# Usage-based linguistics

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**Summary**

Throughout the 20s century, structuralist and generative linguists have argued that the study of the language system (langue, competence) must be separated from the study of language use (parole, performance); but this view of language has been called into question by usage-based linguists who have argued that the structure and organization of a speaker's linguistic knowledge is the product of language use or performance. On this account, language is seen as a dynamic system of fluid categories and flexible constraints that are constantly restructured and reorganized under the pressure of domain-general cognitive processes that are not only involved in the use of language but also in other cognitive phenomena such as vision and (joint) attention. The general goal of usage-based linguistics is to develop a framework for the analysis of the emergence of linguistic structure and meaning.

In order to understand the dynamics of the language system, usage-based linguists study how languages evolve, both in history and language acquisition. One aspect that plays an important role in this approach is frequency of occurrence. As frequency strengthens the representation of linguistic elements in memory, it facilitates the activation and processing of words, categories, and constructions, which in turn can have long-lasting effects on the development and organization of the linguistic system. A second aspect that has been very prominent in the usage-based study of grammar concerns the relationship between lexical and structural knowledge. Since abstract representations of linguistic structure are derived from language users' experience with concrete linguistic tokens, grammatical patterns are generally associated with particular lexical expressions.

**Keywords**

Usage-based linguistics, emergence, network, frequency, cognitive processes, social cognition, lexical specificity, linguistic productivity, constructions, schemas

[1] In Mark Aronoff (ed.), *Oxford Research Encyclopedia of Linguistics*. New York: Oxford University Press. http://linguistics.oxfordre.com/view/10.1093/acrefore/9780199384655.001.0001/acrefore-9780199384655-e-363?rskey=ivWwgv&result=2

## 1. Some basic principles of usage-based linguistics

Language is an instrument of communication. People use language to share information, to ask questions, to make promises, to direct other people's actions, or to express emotions (Austin 1962). The communicative functions of language have left an imprint on linguistic structure. There is evidence that the existence of particular sentence types, word order patterns, and certain kinds of expressions such as demonstratives are motivated by interactive processes of language use (Givón 1979; Tomlin 1986; Diessel 2006).

In addition, linguistic structure is influenced by general cognitive processes that concern the categorization and conceptualization of experience (Langacker 1987), the representation and activation of knowledge in memory (Bybee 2007), the linearization of information in utterance planning (MacDonald 2013), and the flow of consciousness in discourse processing (Chafe 1994). It is the general goal of usage-based linguistics to develop a dynamic theory of language that accounts for the effects of interactive and cognitive processes on the emergence of linguistic structure and meaning (Beckner et al. 2009; Bybee 2006, 2007, 2010; Bybee and Hopper 2001; Diessel 2011a; Goldberg 1995, 2006; Hopper 1987; Kemmer and Barlow 2000; Langacker 1987, 1991, 2000, 2008; Tomasello 2003).

The research program of usage-based linguistics stands in sharp contrast to the structuralist and generative approach. Ever since Saussure, the study of the linguistic system has been separated from the study of language use or performance. In the classic version of generative grammar, language, notably grammar, is primarily seen as a computational system rather than an instrument of communication (Chomsky 1965). Building on this view, grammar is commonly analyzed by a set of primitive categories and concatenating rules which, according to Chomsky (1986) and other generative scholars, are biologically predetermined by a particular faculty of the mind (Pinker 1994; Pinker and Jackendoff 2005).

Usage-based linguists reject the innateness hypothesis of generative grammar and with it the traditional distinction between grammar and usage, or competence and performance. In this approach, language consists of fluid structures and probabilistic constraints that are shaped by communication, memory, and processing. Challenging the widespread assumption that linguistic structure is built from a predefined set of innate linguistic concepts, usage-based linguists conceive of language as a dynamic network in which the various aspects of a language user's linguistic knowledge are constantly restructured and reorganized under the continuous pressure of performance. In order to understand the (synchronic) organization of the linguistic system, usage-based linguists study how languages evolve, both in history and acquisition.

One aspect that plays an important role in the usage-based analysis of linguistic structure and meaning is frequency of occurrence. As frequency strengthens the representation of linguistic elements in memory, it facilitates the activation and processing of words, categories, and constructions, which in turn can have long-lasting effects on the organization of linguistic knowledge in the language network.

A second aspect that is of central significance to the usage-based study of language concerns the relationship between lexical and grammatical knowledge. Since abstract representations of grammatical structure are derived from language users' experience with particular words and utterances, there is a close connection between lexical and grammatical knowledge in the usage-based model of grammar. In the structuralist approach, linguistic structure is assumed to be independent of particular lexical expressions; but in the usage-based approach, syntactic structures are lexically particular.

The usage-based approach has evolved from earlier research in functional and cognitive linguistics which has emphasized the importance of pragmatic and conceptual factors for the emergence of language structure and meaning (Givón 1979; Hopper and Thompson 1980; Talmy 1983; Langacker 1987; Lakoff 1987); but in more recent research the focus of analysis has shifted to the effects of frequency and processing on the development and organization of linguistic knowledge (Arnon and Snider 2010; Bybee and Hopper 2001; Bybee 2006, 2007, 2010; Goldberg 2006; Hay 2001; Krug 2003).

Parallel to the rise of usage-based linguistics, cognitive psychologists began to emphasize the importance of experience and item-specific grammatical knowledge for language acquisition, sentence processing, utterance planning, and speech production. Inspired by computational research with connectionist networks (Rumelhart and McClelland 1986), Bates and MacWhinney (1989) proposed a (theoretical) network model of language acquisition and sentences processing that is closely related to usage-based research in linguistics and that had a strong impact on later psychological research on these topics (MacDonald et al. 1994; MacDonald and Seidenberg 2006; Tomasello 2003).

This chapter provides an overview of some central themes of current research in usage-based linguistics. The chapter consists of two main parts. Part one is concerned with the network architecture of language, which provides a general framework for the analysis of linguistic knowledge; and part two describes some of the interactive and cognitive processes that have been proposed in the linguistic and psycholinguistic literature to explain how linguistic knowledge is shaped by communication and processing.

## 2. The network architecture of language

A basic principle of all usage-based research is that linguistic structure consists of constructions. A construction is a complex linguistic sign that combines a particular structural pattern with a particular meaning or function.[2] A word such as *player*, for instance, instantiates a morphological construction consisting of a nominalizing suffix and a verb that is transformed into a noun denoting an actor (VERB-*er*); and a copular clause such as *I am happy*

[2] Some researchers use the notion of construction also for simple lexemes such as *car* or *run* (Goldberg 1995; Croft and Cruse 2004: §4); but in this article, I use the notion of construction in a more restrictive way for structural patterns that comprise at least two meaningful elements, and I use the notion of sign as a cover term for both simple lexemes and constructions (see Diessel 2015: 299).

represents a syntactic construction consisting of a subject, an inflected form of the copular *be*, and an adjective that describes the preceding nominal (NP-*be*-ADJECTIVE).

In the classic version of generative grammar, morphological and syntactic structures are derived from primitive categories and concatenating rules (e.g. NP → DET ADJ N); but there is good evidence that structures such as [VERB-*er*] and [NP-*be*-ADJECTIVE] are stored and processed as holistic grammatical patterns that evoke a particular semantic representations irrespective of the words they include (see Goldberg 2006: 6-9 for discussion).

Assuming that linguistic structure consists of constructions, usage-based linguists have argued that the entire inventory of linguistic signs constitutes a network in which lexemes and constructions are associated with each other by various types of connections that reflect the language users' experience with particular co-occurrence patterns. The network metaphor of usage-based construction grammar has been used in a large number of studies (e.g. Bybee 1985; Langacker 1987; Goldberg 1995; Croft 2001; Traugott and Trousdale 2013; Hilpert 2014); but the metaphor has not (yet) been elaborated to an explicit model (see Diessel 2015 for some suggestions). In what follows, I illustrate the general approach with a few selected examples from the literature.

To begin with, Bybee (1985) proposed a network model of morphology in which words, rather than morphemes, are the basic units of analysis (see also Aronoff 1994). In this model, affixes are represented together with a base, and complex words (or morphological constructions) are structured by lexical connections that indicate overlapping parts between words of the same paradigm or morphological family. Consider, for instance, the graph in Figure 1 which is very similar to network representations in Bybee (1985, 1988, 1995, 2001) and Hay and Baayen (2005).

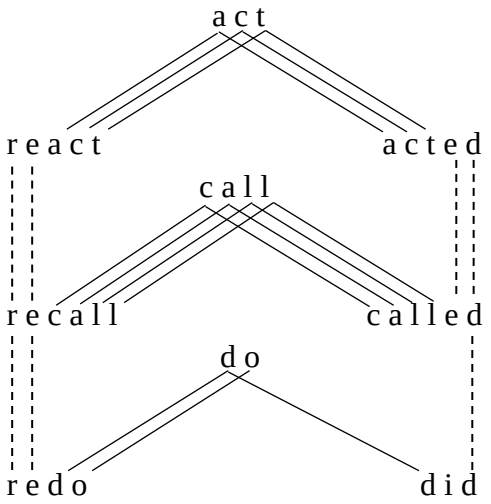


Figure 1. Morphological network (cf. Bybee 1985, 1988, 1995, 2001)

As can be seen, morphologically complex words with overlapping parts are related by associative connections that mark them as members of a particular morphological class (e.g.

the class of regular past tense verbs). In addition, speakers may represent generalizations across groups of connected words in a morphological schema ([re __ ]$_V$, [ __ ed] $_V$); but there is good evidence that (frequent) words are stored together with bound morphemes as prefabricated units (see Bybee 1985, 1995; Sereno and Jongman 1999).

One general advantage of this approach is that morphological structure is analyzed within the same general network model as associations between semantically related lexemes (*cow-farm*), words of suppletive paradigms (*go-went*), words that alliterate (*fry-free-frozen*) or rhyme (*hat-cat- rat*), and phonesthemes (*glow-glitter-glisten*). All of these phenomena involve associative connections between semantically and/or phonologically related expressions that are evident in psycholinguistic experiments. Note that the strength of lexical connections varies on a continuum, which is easily explained in a dynamic network model by assigning different weights to particular connections.

Like morphological constructions, syntactic constructions are related by associative connections that reflect the language users' experience with holistic grammatical patterns. Of particular importance to syntactic constructions is the hierarchical organization of grammar. The general idea is that constructions are represented at different levels of schematicity that are connected by taxonomic links (also referred to as 'inheritance links'; Goldberg 1995: 73-81). Consider, for instance, the following examples of English relative clauses (RCs).

| | | |
|---|---|---|
| (1) | The man who met John. | Subject RC |
| (2) | The man (who[m]) John met. | Object RC |
| (3) | The man (who) John talked to. | Oblique RC |
| (4) | The place (where) we met. | Oblique RC |
| (5) | The man whose friend John met. | Genitive RC |

Relative clauses are subordinate clauses that modify a noun in the main clause, which serves a particular semanto-syntactic role in the relative clause. Subject and non-subject relative clauses are distinguished by word order and the optional 'omission' of the relative marker in non-subject relative clauses (cf. 6-7).

| | | |
|---|---|---|
| (6) | Subject RCs: | NP [ *who/that/which* VERB … ]$_{RC}$ |
| (7) | Non-subject RCs: | NP [ *(who/that/which)* NP VERB … ]$_{RC}$ |

The latter (i.e. non-subject RCs) comprise object, oblique, and genitive relative clauses, which are differentiated by the use of different pronouns (*whom* vs. *who* vs. *whose*), adpositions (*which* vs. *of which*), verb valency (transitive vs. intransitive), and the 'omission' of the 'relativized noun' (i.e. the semantic referent that is coreferential with the noun being modified by the relative clause). The various types of relative clauses constitute a hierarchical network of constructions ranging from lexicalized structures at the bottom of the network (e.g. *All I know*, *The way I am*) to highly abstract representations at the top (Figure 2).

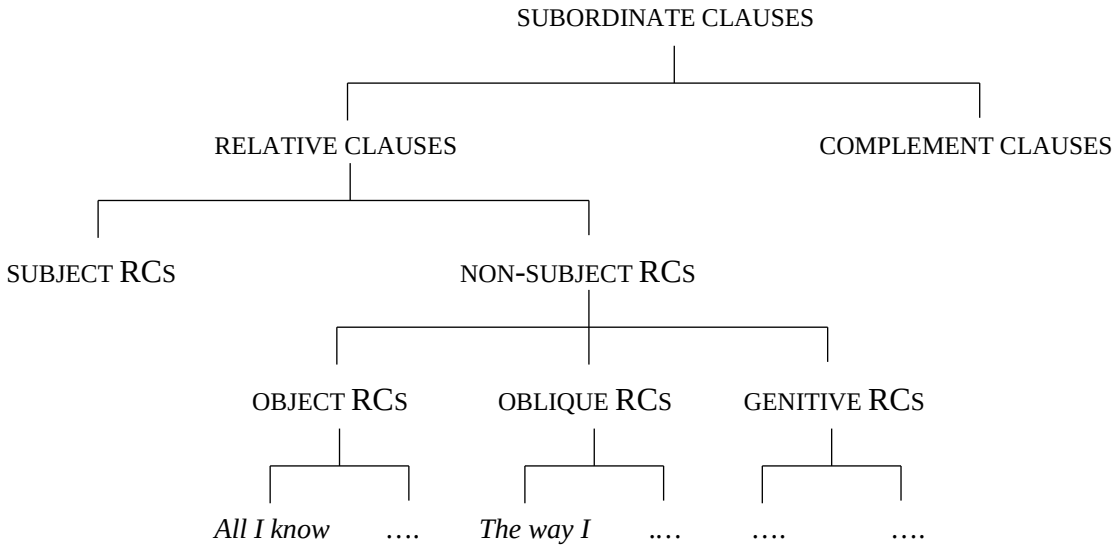


Figure 2. Hierarchical network of English relative clause constructions

Children acquire the hierarchical network of relative clause constructions (and other grammatical pattern) in a piecemeal, bottom-up fashion whereby they 'construct' increasingly more schematic representations of relative clause constructions that enable mature language learners to produce novel relative clauses, that is, relative clauses they have never heard or used before (Diessel 2009).

The hierarchical organization of constructions has been a central topic of usage-based research on language acquisition (Tomasello 2003; Goldberg 2006) and language change (Hilpert 2013; Traugott and Trousdale 2013); but constructions are not only taxonomically related. There are also associative connections between constructions with overlapping and contrastive features (similar to complex words in morphological paradigms; see Figure 1). Content questions, for instance, share a number of properties with relative clauses, which can be explained by analogical connections between constructions in the grammar network. As can be seen in Figure 3, both clause types begin with a WH-word, they differentiate subject from non-subject roles by linear order, and they both occur with stranded prepositions.

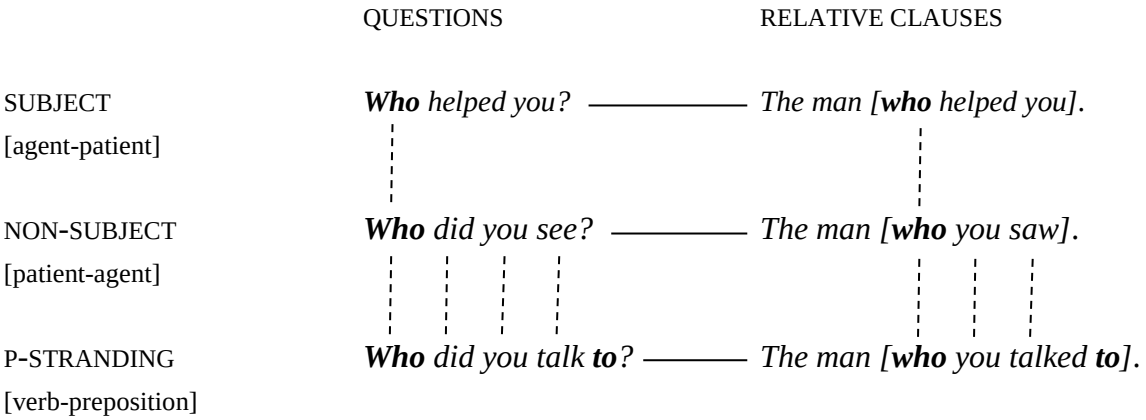


Figure 3. Network of related questions and relative clauses

Like questions and relative clauses, many other syntactic patterns are interconnected. Active and passive sentences, for instance, form a pair of constructions that present a causative event from different perspectives (cf. 8-9) (Langacker 1991: §4); and purpose infinitive clauses share formal and semantic properties with infinitival complement clauses (cf. 10-11) (Schmidtke-Bode 2009: 157-165).

(8) The boy *kicked* the ball.
(9) The ball *was kicked* by the boy.

(10) They left *to be there* on time.
(11) They want *to be there* on time.

In general, in the usage-based approach, grammar consists of conventionalized patterns of form and meaning (i.e. constructions) that are interconnected by various types of links or relations that reflect the language users' experience with particular grammatical patterns. It is a standard assumption of usage-based linguistics that speakers' knowledge of interrelated constructions can be described as some kind of network; but as it stands the network metaphor of usage-based construction grammar has not (yet) been developed into an explicit and comprehensive model (see Diessel 2015 for discussion).

## 3. Cognitive processes

A second principle that is of fundamental significance to usage-based linguistics is that language use and language development are driven by the same cognitive processes as other, non-linguistic forms of cognition and social behavior. Since many usage-based linguists have stressed the importance of frequency for the emergence of linguistic knowledge, there has been a tendency to associate usage-based linguistics with the analysis of memory-related process (which are immediately determined by frequency of occurrence); but memory is not

the only factor that affects speakers' linguistic behavior. There is general consensus among usage-based linguists that language use involves a wide range of cognitive and social processes, which may be divided into three general domains, namely the domains of (i) social cognition (cf. §3.1.), (ii) conceptualization (cf. §3.2.), and (iii) memory and processing (cf. §3.3.)

### 3.1. Social cognition

Language use is a particular form of social interaction, which involves a set of cognitive processes that concern the ability to take other persons' knowledge, intentions, and beliefs into account (Clark 1996; Tomasello 2003). This ability, which is often characterized as a uniquely human capacity (Tomasello 1999), is of central significance to both language use and language development.

A basic form of social cognition is joint attention (Carpenter et al. 1998; Tomasello 1999; Eilan et al. 2005). In order to communicate, the interlocutors must focus their attention on the same experience, which may involve an object or event in the surrounding situation or a concept that is evoked by the preceding discourse. In face-to-face conversation, joint attention is commonly established by non-verbal means of communication such as eye gaze, head movement, and gesture. Of particular importance is deictic pointing—a communicative device that is universally available to establish joint attention and that is commonly accompanied by demonstratives (or spatial deictics) (Bühler 1934; Diessel 2006).

Joint attention is a prerequisite for social interaction; but communication involves more than a shared focus of attention. In order to communicate, the interlocutors have to align their knowledge and beliefs; that is, they have to establish a common ground that is available as a background for the interpretation of novel information (Clark and Brennan 1991; Clark 1996). Common ground provides the basis for what some psychologists call 'audience design', which is the process whereby speakers seek to construct a sentence according to what they think the hearer 'needs' in order to understand their communicative intention in a particular situation (Clark and Marshall 1981; see also Horton and Gerrig 2005).

To illustrate, all languages have multiple types of referring expressions—definite and indefinite NPs (*a/the boy*), proper names (*John*), demonstrates (*that one*), third person pronouns (*he*), and zero anaphors (Gundel et al. 1993). Functional linguists have shown that the occurrence of the various types of referring expressions correlates with aspects of the linguistic and non-linguistic context (Givón 1984; Ariel 1990; Chafe 1994); but from a cognitive perspective we may say that speakers choose a particular term based on what they think the listener knows and sees; and listeners interpret the chosen expressions based on the assumption that speakers construct sentences according to this strategy (see Arnold 2008 for a review). In other words, the choice and interpretation of linguistic expressions is crucially influenced by the interlocutors' assessment of common ground.

What is more, joint attention and common ground are also important for language acquisition and language change. As Tomasello and colleagues have shown, the ability to engage in social interactions evolves only gradually in early childhood (Carpenter et al. 1998;

Tomasello 2003). While infants respond to adults' actions from early on, it is only around the first birthday that they begin to understand the communicative functions of pointing and eye gaze and the role of intentions, which, according to Tomasello is a prerequisite for language learning. In order to understand a (linguistic) symbol, the child must be able to recognize that language is used for particular purposes and that the (communicative) actions of adults are driven by intentions.

Moreover, there is good evidence that the diachronic development of grammatical markers and constructions is influenced by the communicative pressure to coordinate the interlocutors' attention and knowledge. For instance, the frequent development of demonstratives into grammatical markers can be explained by their communicative function to establish a joint focus of attention (Diessel 2006). In their basic use, demonstratives refer to objects and events in the surrounding situation; but, as can be seen in (12) and (13), they can also refer to linguistic elements in discourse.

(12) I was very tired last night. **That**'s why I left early.
(13) Listen to **this**: Peter and Jane will get married!

Starting from this use, demonstratives are frequently reanalysed as definite articles, third person pronouns, topic markers, sentence connectives, and a wide range of other grammatical function words (Diessel 2006), which is arguably motivated by their communicative function to focus the interlocutors' attention on linguistic elements in the unfolding speech stream (see also Bühler 1934 and Diessel 2012a).

What is more, information-structure constructions such left-dislocation (14), cleft-sentences (15), and preposed adverbial clauses (16) can be seen as grammatical strategies that have evolved to establish shared or presupposed knowledge as a foundation or background for the interpretation of subsequent information in the progressing discourse (see also Givón 1990; Clark and Brennan 1991).

(14) Peter and I, we decided to ….
(15) What she did not tell you is …
(16) If I had known this, …

In general, joint attention and common ground are domain-general cognitive phenomena that are foundational to communication and language. They influence the language users' linguistic decisions and choices in both speaking and listening and motivate the development of grammatical markers and constructions that serve to enhance discourse coherence through the coordination of (shared) knowledge and attention.

### 3.2. Conceptualization

Conceptualization concerns the construction of meaning. In formal semantics, meaning is defined in terms of reference and truth conditions (reference to article in the OUP Encyclopedia); but in the usage-based approach, semantics is shaped by conceptualization, which is the cognitive structuring of experience (or semantic content) (Langacker 1991; Talmy 2000).

Like all other cognitive processes of language use, conceptualization is not specific to language. In fact, the conceptual approach to semantics is inspired by general psychological research on vision. Pioneering research on conceptualization comes from gestalt psychology, which had a strong impact on conceptual semantics (Talmy 1983; Langacker 1987). The gestalt psychologists showed that vision involves more than the passive recording of sensory cues—that visual perception is guided by general cognitive principles such as the segregation of figure and ground and reification (which is the enrichment of perceptual information through inference).

Inspired by this research, cognitive and usage-based linguists developed a conceptual theory of semantics in which the meaning of linguistic expressions is structured by general conceptual processes (which Langacker 2008: 55-89 calls 'construal operations'), such as metaphor, metonymy, deixis, fictive motion, selective attention, schematization, categorization, force dynamics, and the figure-ground segregation (Croft and Cruse 2004: §3; Fillmore 1982; Lakoff and Johnson 1980; Lakoff 1987; Langacker 1987: §3.3; Talmy 2000).

Langacker (1991: 117) argues that there are always multiple ways of viewing and describing the same experience (see also Croft and Cruse 2004: §3). The analysis of alternative descriptions provides a useful strategy to illustrate that (linguistic) meaning resides in the cognitive structuring of sensory experience. Consider, for instance, the use of *come* and *go* in (17) and (18).

(17) She came to school.
(18) She went to school.

*Come* and *go* are deictic verbs that can often be used with reference to the same scene, but they describe the scene from different perspectives. In the case of *come*, the conceptual figure is moving towards the observer; but in the case of *go*, the figure is moving away from the observer (Figure 4).

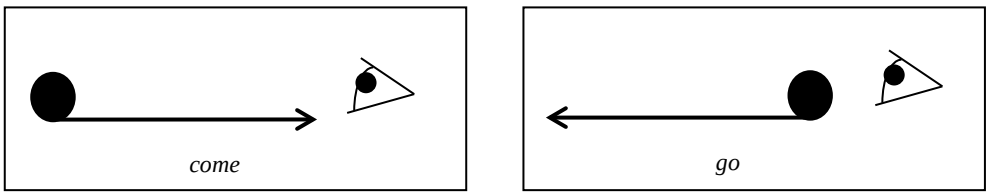


Figure 4. Conceptualization of *come* and *go*

Both *come* and *go* are interpreted relative to a particular point of reference, the deictic center, which is the origin of a coordinate system that is usually grounded by the speaker's location at the time of the utterance; but the deictic center can be shifted from the speaker to another person, or fictive observer, providing additional evidence for the view that meaning is constructed by conceptualization (Diessel 2014).

Like words, constructions involve conceptualization. Consider, for instance, the active-passive alternation in examples (19) and (20).

(19) The man kicked the ball.
(20) The ball was kicked (by the man).

An active sentence construes a scene from the perspective of the agent. In sentence (19), the agent is in the focus of attention and the patient is backgrounded relative to the agent; but in the passive sentence in (20) it is the other way around. In this case, the patient serves as figure and the agent is a secondary focal point (Langacker 1991: §3), which can be 'omitted', but, of course, conceptually, the passive construction entails an agent or agentive force (Figure 5). Analyzing grammatical relations in this way creates an explicit link between argument structure and general conceptual processes.

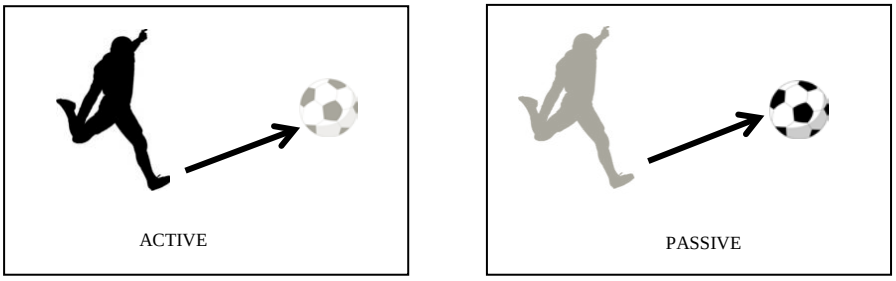


Figure 5. Conceptualization of active and passive

To give one more example, in languages with perfective and imperfective aspect, action verbs can be conceptualized in two different ways: as ongoing (imperfective) actions (e.g. *He was writing a book*) or as completed (perfective) actions (e.g. *He has written a book*). One feature that distinguishes perfective from imperfective aspect is conceptual boundedness (Langacker

1987: 86-7). Perfective events are temporally bounded, whereas imperfective events are unbounded (Figure 6). Of course, every event has a beginning and an ending; but perfective verb forms construe an event as temporally bounded, whereas imperfective verb forms present the same event as ongoing and expansible (Talmy 2000: 50-62).

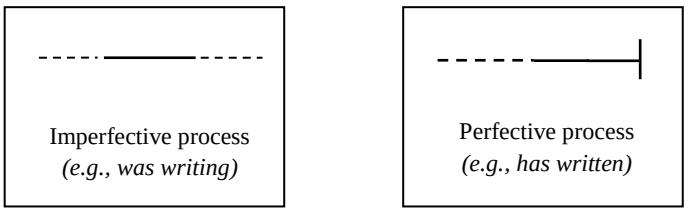


Figure 6. Conceptualization of perfective and imperfective verbs

In general, in the usage-based approach, semantic conventions are emergent from recurrent conceptualizations of the same or similar experiences (or as Langacker 1987: 99 put it: "semantic structure is conceptualization tailored to the specifics of linguistic convention"). What is more, conceptualization is not only the driving force behind the 'construction' of meaning, it also plays an important role in the diachronic development of grammar. In particular, the early stages of grammaticalization are generally motivated by conceptual processes, notably by metaphor and metonmy (Heine et al. 1991) and the projection of the deictic center (Diessel 2012a).

The paradigm example of grammaticalization is the English expression *be going to*, which has developed from a motion verb into a future tense marker, or future tense auxiliary, as evidenced by the fact that *be going to* (or the contracted form *gonna*) can be used with a semantically empty, non-moving subject to indicate future (*It's gonna rain*). Like English, many other languages have future tense auxiliaries derived from motion verbs, which is, of course, related to the fact that time is commonly conceptualized in terms of space and motion (similar conceptual processes occur in L1 acquisition; see Diessel 2011b, 2012b).

The grammaticalization of demonstratives is motivated by their communicative function to coordinate the interlocutors' attention in discourse (cf. §3.1.), but this also involves conceptualization (Diessel 2014). Linguists often look at language from a top down perspective as if all linguistic elements are simultaneously present; but of course language unfolds in time and can be conceptualized in the same way as time. Both time and language (or discourse) involve a band of successive elements that is divided into separate areas by the deictic centre. However, while the deictic centre of time is defined by an observer, the deictic centre of language/discourse is defined by the location of a demonstrative in the unfolding speech stream, from where it directs the interlocutors' attention to linguistic referents in the surrounding discourse (see Figure 7a-b). The German psychologist Karl Bühler (1934) described this as follows:

If deictic expressions of this use could speak, “they would speak as follows: look ahead or back along the band of the present utterance. There something will be found that actually belongs here, where I am, so that it can be connected with what now follows. Or the other way round: what comes after me belongs there, it was only displaced from that position for relief. [Bühler 1934; English translation from Goodwin 1990: 443]

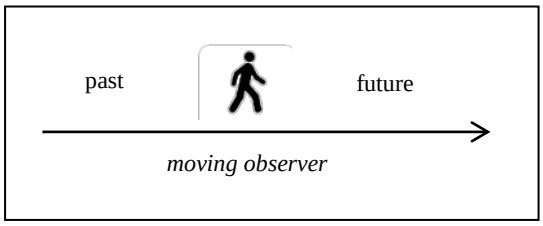


Figure 7a. Conceptualization of time

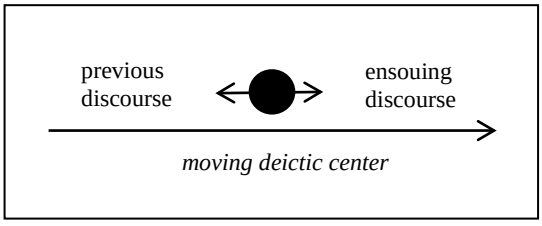


Figure 7b. Conceptualization of the unfolding speech stream

## 3.3. Memory and processing

Linguistic information is ‘represented’ in memory. In the older literature, memory is often described as some kind of place where information is stored, but in current cognitive psychology, the term memory subsumes a set of cognitive processes that concern the activation, processing, and organization of knowledge (Cowan 2005; Jonides et al. 2008). In what follows, we will consider some of the memory-related processes that influence language use and language development.

### *3.3.1. Exemplar-based representations*

Usage-based linguists have emphasized the importance of frequency and repetition for the storage and organization of linguistic information in memory (see Diessel and Hilpert 2016 for a comprehensive discussion of frequency effects in grammar; see also Diessel 2007 and Ellis 2002). There is general consensus that frequency is an important determinant of linguistic knowledge, but the cognitive mechanisms behind the many frequency effects in language are not (yet) fully understood.

Some usage-based linguists refer to exemplar theory to explain the role of frequency in language (Bybee 2006; Abbott-Smith and Tomasello 2006; Goldberg 2006). Exemplar theory has been developed by cognitive psychologists as a general cognitive model of categorization and concept learning (Medin and Schaffer 1978; Nosofsky 1988). In this approach, concepts are formed from tokens with similar properties which together provide a cognitive reference point for the classification of novel experiences, or novel tokens. As a consequence of experience-based learning, concepts are linked to individual memory traces and categorization does not always draw on high-level generalizations, but often involves knowledge of particular experiences or local clusters of similar tokens (see Murphy 2002 for discussion).

Exemplar theory has been especially influential in research on phonetics and phonology (cf. Johnson 1997; Bybee 2001; Pierrehumbert 2001), where speech-sound categories such as the (English) vowel phonemes /ɛ/ and /ɔ/ are emergent from many slightly different phonetic tokens that a language user encounters in experience (Figure 8). If a new phonetic token is encountered, it is categorized according to its similarity to stored tokens (or the entire token cluster).

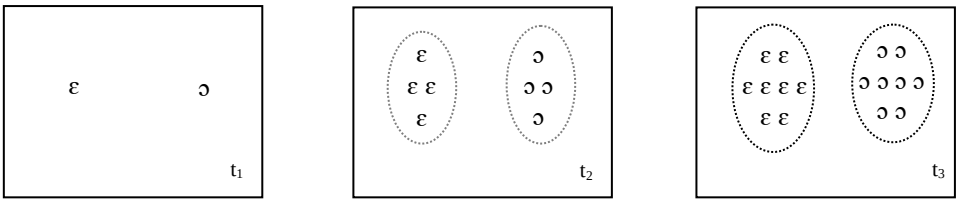


Figure 8. The emergence of exemplar-based speech sound categories

Building on this analysis, Bybee (2006) and other usage-based linguists have argued that the exemplar approach can also be applied to morphology and syntax (Goldberg 2006; Bod 2009). Specifically, these researchers suggest that grammatical constructions are emergent from the language users' experience with strings of lexical tokens and that the cognitive representations of grammatical structure are often associated with particular lexical expressions. On this view, knowledge of grammar includes a great deal of item-specific information (see Diessel 2016 for discussion).

### *3.3.2. Automatization*

Automatization is a general cognitive mechanism whereby a string of distinct elements is transformed into a processing unit (Logan 1988; Schneider and Chein 2003). Langacker (2008: 60-73) uses the notion of 'unit' as a technical term for automated sequences that are internally structured but activated and executed as integrated wholes (see also Langacker 1987: 494). Bybee (2010: 8) refers to units as chunks and to the process of unit formation as chunking: "Chunking is the process by which sequences of units that are used together cohere to form more complex units" (see also Bybee 2002). Units, or chunks, are cognitive routines that concern both motor actions such as dancing and cognitive activities such as counting or reciting the alphabet (Langacker 2008: 16-7; see also Diessel 2016).

Like exemplar learning, automatization is driven by frequency of occurrence. One linguistic phenomenon that is crucially influenced by automatization is the widespread occurrence of formulaic sequences (Erman and Warren 2000). Generative linguists have always emphasized that language use is innovative and creative; but natural language abounds with formulaic lexical sequences (Wray 2002) and there is experimental evidence that speakers' store these sequences as prefabricated units (Arnon and Snider 2010). Some lexical prefabs are fully regular expressions such as *I am happy* or *I love you*, which are semantically and structurally

predictable from general patterns of the (English) language; but there is a tendency for formulaic expressions to develop a life of their own. Many prefabs have idiosyncratic properties that characterize them as idioms (e.g. *take into account, as a matter of fact, I was wondering if, to be about to*). For many linguistic scholars, idioms constitute a small class of irregular expressions that are listed in the mental lexicon and excluded from grammatical analysis; but in the usage-based approach idiomaticity is seen as a continuum that concerns a wide range of formulaic expressions (Fillmore et al. 1988) shaped by automatization (in conjunction with general conceptual processes such as metaphor and categorization).

What is more, automatization is not only the driving force behind the emergence of formulaic sequences, it is also an important determinant of phonetic reduction and fusion. There is now an extensive body of research indicating that frequent word strings are more likely to undergo phonetic reduction than infrequent word combinations (Bell et. al. 2003, 2009; Bybee 1985, 2001; Jurafsky et al. 2001), which, according to Bybee (2010: 37-34), is primarily caused by automatization or chunking (see also Bybee 2001: 73-4). Note that the reduction effect of automatization concerns both motor movement, that is, the production of articulatory gestures, and lexical access, that is, the activation of linguistic knowledge. Linguistic expressions that are commonly reduced in speech production may lose their status as independent words and may develop into affixes. There is a well-known developmental path leading from independent words via clitics to bound morphemes (Givón 1979) that correlates with frequency of occurrence. In this way, automatization is one of the cognitive processes that shapes the morphological structure of language (Bybee 1985, 2001; Krug 1998).

Moreover, automatization is an important determinant of constituency. Phrases and sentences are schematic processing units that reflect the language users' experience with frequent combinations of particular classes of lexical expressions. Other things being equal, the more often the items of particular word classes occur together, the stronger the associative bond between them. The combination of adjective and noun, for instance, is more frequent, and therefore more cohesive, than the combination of verb and manner adverb (*old/new house* vs. *ran fast/slowly*). Of course, the co-occurrence of linguistic expressions is motivated by semantic and pragmatic factors. There is, for instance, a well-known tendency to place semantically related expressions next to each other (Langacker 2008: 207); but in addition to semantic and pragmatic factors, automatization has a significant impact on the formation of syntactic groups or chunks (Bybee and Scheibman 1999; Bybee 2002, 2010: 136-143).

Crucially, automatization increases the amount of information that can be held in working memory. At any given moment in time, the human processor can focus on only a few items (Cowan 2005: §3); but since these items often consist of prefabricated chunks that are internally structured and hierarchically organized, it is possible to integrate large amounts of information into the units that are currently activated and processed (Miller 1956; see also Cowan 2005 for a review of recent research on this topic). A sentence, for instance, can be seen as a schematic processing unit that consists of a limited number of syntactic chunks—arguments and adjuncts—that are related to lexical chunks—words and collocations—which in turn consist of automated sequences of articulatory gestures. In this view, the hierarchical organization of syntax is to a large extent a consequence of the fact that syntactic structure

consists of prefabricated chunks, both lexical chunks (words and collocations) and schematic chunks (syntactic constituents and sentences), that have been shaped by automatization.

### *3.3.3. Analogy*

The notion of analogy is used in many different ways by different scholars. In historical linguistics, analogy is often used as a descriptive term for a certain type of structural change, notably morphological change (Trask 1996: 105-115); but in usage-based linguistics, analogy is a domain-general cognitive phenomenon that accounts for the productive use of language (Bybee and Moder 1983; Barðdal 2008) as well as certain types of language change (Bybee 2010: §4) and language acquisition (Diessel 2013).

Traditionally, linguistic productivity is explained by algorithmic rules (Pinker 1999); but in the usage-based approach, the traditional notion of a linguistic rule has been replaced by the notion of construction or schema (Bybee 1995; Langacker 2000). As pointed out in section 2, (constructional) schemas are abstract grammatical patterns that emerge as generalizations over complex words and utterances with overlapping properties. The regular English past tense, for instance, constitutes a morphological schema (cf. VERB-ed), and the copular construction can be seen as a syntactic schema (NP-*be*-ADJECTIVE) (§2).

Since constructional schemas are emergent from the language users' experience with concrete words and utterances, they are associated with particular lexical expressions (§3.3.1.); but they can be extended to new items by analogy. Two general factors influence the analogical extension of a constructional schema to novel expressions: (i) the activation strength of a schema in memory and (ii) the similarity between lexical expressions that appear in a schema. To illustrate, let us consider the formation of the English past tense, which has been at the center of the debate about analogy and rules (Bybee 1995; Pinker 1999).

In the generative approach, the regular past tense is formed by a concatenating rule that combines the suffix *-ed* with a verb stem (Pinker 1999); but in the usage-based approach, it is analyzed as a constructional schema that competes with several other, irregular schemas to form the past tense (Bybee 1995). The irregular past tense schemas are defined by particular phonetic forms that are associated with phonetically similar present tense forms. There are several classes of related irregular present and past tense forms: *sing-sang, swim-swam, fly-flew, lend-lent, hit-hit*.

Since the regular past tense occurs with a very large number of verb types, it is deeply entrenched in memory and commonly selected to form the past tense of novel verbs, as, for instance, in the case of *faxed, emailed,* and *googled*. However, as Bybee and Moder (1983) have demonstrated, if a novel verb is phonetically similar to an irregular verb, speakers may choose an irregular schema to form the past tense. Using a nonce word task, they found that people often produce irregular past tense forms, which they have never heard before, when asked to provide the past tense of the following base forms: *spim* → [spæm], *shink* → [ʃʌŋk], *spling* → [splʌŋ].

Pinker (1999) argued that regular and irregular past tense forms are produced by different cognitive mechanisms. Specifically, he claimed that while irregular past tense forms are created by analogy, regular past tense forms are produced by a concatenating rule. However, challenging Pinker's 'dual-mechanism' account, Bybee (1995) argued that the regular past tense constitutes an 'open schema' that is automatically activated as a default to form the past tense unless a verb is drawn to an irregular schema because of its phonetic form. On this account, regular and irregular past tense forms are produced by a single cognitive mechanism of pattern matching or analogy. In accordance with this view, cognitive scientists have successfully simulated speakers' choice of regular and irregular past tense forms in connectionist network models that learn how to map a given input pattern (i.e. a particular base form) onto a particular output pattern (i.e. a particular past tense from) from processing linguistic data (Rumelhart and McClelland 1986; Plunkett and Marchman 1993).

Like productivity in morphology, productivity in syntax can be explained by analogy. For instance, a number of recent studies have argued that the extension of argument constructions to novel verbs is determined by the combined effect of memory strength and similarity (Barðdal 2008; Bybee 2010). Consider, for instance, the following examples from a two-year old girl (data from Bowerman 1982):

(21) Kedall *fall* that toy.
(22) Who *deaded* my kitty cat?

Although *fall* and *dead* are exclusively used as intransitive verbs in adult language, it is easy to see why children use them in the transitive construction. Since *fall* and *dead* are semantically similar to transitive verbs such as *drop* and *kill*, they are readily accommodated to the transitive construction, given that many English verbs of this semantic type are used in both transitive and intransitive constructions (see Diessel 2013 for further discussion).

Related to this finding, Boas (2008) observed that the productivity of syntactic constructions in adult language is constrained by semantic criteria. Specifically, he argued that the likelihood of a construction to be extended to a new verb by analogy is contingent on the semantic relationship between the new verb and the verbs that are routinely used in the construction. The intransitive verb *sneeze*, for instance, is readily acceptable in the caused-motion construction, as in Goldberg's famous example *She sneezed the napkin off the table*, because *sneeze* is semantically similar to *blow*, which is well established in the caused-motion construction (cf. *The wind blew the leaves around the yard*). Other intransitive verbs that are semantically more distantly related to verbs of the caused-motion schema are not so easily coerced into this construction.

In general, analogy is an item-specific process that is crucially determined by the cognitive strength of a constructional schema and the similarity between established and novel expressions. Note that analogy concerns both the grammatical treatment of newly created expressions such as *to google* and *to email* and the change of established patterns. In the latter case, the extension of a constructional schema varies with the frequency of individual lexical

expressions. Since frequent expressions are strongly represented in memory, they are less likely to be changed by analogy than infrequent ones (Bybee 1985, 2010). This explains why structural irregularity correlates with lexical frequency. Suppletive paradigms, for instance, typically involve frequent words that resist the pressure from analogy (e.g. *go-went; is-are-was-were; good-better*), and syntactic word order patterns are less likely to be changed with frequent word strings than with infrequent ones (Krug 2003 and Bybee 2010 for discussion).

### *3.3.3. Priming*

Priming is the process by which the activation of information in memory is facilitated through the previous activation of the same or related information. Although priming can occur with all kinds of information, linguistic and non-linguistic, most research on priming is concerned with language. Two general types of (language) priming can be distinguished: (i) lexical priming and (ii) relational (or structural) priming.

Lexical priming refers to the facilitatory (or inhibitory) effect of a lexical item, the prime, on the activation of a related item, the target. Lexical priming can involve both the meaning and form of lexical expressions. For instance, people are faster and more accurate in identifying a word such as *dog* if the word is preceded by a semantically related item such as *cat* than if it is preceded by an unrelated word such as *city*. There is also evidence that the phonetic features of a word affect the activation of phonetically related expressions (that rhyme or alliterate with the prime) and that repetition speeds up lexical access and word recognition (Harley 2001: 145-150).

Like lexical priming, relational priming is an implicit memory effect that concerns the activation of knowledge; but relational priming has to do with structure rather than with lexical items. Relational priming has become a central topic of psycholinguistic research on language production and learning (see Pickering and Ferreira 2008 for a review).

One of the earliest and most influential studies on relational priming is Bock (1986), who showed that people are more likely to describe a ditransitive scene depicting an act of transfer by the *to*-dative construction (*She gave the book to John*), rather than the (related) double object construction (*She gave John the book*), if they had 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 most priming experiments involve the same sentence types as prime and target, Bock and Loebell (1990) observed that there are also priming effects between distinct constructions that share some of their structural properties. For instance, in one of their studies they found that active sentences with a locative *by*-phrase prime passive sentences with an agentive *by*-phrase and vice versa:

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

Bock and colleagues emphasized that relational priming concerns syntactic structure; but later research showed that relational priming is significantly enhanced if prime and target include the same content words. Pickering and Ferreira (2008) call this the 'lexical boost' of relational priming, which was first noticed in a study by Pickering and Branigan (1998). Using a sentence completion task, these researchers found a much stronger priming effect if prime and target included the same verb than if they included different verbs. This finding was replicated by other experimental studies (Ferreira and Pickering 2008) and confirmed by corpus investigations (Gries 2005; Szmrecsanyi 2006). Interestingly, Szmrecsanyi (2006) argues, based on corpus data, that lexical expressions can prime the occurrence of a particular construction even if the prime sentence does not have the same structure as the prime target. The motion verb *go*, for instance, primes speaker's choice of the *be-going-to* future, as opposed to other future tense forms (e.g. *will do*), although the intransitive verb *go* and the *be-going-to* future are embedded in different constructions.

Generalizing across these findings, we may say that priming, both lexical priming and relational priming, provides strong evidence for the network architecture of language. Of particular importance is the lexical boost of relational priming as it suggests that structural patterns are associated with lexical expressions—that constructions are lexically particular (Pickering and Branigan 1998).

What is more, recent research has argued that priming, notably relational priming, is an important mechanism of language learning (Bock and Griffin 2000; Kaschak and Borregine 2008). Although priming is commonly characterized as a short-term phenomenon, these studies observed that relational priming can have long-lasting effects on (adult) speakers' linguistic behaviour, which may be seen as some kind of 'implicit learning' (Chang et al. 2006). In accordance with this view, research with children showed that structural repetition is a conspicuous property of early child language and that young children are extremely sensitive to recurrent structural patterns, especially when these patterns are reinforced by lexical expressions (Savage et al. 2003; Rowland et al. 2012). Taken together, these studies suggest that priming, just like all other cognitive processes described in this chapter, have a significant impact on both usage and language development.

## 4. Conclusion

To conclude, this paper has reviewed linguistic and psycholinguistic research on the usage-based model. Challenging longstanding assumptions of linguistic analysis, usage-based scholars conceive of language (and grammar) as a dynamic network of interrelated lexemes and constructions that are in principle always changing under the continuous influence of domain general processes of language use. Combining research from functional and cognitive linguistics with research from cognitive psychology, the paper has given a comprehensive overview of cognitive processes from three general domains, namely the domains of social cognition, conceptualization, and memory and processing, and has explained how the various processes affect linguistic behavior and language development in both L1 acquisition and language change.

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