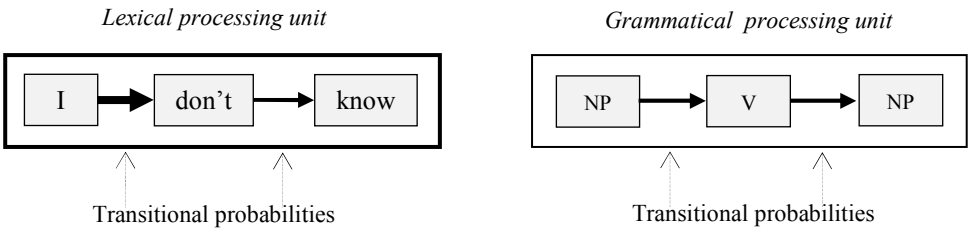

Figure 13. Processing units

The cognitive result of this process is the emergence of an automated processing unit. Since automatization is a gradual process driven by frequency (or repetition) the units of speech vary on a continuum. Other things being equal, the more frequent a particular string of linguistic elements is processed, the stronger is the cohesion of the emerging processing unit; or as Bybee (2002: 220) put it: "the more often particular elements occur together, the tighter the constituent structure".

Since smaller units are usually more frequent than large ones, length and complexity vary with the degree of syntactic cohesion. As a consequence of this, more tightly organized processing units appear to be embedded in less automatized ones, creating a hierarchical organization of linguistic structure which one might analyze in terms of phrase structure trees. Note, however, that the resulting phrase structures are very different from traditional phrase structure representations. In generative grammar, syntactic phrase structure is analyzed by a set of discrete categories that are defined prior to syntactic analysis; but in the usage-based approach phrase structure is emergent and non-discrete. It is grounded in the language user's experience with strings of linguistic elements that are combined to fluid units. As a consequence of this, constituent structure is much more diverse and variable than in generative linguistics. Consider, for instance, a verb phrase such as *(She) arrived after John* (cf. Figure 14). In traditional phrase structure analysis, it is assumed that the VP consists of two immediate constituents, namely V and PP; but it is well-known that in a parallel structure such as *(She) looked after John* the preposition is more strongly associated with the verb than with the noun, creating a grouping of syntactic categories that is not consistent with general phrase-structure rules (i.e. [[V-P] NP]).

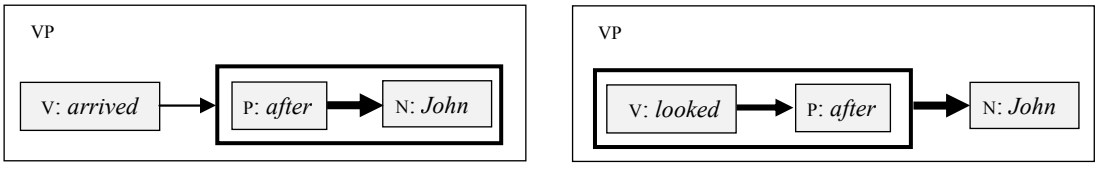

Figure 14. Processing units

In the usage-based approach, this is readily explained by automatization or chunking. Since the sequence *look after* is much more frequent than *after John*, *look after* constitutes a chunk, i.e. an automated processing unit, that is largely independent of the general VP schema in which postverbal prepositions are associated with a subsequent noun, rather than with the verb. Other mismatches between traditional phrase structures and lexically specific chunks are described in Bybee and Scheibman (1999), Bybee (2002), and Beckner and Bybee (2009). Taken together these studies suggest that constituency is a gradient phenomenon emergent from concrete utterances of language use, just like any other aspect of grammar.

8. Conclusion

To conclude, this chapter has provided an overview of recent research on grammar in cognitive linguistics. The goal of this research is to develop a framework for the analysis of linguistic structure as it evolves from domain-general cognitive processes. In this approach, grammar is seen as a self-organizing system of emergent categories and fluid constructions that are in principle always changing, always in flux, under the influence of general cognitive mechanisms involved in language use such as analogy, categorization, and automatization (or chunking). There are two basic tenets that underlie the analysis of linguistic structure in this approach: First, linguistic structure consists of signs, i.e. constructions, and second constructions are associated with each other (and other linguistic signs) by various types of links creating an intricate system of interconnected elements that one might characterize as a dynamic network. The purpose of this chapter has been to elaborate the network metaphor of usage-based construction grammar, which had not yet been sufficiently described.

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Holger Diessel (University of Jena)