10.3 Conclusion

This chapter has presented the essential features of a construction grammar, and some of the different positions on basic representational issues found in different theories of construction grammar. Unfortunately space prevents us from describing analyses of more specific grammatical phenomena in the various theories, such as argument structure, so-called movement phenomena, information structure constructions, word order variation and so on; or specific grammatical constructions (other than those illustrated in chapter 9). There are also a variety of issues of representation and the processes that use that representation which have not been fully addressed by the construction grammar models at the time of writing. Nevertheless, there is a large and growing body of construction grammar analyses of a wide range of grammatical constructions, and a lively debate on basic issues of grammatical representation and process in a construction-based approach.

11

The usage-based model

11.1 Grammatical representation and process

Grammatical knowledge is not merely a representational structure in the mind of a speaker. In a recent survey of knowledge representation models in psychology, Markman argues that there are four basic elements to a model of knowledge representation (1999:5–10). One element is the representing world, that is, the domain of the representations themselves. In the cognitive linguistic approach to language, the representing world is of course the mind. A second element is the represented world. For grammatical knowledge, the represented world is utterances, that is, the form of utterances and their meaning in the discourse context. The third and fourth elements in Markman's analysis are some mechanism to link the representing world to the represented world, and processes using the representation. This last element is particularly important:

> It makes no sense to talk about representations in the absence of processes . . . Only when there is also a process that uses the representation does the system actually represent, and the capabilities of a system are defined only when there is both a representation and a process. (Markman 1999:8)

The primary processes in which grammatical knowledge is involved are communication – the production and comprehension of utterances; the acquisition of grammatical knowledge by children and by adults; and the changes in grammatical knowledge of speakers over time. These processes link the representing world – the grammatical knowledge – and the represented world – the world of utterances and their meanings. These processes are the locus for the link between the representing and represented worlds, Markman's third element of a representation model.

Many cognitive linguists propose a **usage-based model** for language use, language acquisition and language change (§§11.2.2–11.2.4; see inter alia Langacker 1987, chapter 10; Barlow and Kemmer 2000; Bybee and Hopper 2001).[1] The

[1] Construction Grammar, on the other hand, is intended to be a competence model (Paul Kay, pers. comm., 1999).

usage-based model contrasts with the traditional structuralist and generative models of grammatical representation. In the structuralist and generative models, only the structure of the grammatical forms determines their representation in a speaker's mind. For example, the traditional models make a sharp distinction between **regular** and **irregular** word forms. Regular inflected word forms, such as the English plural form *boy-s*, are derived by a highly general **rule** forming the plural from the singular, because the structural relationship between *boy* and *boys*, namely addition of *-s*, allows this possibility. Irregular word forms, such as the plural form *feet*, do not have a straightforward structural relationship linking the singular and the plural. Since they cannot be derived by a general rule, irregular plural word forms are therefore **listed** in the lexicon.

In the usage-based model, properties of the use of utterances in communication also determine the representation of grammatical units in a speaker's mind. In particular, two usage-based properties are assumed to affect grammatical representation: the frequency of occurrence of particular grammatical forms and structures, and the meaning of the words and constructions in use. In §11.2, we discuss four hypotheses of the usage-based model derived from this assumption, and the evidence for those hypotheses in morphology, the area of grammar most intensively studied in the usage-based model (Bybee 1985, 1995, 2001). In §11.3, we discuss how the hypotheses of the usage-based model can be applied to the representation of syntactic constructions, their acquisition and syntactic change.

11.2 The usage-based model in morphology

11.2.1 Entrenchment and representation of word forms

The primary factor determining the independent storage of word forms in the usage-based model is the frequency of occurrence of the word form in language use, that is, the **token frequency** of the word form. The hypothesis is that each time a word (or construction) is used, it **activates** a node or pattern of nodes in the mind, and frequency of activation affects the storage of that information, leading to its ultimate storage as a conventional grammatical unit. A word form that occurs frequently enough in use to be stored independently is described as **entrenched** (Langacker 1987:59–60). Entrenchment comes in degrees, even beyond the minimum threshold required for independent storage.[2] In the usage-based model, the entrenchment of word forms is possible even if the word form is predictable from a more schematic grammatical representation. For example, the plural form *boys*

[2] Bybee has used the terms 'autonomy' and 'lexical strength' to refer to degree of entrenchment in her work (1985, 1995).

may be entrenched even though it is a regular instance of the noun plural schema [NOUN-*s*] because it has a high token frequency. In contrast, it is less likely that the plural form *cornices* is entrenched, because its low frequency of occurrence is probably insufficient to lead to the storage of this form independently of the base form *cornice* and the noun plural schema [NOUN-*s*]. This first hypothesis of the usage-based model is summarized in (1):

(1) *Hypothesis 1*: the storage of a word form, regular or irregular, is a function of its token frequency.

It is clear that irregular forms must be independently stored in any model of morphology, since they are not entirely predictable from a more general schema. In the structuralist/generative models, irregular forms are simply listed in the lexicon. The usage-based model predicts that irregular word forms will be found among the more frequent words in the lexicon. The more frequent words are those more likely to be entrenched, and hence irregularities can survive in such forms. If an irregular form is not frequent enough, or declines in frequency of use, then it will be regularized: its representation will not be sufficiently entrenched and reinforced through use, and so the regular schema will take over in the production of the relevant inflection. The structuralist/generative model, in which there is no effect of frequency, predicts that there should be an even distribution of irregular word forms across the lexicon.

In this case, the evidence clearly favors the usage-based model. Irregular inflectional forms are consistently found among the higher frequency words in the lexicon. For instance, it is not surprising that the verb with the most irregular person forms in English is the extremely frequent verb *be* (*am*, *is*, *are*; *was* and *were* – the only past forms in English that distinguish person).

There is also evidence that low-frequency irregular inflected forms are regularized, while high-frequency irregulars resist regularization to a greater degree. For example, Bybee and Slobin examined the English verbs that form the past tense by changing the final stem consonant from *d* to *t*, as in *build/built* (Bybee and Slobin 1982:275). They compared the list of verbs in Jespersen's historical grammar of English (Jespersen 1942) to the same verbs listed in the *American Heritage Dictionary*; the verbs with the *American Heritage Dictionary* past tense forms are given in (2):

(2)

past in *t* only:	past in *ed* or *t*:	past in *t* or *ed*:
bend	*blend*	*rend*
lend	*geld*	past in *ed* only:
send	*gird*	*wend*
spend		not listed in *AHD*:
build		*shend* 'to shame'

Bybee and Slobin observe that the forms that retain the irregular past in *t* are all frequent, while the others are rare (in fact, one has dropped out of the language).

Further dynamic evidence that irregularity is correlated with frequency is the evidence that low-frequency irregular forms are more likely to be regularized in production. For example, Bybee and Slobin discovered that there was a significant rank order correlation between the likelihood of regularization of irregular past tense forms by preschool children and the token frequency of the verb in the adult caretaker's speech, such that lower token frequency correlated with a high regularization rate (Bybee and Slobin 1982:270). Bybee and Slobin found significant correlations between token frequency and regularization for some though not all irregular verb classes in experimental production tasks given to third-grade children and adults (1982:270–71).

A more indirect piece of evidence that regular forms are stored independently under some circumstances is that a regularly inflected word form, or a regularly derived word form, may diverge semantically from its parent word. For example, 'something can be *dirty* without involving real dirt at all . . . someone can *soil* an item without being anywhere near real soil' (Bybee 1985:88). Examples of divergence of a former inflectional form are *clothes*, formerly the plural of *cloth* (Bybee 1985:91) and *shadow*, formerly an Old English oblique case form of *shade* (Croft 2000:36). Presumably, semantic divergence presupposes the independent representation of the inflected form, which then is free to diverge in meaning.

This evidence regarding irregular word forms has led some generative linguists, including Pinker and colleagues, to accept that frequency effects associated with degree of entrenchment are found with irregulars. Hence, they accept that the usage-based model is valid for irregularly inflected word forms. However, Pinker and colleagues argue that regularly inflected word forms are not sensitive to frequency effects. Instead, regularly inflected word forms are represented by a grammatical rule based only on the structure of the word forms and not any properties of their use (Pinker and Prince 1994; Marcus et al. 1992). This model is called the **dual-processing model** of grammatical representation.[3]

Evidence from an experiment on the more regular third person present inflection in English indicates that low frequency regular forms are not stored in the lexicon, because they do not exhibit gang effects (Stemberger and MacWhinney 1988:111–12). Gang effects are effects on stored word forms of phonologically

[3] In fact, the traditional model, in which regularly inflected forms are generated by a structural rule and irregular forms are listed in the lexicon, is also a dual-processing model. The only innovation in the model proposed by Pinker and colleagues is that the irregulars conform to the usage-based model's predictions, instead of merely being listed in the lexicon.

similar stored word forms; if word forms are not stored, gang effects would not occur. The absence of gang effects has been taken to imply that regularly inflected forms are not stored (see, for example, Prasada and Pinker 1993). Other experiments, however, do suggest that high frequency regular inflected forms are stored. Stemberger and MacWninney conducted an experiment in which subjects were required to produce past tense forms of regular verbs at high speed, and errors occurred significantly less often on high frequency regular past tense forms, implying that the high frequency regular past tense forms are stored (Stemberger and MacWhinney 1988:106). Bybee reports an experiment conducted by Losiewicz (1992) which provides some evidence of a frequency effect for regular forms (Bybee 1995:450–51). Losiewicz observed that the acoustic duration of word-final /t/ or /d/ is shorter if it is part of the word than if it is the regular past tense ending (e.g. *rapt* vs. *rapped*). If the difference in acoustic duration is due to storage of the word form, then high-frequency regulars should have shorter final /t/ or /d/ than low-frequency regulars. In a sentence reading task, subjects had an average 7 msec difference in duration between high-frequency and low-frequency final /t/ or /d/ duration, which was highly significant.

The evidence reported in the last paragraph is compatible with a model in which high-frequency regular word forms are stored but low frequency regular word forms are not. The results suggest that frequency affects the storage of regular word forms, and supports Hypothesis 1.[4]

11.2.2 Regularity, productivity and default status

In a structuralist/generative model, regularity is modeled by a **rule**. A rule is generally analyzed as an operation over strings, such as the phonological string of a word form or the syntactic strings of words and constituents of a construction. Affixation, such as the suffixation of the English past tense suffix allomorphs /t, /d/ or /id/, is a relatively simple operation. Other rule-governed operations are more complex: they may involve internal changes to a word form, or other changes.

In a usage-based model, a simple rule such as the addition of the past tense would be represented by a **schema** of the sort used for the representation of constructions in chapter 10. The schema for the English past tense would be represented as something like [VERB-*ed*] (ignoring for now the three different allomorphs of

[4] It is possible that the absence of a frequency effect for regulars is what one would expect even in a usage-based model; activation network models trained on regular inputs do not display a gang effect (Daugherty and Seidenberg 1994).

the past tense). The representation of a generalization as a schema conforms to the principle that all grammatical knowledge is represented in a uniform fashion (§9.4).

There are some differences in what can be represented as rules vs. schemas, which will be discussed in §11.2.3. In this section, however, we will look at what determines regularity, rather than how regularity is to be represented.

One property of regular inflections is the **productivity** of the inflection. As the name implies, a productive inflection is one that is applied to almost any semantically and phonologically appropriate word form, including new forms coined or borrowed into the language. In the rule-based model, productivity is the open-ended scope of application of the rule, within the phonological and semantic constraints imposed by the inflection. As we will see, however, the interpretation of productivity in the usage-based model has led to the clarification of some hidden distinctions in the definition of regularity as productivity.

In a usage-based model, a productive inflection is one in which the schematic representation of the inflection is entrenched. The difference between the *-en* plural of *oxen* and the *-s* plural is that the only entrenched form in the former is [*oxen*], while in the latter case a schematic construction [NOUN-*s*] is entrenched. But the productivity of the regular plural form *-s* implies the existence of a general schema that can easily be combined with a particular noun to form a plural. From a usage-based point of view, then, the question is: what factors determine the entrenchment of a schematic morphological construction?

Bybee argues that the productivity of a schema is a function of **type frequency** (Bybee 1985:132–34; 1995):

(3) *Hypothesis 2*: The productivity of a schema is a function of the type frequency of the instances of the schema.

Type frequency is the number of different word forms that are instances of a particular schema. The type frequency of the English past tense schema [VERB-*ed*] is thus the number of regular past tense verbs in English. The English past tense suffix *-ed* is highly productive under this account. There is a vast number of lower frequency verbs with the *-ed* past tense suffix which reinforce the past tense schema [VERB *-ed*]. In fact, of course, the past tense schema has three allomorphs, /t/, /d/ and /ɨd/. But each of these phonologically defined schemas has a high type frequency of low token frequency instances, so each allomorph is highly productive for its phonologically defined class.

There is another important aspect of productivity: one must be able to form a coherent schema (Bybee 1995:430). That is, there must be enough resemblance between the types that contribute to the entrenchment of the schema that one

can form a schema in the first place. The closer the resemblance, the more entrenched is the schema. Each allomorph of the English productive past tense is a coherent schema, that is, for the past tense suffix each allomorph defines a phonologically and semantically coherent category, namely [-t/PAST], [-d/PAST] and [-ɨSd/PAST]. Moreover, the three allomorphs possess a phonological family resemblance, reinforced by their complementary phonological distribution (in terms of the final segment of the verb stem) and identity of meaning. Because of the family resemblance a speaker may form a superordinate category, notated here [-*ed*/PAST] with the orthographic representation standing in for the phonological schema.

Bybee argues that instances of a schema that have a high token frequency will not contribute to the productivity of a schema (1985:132–34). Instances with a high token frequency are strongly entrenched (1995:434). Only the entrenched specific word form will be activated in language use and thus will not reinforce the superordinate schema. On the other hand, word forms with a low token frequency will not be as strongly entrenched (if they are entrenched at all; see §11.2.1). Bybee argues that low frequency word forms will contribute to the entrenchment of a schematic representation of the inflectional ending that applies across many different word forms, including new forms. However, the examples that Bybee gives in support of this hypothesis do not fully separate token frequency and type frequency. Instances of a productive schema with a high token frequency, such as the most common regular English past tense forms, are swamped by the number of instances with a low token frequency. One would have to find a conjugation class in a language where excluding the high token frequency instances results in too low a type frequency to make the schema productive, but including them would result in a high enough type frequency to make the schema productive. Hence, it is not clear that high token frequency instances in fact do not contribute to the productivity of a schema.

The usage-based definition of productivity is gradient, because type frequency is gradient. Thus, the usage-based model predicts that productivity might vary in degree. Forms for which there is a low type frequency may exhibit a minor degree of productivity. Evidence for this is found among the irregular English past tense forms. Most of the irregular English past tense forms involve an internal change to the stem, usually a change to the stem vowel. One particular class has a relatively high type frequency of relatively low token frequency verbs. This class is Bybee and Slobin's Class VI. Class VI verbs fall into two subclasses, those with a past tense form with /æ/ and a past participle with /ʌ/ (Class VIa in example [4]) and those with a past tense form with /ʌ/ (Class VIb; Bybee and Slobin 1982:288, Appendix).

(4)

Class VIa:		Class VIb:	
m	swim/swam/swum	*n*	spin/spun
n	begin/began/begun		win/won
	run/ran	*ng*	bring/brung* [dialectal]
ng	ring/rang/rung*		cling/clung
	sing/sang/sung		fling/flung*
	spring/sprang/sprung		hang/hung*
nk	drink/drank/drunk		sling/slung*
	shrink/shrank/shrunk		sting/stung*
	sink/sank/sunk		string/strung
			swing/swung
			wring/wrung
		nk	slink/slunk
		k	sneak/snuck* [dialectal]
			stick/stuck*
			strike/struck*
			shake/shuck* [dialectal]
		g	dig/dug*
			drag/drug*

Class VI irregulars are relatively coherent as a phonological class: most of them have present tense vowel /I/ and end in a velar or nasal or nasal+velar. The past tense form of Class VIb in particular can be described as having a prototype pattern of present tense /Ciŋ/ and past tense /Ciŋ/, with extensions to velar and/or nasal final consonants and some variation in the stem vowel (cf. Bybee and Moder 1983 and §11.2.3). However, many of the Class VI verbs, particularly Class VIb verbs, are relatively low in token frequency (Bybee and Slobin 1982:278). Hence Class VI can be predicted to be mildly productive, although not nearly as productive as the *-ed* past tense allomorphs.

The evidence for the productivity of this schema is historical and psycholinguistic. The verbs asterisked in (4) were not part of this irregular class in Old English (Bybee and Slobin 1982:288, citing Jespersen 1942). In fact, three of the asterisked Class VIb forms are not standard English forms, but are used in nonstandard English dialects, suggesting a relatively recent shift of these verbs to Class VI. The asterisked forms were either irregular verbs of other classes, or even regular verbs to which the Class VIb vowel alternation was extended because of the phonological resemblance of their verb stems to the stems of Old English Class VI verbs, and the relative productivity of Class VI.

Bybee and Slobin also conducted experiments with children and adults: the children were asked to provide past tense forms in sentence completion tasks, and the adults were asked to provide past tense forms under extreme time pressure. Both tasks elicited novel past tense forms. Of these, the data for both children and adults indicated a mild degree of productivity of Class VI, such as *streak/struck* and *clink/clunk* (Bybee and Slobin 1982:278).

Advocates of the dual-processing model of morphological representation have argued that, while irregular verbs may display frequency-related patterns such as those found by Bybee and Slobin for the Class VI past tense verbs, regular inflections do not display any type frequency effects. Instead, regular inflections are productive because they impose the least phonological specificity on the verb stem (Prasada and Pinker 1993). For example, the allomorphs of the English regular past tense impose the least phonological specificity on their verb stems: verb stems are constrained only by certain phonological features of the final segment. In schema terms, the regular inflection provides a maximally **open** schema. The dual-processing hypothesis is given in (5):

(5) *Hypothesis 2'*: productivity of a rule is determined by its being a (relatively) open schema.

English does not provide a good case to differentiate these two hypotheses for productivity, type frequency vs. open schema. The regular English past tense has both a much higher type frequency than any other past tense form and a very open phonological schema. Thus, both hypotheses predict (correctly) that the regular English past tense is highly productive. However, there are languages in which the open schema for an inflection does not have a high type frequency. Examples include the German plurals (Marcus et al. 1995) and Arabic plurals (McCarthy and Prince 1990).[5]

The German and Arabic plural cases both dissociate type frequency from open schema. Both German and Arabic have a range of plural formation processes, none of which has an overwhelmingly greater type frequency such as is found with the English plural *-s*. Both German and Arabic have an open schema plural, the German *-s* and the Arabic sound plural (a suffix instead of an internal stem change). Both German and Arabic open schema plurals are used as the plural schema with items other than standard common nouns, such as proper names, new borrowings and derived nouns and adjectives (Bybee 1995:440–42; Janda 1990:146–48). The open schema plurals are open schema precisely because they must be applicable to noncanonical nouns; but they are also of low type frequency for the same reason.

[5] Clahsen and Rothweiler (1992) argue that the German past participle ending *-t* has a lower type frequency than *-en* and yet is more productive. However, Clahsen and Rothweiler used only the first 1,000 verbs of a 4,314-verb frequency list of German verbs, thereby leaving out a very large number of regular verb types, and they counted the verb stems multiple times if they occurred with multiple productive prefixes, which again artificially increases the type frequency of *-en* (Bybee 1995:438).

Marcus et al. and Pinker and Prince argue that the applicability of the open schemas to noncanonical nouns is evidence of their high productivity. Bybee, on the other hand, argues that this is evidence only of their 'emergency' or **default** status by virtue of their open schema, and that investigating the full range of common nouns indicates that the default schema is no more productive than plural schemas with a high type frequency. For Arabic, the iambic broken plural has the highest type frequency, and is productive with any noun (including borrowed nouns) that fit its canonical phonological shape criteria. The iambic broken plural is overgeneralized by children as well as the default sound plural (Omar 1973, cited in Bybee 1995:442), indicating that both the iambic broken plural and the default sound plural are productive, the former especially so.

The German plural situation is more complicated. No single plural formation pattern is highly productive. However, the evidence for productivity apart from noncanonical nouns indicates some degree of productivity of several different plural endings, including *-s* (see Bybee 1995:440–41 and references cited therein). Children overgeneralize *-en* most frequently, and in nonce-probe tasks, different endings were preferred for different noun genders, particularly if the nonce forms were identified as common nouns. Even recent borrowings use *-en* and to a lesser extent *-e* especially for masculine nouns; *-s* is used about half of the time, and some loans have given up *-s* for *-en* upon integration into the language. Also, nouns ending in vowels favored *-s* in a nonce-probe task (Köpcke 1988) and in acquisition (Köpcke 1998:313–15). Among ordinary German common nouns *-s* is associated with nouns ending in a full vowel (Janda 1990:145–46). These facts suggest that *-s* is not truly a default schema.

A default schema does not require a high type frequency to arise. A default form can arise if the non-default forms form relatively narrow and phonologically well-defined classes, while the instances of the default schema are scattered across the remaining phonological space, even if those instances have a low type frequency (Hare, Elman and Daugherty 1995:626–27; they also simulate this effect in a connectionist network). The German and Arabic plurals conform to this pattern (compare Hare et al. 1995:608). If the phonological unity of the non-default classes breaks down through phonological change, as happened with the Old English past tenses, then the system becomes unstable, leading to a reorganization of the irregular forms around new phonological classes or survival by high token frequency (Hare and Elman 1995).

11.2.3 *Product-oriented schemas*

Up to this point, we have assumed that morphological generalizations such as the relationship between the present and past tense forms of English verbs

can be equally well captured by rules deriving one form from another (or both forms from a common underlying form). Instead, we have focused on the fact that the usage-based model can capture generalizations about morphological patterns that are based on token frequency and type frequency, whereas rules in the dual-processing model do not imply the existence of any generalizations linked to frequency, at least for regular inflections. However, Bybee and others have argued that rules and schemas in fact make slightly different predictions about what sort of generalizations can be made over related word forms.

Structuralist and generative morphological rules are what Bybee calls **source-oriented**. Source-oriented rules specify the basic word form, such as the present tense of a verb like *wait*, and describe a single operation with a single set of conditions that produce the derived form, such as addition of /id/ to a stem ending in *t* or *d* to form *waited*. In the usage-based model, a source-oriented schema is a schema with a systematic structural relationship to another schema (the source in a rule-based model). For instance the regular past tense schema [VERB-id] contains the same stem as the present tense schema [VERB(-iz)], and so the past and present tense verb form schemas can be uniformly represented across all stems. The term 'source-oriented' is somewhat misleading in the usage-based model because there is no derivation of one schema from another by a rule in the usage-based model. The term 'source-oriented' simply indicates that the 'source' schema is as coherent, phonologically and semantically, as the 'product' schema.

Bybee argues (following Zager 1980) that in addition to source-oriented schemas, there also exist **product-oriented** schemas:

(6) *Hypothesis 3*: In addition to source-oriented morphological rules/schemas, there also exist product-oriented schemas, which cannot be easily represented by derivational rules.

A product-oriented schema is a morphological schema that is coherent in terms of the phonological form and meaning of the 'derived' inflected form of the word, not in terms of a rule deriving the inflected form from a base form (Bybee 1995:443). In a morphological inflectional category with a product-oriented schema, the 'product' schema is more coherent phonologically than (and at least as coherent semantically as) its counterpart 'source' schema.

An example of a product-oriented schema is the schema for the Class VI irregular verb class illustrated in (4) above. Because of the variety of phonological shapes of the present tense forms of Class VI verbs, one cannot construct a single coherent rule to derive the past tense form from the base form. Instead, the past tense forms are more or less converging on the prototypical past tense shapes [. . . æŋ] (for Class VIa past tense forms) and [. . . ʌŋ] (for Class VIb past tense forms, and the Class VIa past participle forms).

Product-oriented schemas cannot be described in terms of a rule that converts a base form into a derived form. At best, one would have to have a different rule for each word (or small sets of words) deriving the product form from the source form. The reason for this is that product-oriented schemas are more coherent and unified categories than their so-called source schemas. Product-oriented schemas can best be described in terms of a prototype schema towards which the 'derived' forms converge, by whatever phonological means necessary (Bybee and Moder 1983). Since a purely structural description of a product-oriented schema is not possible (short of a 'rule' for each word), the structuralist/generative model predicts that product-oriented schemas should not exist.

The term 'product-oriented' is misleading in the usage-based model in the same way that 'source-oriented' is. In a usage-based model, 'product-oriented' schemas arise because they represent a schematic (taxonomic) generalization across the 'derived' forms, which are represented as independent units. The primary factor determining the existence of a schema, 'source'- or 'product-oriented', is a (relatively) high type frequency (§11.2.2). Hence, if a 'product-oriented' pattern in word forms is at least partially productive, then it provides evidence in favor of the usage-based model.

Such evidence is found with the English Class VI past tense schema. No single rule 'derives' the past tense form from the present tense form. But the past tense forms of Class VI can be described in terms of a family resemblance category, whose prototype is [. . . ʌŋ/PAST]. As we saw in §11.2.2, the schema is productive, demonstrated by performance by children and adults in psycholinguistic experiments, and in the extension of the Class VI past tense schema to other English verbs in the history of the language (see Bybee and Moder 1983 for a more detailed argument in favor of this schema).

Bybee cites further evidence from plural formation in Hausa (Bybee 1995:443–44). Haspelmath (1989) demonstrates that there is no set of general rules for forming the plural in Hausa, but the plural forms can be described in a set of product-oriented schemas which in turn can be subsumed under a more general product-oriented plural schema. Lobben (1991, cited in Bybee 1995) conducted nonce-probe experiments with Hausa speakers that indicate that the plural schemas were indeed productive.

11.2.4 Network organization of word forms

In chapter 10, we observed that in construction grammar, constructions are organized in a network in a taxonomy. However, in §10.1.2, we also observed that constructions can, and usually do, have multiple parents in the taxonomy. The description of the construction grammar of a language in any detail is going to lead to an extremely tangled network of construction taxonomies. Is there any evidence to determine which categories are more important in organizing multiple parent taxonomies?

Bybee proposes a model in which the essential organizing feature of the network of words is similarity. Similarities are connections or links between words. Bybee further makes a number of proposals regarding which similarities between words are more important. We may summarize Bybee's proposals in (7):

(7) *Hypothesis 4*: strength of connection between word forms, and thus forces influencing their phonological shape (among other things), is a function of similarity. Similarity is measurable by comparing words to each other in both meaning and form; similarity in meaning is much stronger than similarity in form.

Hypothesis 4 is part of the usage-based model of morphological representation in that the meaning of word forms, which is manifested in their use in communication, influences the organization of the knowledge of those word forms in a speaker's mind. In the structuralist/generative model, only structural properties determine the organization of word forms in a speaker's mind.

Words may be similar in form, meaning or both. Bybee describes similarity in form as implying a **phonological connection**, similarity in meaning a **semantic connection**, and similarity in both a 'morphological connection'; for the latter case, we will use the more general term **symbolic connection**.

Bybee argues that a solely phonological connection between words – in other words, homophony – is the weakest connection of all (Bybee 1985:118). Homophones such as the two most distinct senses of *bank* or *crane* have relatively little psychological effect. Homophony does give rise to a minor yet robust priming effect. In lexical decision and target naming tasks using homonyms, there is a priming effect of both the contextually appropriate meaning and the homonymous meaning within 0-200 msec of presentation of the stimulus; after 200 msec, only the contextually appropriate meaning is primed (Swinney 1979, 1982; Seidenberg et al. 1982). This priming effect indicates that there is a lexical connection based on mere phonological similarity, but not a strong one.

A solely semantic connection between words is much stronger. An example of a close semantic connection without a phonological connection is suppletive paradigms, as in English *go/went*. Bybee observes that suppletion is subject to regularization, as found in innovations in language use such as *goed* for *went* and the replacement of suppletive forms over time in languages. The semantic connection between GO+PRESENT and GO+PAST is so strong that one of the forms is changed (*went* > *goed*) in production so as to make it more similar to the other form with the similar meaning (*go*). In contrast, the existence of similarity in form in homonyms or near homonyms does not lead to one of the words changing meaning so as to make it semantically more similar to the other word with a similar form.

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The strongest connection is a symbolic connection: similarity in form and meaning. Bybee argues that there are three factors that determine the strength of a symbolic connection: degree of semantic similarity, degree of phonological similarity and degree of entrenchment. Beginning with the last factor first: relative degree of entrenchment largely determines the direction of analogical changes in word paradigms. For example, one would predict that it is more likely that a speaker would produce *writed* in place of *wrote*, by analogy with *write(s)*, rather than *wrotes* in place of *writes*. The past tense is less entrenched because it is less frequently used than the present tense, and so is less resistant to being replaced by an analogical formation that results from activation of the more entrenched form.

As with solely phonological and solely semantic connections, in symbolic connections degree of semantic similarity is the more important factor. Bybee describes degree of semantic similarity as **relevance**. The notion behind relevance can be described by examining the inflectional categories that Bybee studied, those of the verb: aspect, tense, mood and person.

An inflectional semantic category that is highly relevant to the verb is one that makes the greatest change in the verb's meaning. For example, a change in aspect from, say, present meaning to habitual/generic meaning is a substantial change in meaning. The present time reference in (8a) describes a current state of affairs, true at the present moment but not long lasting. The habitual/generic meaning in (8b) describes a series of eating events over a long period of time (habitual), or an inherent property of mine that disposes me towards eating ice cream (or at least does not prevent me from eating ice cream):

(8) a. I'm eating ice cream.
b. I eat ice cream.

In contrast, changing the person who is doing the eating does not make a very substantial change in the nature of the eating event itself:

(9) a. I'm eating ice cream.
b. She's eating ice cream.

Relevance is inversely related to strength of semantic connection. Two different aspectual forms of a single verb are more weakly connected semantically, because the event types they describe are more different. Two different person agreement forms of a single verb are more strongly connected semantically, because the event types they describe are more similar.

On the basis of semantic argumentation, Bybee proposes the following ranking of verbal inflectional semantic categories, from most relevant to the verb/event to least relevant (see Bybee 1985:20–23 for the semantic argumentation):

(10) valence changing < voice < aspect < tense < mood < person/number agreement

Bybee puts forward several types of typological and diachronic evidence for the ranking in (10). For example, more relevant inflectional categories of the verb occur closer to the verb stem. The reasoning behind this prediction is that the greater the meaning change, the more intimately associated with the stem meaning is the semantic category of the inflection. Bybee tested the hypothesis on the four most common verbal inflectional categories, aspect, tense, mood and person agreement, in a fifty-language sample (Bybee 1985:33–35). There were virtually no counterexamples to the ordering of aspect, tense and person/mood with respect to the other categories; mood and person agreement were more equivocal.

The notion of relevance is a further refinement of Hypothesis 4: that semantic similarity to different degrees influences formal similarity of word forms to different degrees. That is, greater semantic similarity will favor greater phonological similarity (and thus increase symbolic similarity). Semantic distinctions expressed lexically will be more phonologically different than semantic distinctions expressed inflectionally, on the whole. It should be remembered that other factors such as degree of entrenchment also affect phonological similarity: a higher degree of entrenchment weakens the connection between word forms and thus may lead to greater phonological differences.

Thus, another prediction from Hypothesis 4 is that, other things being equal, a stronger semantic connection between words will imply a greater phonological similarity of those words. Also, one would expect to find that phonological similarity can be increased through analogical change of semantically strongly connected words. There is considerable evidence for this prediction as well. Bybee reports that data from her survey and from Rudes (1980) indicate that suppletion in verbal paradigms is most likely along aspectual distinctions, then along tense, and least likely along mood. There is also some suppletion along person distinctions, but only in very high frequency forms; this can be explained by the principle given in the preceding paragraph, that a high degree of entrenchment weakens connections between words.

Finally, when paradigms are leveled analogically, they are most likely to be leveled among semantically closely related forms, in particular different person/number forms of the same tense-aspect-mood paradigm. Also, the direction of leveling will be most likely towards the most frequent form (third person singular, followed by first person singular), because forms with weak connections will give way to analogical formations from stronger forms. Bybee presents a number of examples of such leveling within person-number forms (Bybee 1985, chapter 3; see also Bybee and Brewer 1980 for Spanish). For example, the Old Provençal person-number forms for the preterite indicative in (11) were reformed analogically on the third person form including that form's *-t* person/number suffix, in a number of Modern Provençal dialects, such as the Charente dialect in (12) (Bybee 1985:55; Charente data from Meyer-Lübke 1923:352):

(11) *Old Provençal preterite of* am- *'love'*:

am-éi	am-ém
am-ést	am-étz
am-ét	am-éren

(12) *Charente preterites of* cant- *'sing'*:

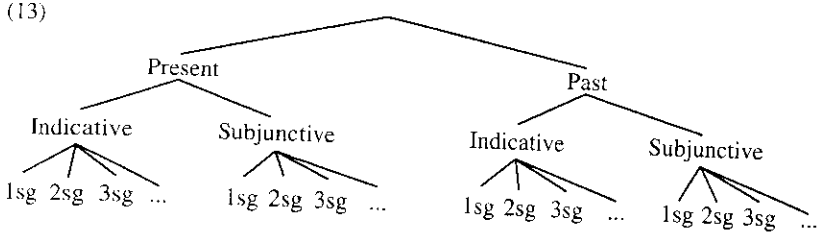
cantí	cantét-em
cantét-ei	cantét-ei
cantét-Ø	cantét-en

In (12), the original third person singular stem *cantét* has become the base for the analogical reformation of the other person-number forms. The only form to resist the analogical change is the first singular form, which has the highest token frequency of the person-number forms after third singular.

Bybee and Pardo (1981) used a nonce-probe task with Spanish speakers to compare the effect of semantic connection on phonological production. Many Spanish verbs have a vowel stem alternation in the present vs. preterite forms, for example third singular present *comienza* 's/he begins' with a diphthong vs. third singular preterite *comenzó* 's/he began' with a simple mid vowel. Bybee and Pardo presented a third singular present form of a nonce verb with a diphthong followed by either the infinitive or the third singular preterite form with a mid vowel, and then asked subjects to produce a first singular preterite form. Subjects produced more mid vowel variants when presented with the semantically closer related third singular preterite than when presented with the more distant infinitive.

The evidence presented by Bybee and others (e.g. Andersen 1980) implies that semantic similarity of grammatical units such as words plays an important role in the organization of grammatical knowledge in a speaker's mind. Given a set of word forms, each of which can be subsumed under several more schematic categories (indicative, present, third person, singular), one can postulate a ranking of those schematic categories in terms of the network connections between words. One could go so far as to restructure the multiple-parent representation into a hierarchy, with the semantically most relevant (and hence most weakly connected) distinctions at the top of the hierarchy, as in (13) (compare the display of the Spanish verb paradigm in Bybee 1985:61, Table 1):

(13)



The hierarchy in (13) is still an oversimplification. The connections between members at the lowest level are not displayed, nor are the lowest levels (person and number) stratified. There remain semantic connections between the corresponding mood values (present indicative and past indicative etc.), and the corresponding person/number values (1sg present indicative, 1sg past indicative, 1sg present subjunctive, 1sg past subjunctive etc.). However, the hierarchy does indicate degree of semantic connection: one can heuristically measure degree of semantic connection by the number of connections that must be traversed in (13) in order to reach related forms. For example, only four connections need to be traversed to reach first singular present subjunctive from first singular present indicative, but six connections need to be traversed to reach first singular past indicative from first singular present indicative (for an alternative representation of degree of semantic connection, see §11.3.4).

11.2.5 Conclusion

The empirical data that we have discussed in support of the details of the usage-based model are drawn from the processes of language use (as tested in psycholinguistic experiments) and language change. These data provide evidence supporting four hypotheses about the effects of language use on grammatical representation. The independent representation of an inflected word form is a function of its token frequency in language use. The productivity of a rule/schema is a function of a high type frequency of low token frequency instances, not of the structural openness of the schema. Product-oriented schemas exist, that is, schemas can be formed from members of an inflectional category that cannot be described by rules deriving the members of the category from a source form. Finally, the organization of inflected word forms is influenced by the degree of semantic similarity between word forms.

The hypotheses of the usage-based model can be accounted for by an **interactive activation** network for the representation of knowledge (Elman and McClelland 1984). The storage of word forms is determined in part by patterns of activation of the network as a result of language use (§11.2.1). The phenomena described in Hypotheses 2–4 of the usage-based model are all analyzed in terms of the interaction of activation patterns, such that a schema activates an instance and vice versa, and a structure's activation can result from the activation of formally and especially semantically related structures. The result of the interactive activation is manifested not only in the conventional production and comprehension of word forms, but also in 'errors' in certain contexts, and innovations in language acquisition and language change.

The usage-based model contrasts with the complete inheritance model in two important respects. As we noted in §10.2.2, in the complete inheritance model information is stored only at the most schematic level possible. In the usage-based model information can be represented redundantly in less schematic constructions, if activation levels lead to entrenchment. The second contrast follows from the first. In the complete inheritance model, information flows down from the most schematic constructions in the processing of an utterance. In the usage-based model, processing involves activation of the entrenched construction(s) whose structure(s) most closely matches those of the utterance. Since more specific constructions match utterances more closely than more schematic constructions, the former are more activated than the latter. It is therefore possible that speakers will not have the most schematic constructions represented in their minds, if they are not activated sufficiently (Croft 1998c).

11.3 The usage-based model in syntax

In §11.2 we examined morphological representations of words, what they represent and the processes they are involved with. A number of concrete hypotheses and supporting evidence were put forward on the nature of word representations and processes, including the role of token frequency in entrenchment, the role of type frequency in productivity, the formation of schemas, phonological and semantic similarity in connections between words, and the emergence of generalizations in language acquisition. How many of these hypotheses might hold for syntax as well as morphology? In §9.4, we argued that the same types of phenomena found in the study of syntactic idioms are also found in morphology. In this section, we will examine the applicability of hypotheses about morphological networks to syntax.

11.3.1 Type/token frequency, productivity and entrenchment

In §§11.2.1–2, it was seen that type and token frequency play distinct roles in the empirical predictions of the usage-based model for morphology. In morphology, token frequency determines the degree of entrenchment of individual substantive word forms, and also implies that strongly entrenched words will have weak links to related forms (§11.2.4). Type frequency, and phonological coherence, determine the degree of entrenchment of a schema such as [VERB-*ed*] for the regular past tense.

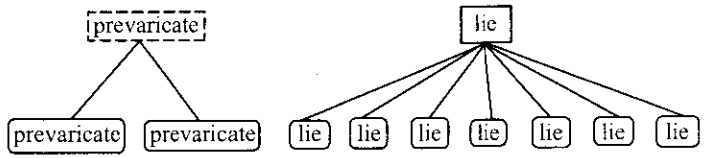
However, all syntactic constructions, except for completely substantive idioms, are schematic to some degree. Even an idiomatic phrase like [*kick*-TNS *the bucket*] is schematic in that it can be used in different tense-aspect-mood forms, including auxiliaries:

(14) a. He kick**ed** the bucket.
b. He**'s gonna** kick-**Ø** the bucket one of these days. [etc.]

In syntax, one would like to be able to differentiate between constructions at different levels of schematicity, such as [*kick the bucket*], [*kick* OBJ] and [TR VERB OBJ]. If we want to apply the generalizations of usage-based morphology to syntax, then we will have to find a more general description of frequency and the role it can play in morphology.

In the usage-based model, token frequency determines degree of entrenchment of a single word. A high token frequency for a word corresponds to a high number of specific usage events with that word. The network pattern for low vs. high token frequency is illustrated in (15) (boxes with rounded corners correspond to usage events, and a dashed box, a lower degree of entrenchment):

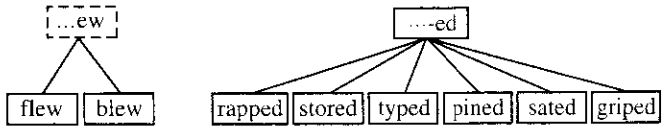
(15)



Low Token Frequency High Token Frequency

Type frequency determines the degree of entrenchment of a schema. A high type frequency for a schema means that the schema is more deeply entrenched. The network pattern for low vs. high type frequency is illustrated in (16):

(16)



Low Type Frequency High Type Frequency

The network structure for low vs. high token frequency (entrenchment) and low vs. high type frequency (productivity) is the same: the higher the number of instances, the more entrenched the superordinate category is. We may then formulate the following generalized definition of productivity:

(17) *Generalized entrenchment/productivity*: entrenchment (productivity) of a construction is proportional to the number of instances of the construction at any level of schematicity, and to the degree of formal and semantic coherence of the instances of the construction.

Of course, two other factors have to be recognized in determining the degree of entrenchment of the superordinate category (as were noted in §11.2.2). First, the instances must be similar so that a category schema can be formed. Second, instances that are themselves highly entrenched may not contribute as much to the entrenchment of the superordinate category schema as instances that are not very entrenched.

Proponents of the usage-based model have presented data supporting frequency effects in syntax. Bybee and Thompson observe that the syntax of English auxiliaries is conservative, in that auxiliaries may invert with the subject in questions and precede the negator *not* rather than follow it (Bybee and Thompson 1997):

(18) a. Have you eaten?
b. *Eat you?

(19) a. I have not eaten.
b. *I ate not.

In Middle English, all verbs had this ability, but it was lost in Modern English (Bybee and Thompson 1997, from Mossé 1952):

(20) Gaf ye the chyld any thyng?
'Did you give the child anything?

(21) a. My wife rose nott.
b. cry not so

We will explain the analysis with the interrogative constructions; the same argument applies to the negative constructions. The auxiliary verbs have a very high token frequency, compared to other verbs. In constructional terms, this means that a construction schema such as [*Have* SBJ . . . ?] is much more entrenched than was [*Eat* SBJ . . . ?]. That is, there are far more instances of the *have* constructions (and other auxiliary constructions) than of the *eat* constructions (and other lexical verb constructions). In early Modern English, the more schematic construction [VERB SBJ . . . ?] declined, while [*Do* SBJ VERB . . . ?] spread and became entrenched (see the account in Denison 1993, chapter 15). The (relatively) low entrenchment of [*Eat* SBJ . . . ?] meant that [*Eat* SBJ ?] died out and was replaced with [*Do* Sbj *eat*?]. However, [*Have* SBJ . . . ?] survived because of its high degree of entrenchment.[6]

[6] This analysis is slightly different from Bybee and Thompson's. Bybee and Thompson argue that this is a case of high token frequency, which is true for the individual auxiliary forms but not for the auxiliary construction schema. The syntax of the auxiliary must be analyzed in terms of the constructions in which it occurs. However, Bybee and Thompson's analysis is easily translatable into the analysis presented here.

Readers may wonder why the construction schemas abstract away from arguments first, leaving invariant the verbs and auxiliaries. Arguments in favor of this abstraction based on semantic relevance and on language acquisition data are presented in §§11.3.3–4.

Bybee and Thompson also discuss a large scale corpus study of the French subjunctive by Poplack (1992, 1996). The French subjunctive form is disappearing from the spoken language, but is still variably used. However, the French subjunctive has survived largely in the complements of the highly frequent main clause verb *falloir* 'have to,' and/or in the most highly frequent complement verbs, including *avoir* 'have,' *être* 'be,' *aller* 'go' and *faire* 'make, do,' as predicted by the usage-based model.

The example of English auxiliaries in questions and negative sentences illustrates the maintenance of irregularity in more entrenched constructions that have resisted changes in the more schematic constructions of the language. Another respect in which more entrenched constructions are irregular is that they undergo changes that less entrenched constructions do not undergo. These changes commonly involve reduction, a typical concomitant of high frequency. In schematic constructions, reduction applies of course to the substantive unit(s) of the construction.

An example of reduction in a highly entrenched construction is the contraction of *not* with the auxiliary in the [SBJ AUX-*n't* . . .] construction. This contraction is recognized in written English, and includes the fused form *won't*. Of course, such reduction originated in the spoken language, and one would expect to find reduction of other negative-auxiliary contractions in the spoken language. Bybee and Scheibman (1999) investigate the reduction of one specific negative auxiliary form, *don't*, in spoken American English conversation. They demonstrate that the phonetic reduction of *don't* is strongly correlated with the frequency of the verb and of the subject with which *don't* is combined in the [SBJ *don't* VERB . . .] construction. The highest frequency subject is the first person singular *I*, and the highest frequency verb in this construction is *know*; in fact, this reduction is so salient that it is loosely represented orthographically as *I dunno*. But *I dunno* is only the extreme end of a continuum of phonetic reduction that spans the full range of verbs and subjects used in this construction. Bybee and Scheibman further note that the reduction applies across the substantive units in the constructions as a whole, regardless of their internal constituent structure.

In addition to syntactic irregularity as a consequence of high frequency, one would expect to find degrees of syntactic productivity. Of course, maximal syntactic productivity is the characteristic of the major, most schematic constructions of the language, such as the transitive construction [SBJ VERB OBJ]. The high productivity of this highly schematic construction is due to the very high frequency of instances of this construction, due to the high number of transitive verbs, the vast majority of which have a relatively low token frequency. However, even with completely schematic syntactic constructions, one can find varying degrees of productivity.

Bybee and Thompson (1997) cite an example of different degrees of productivity from the analysis of argument structure constructions by Goldberg (1995). Goldberg compares two constructions, the Caused Motion construction and the Ditransitive construction, illustrated in (22) and (23) respectively:

(22) He told the news to the woman.
(23) He told the woman the news.

The two constructions overlap in their distribution: some verbs allow both constructions, with approximately the same meaning, as in (22)–(23). The Ditransitive construction is used with many fewer verbs than the Caused Motion construction, and hence is much less productive than the Caused Motion construction (Goldberg 1995:124):

(24) Sally whispered some terrible news to him.
(25) *Sally whispered him some terrible news.

However, Goldberg notes that the prototypical ditransitive construction ('SBJ cause OBJ1 to receive OBJ2'; see §10.2.2) has the highest type frequency of any of the ditransitive subconstructions. And in fact the prototypical ditransitive has some productivity compared to the other ditransitive subtypes. The protoypical ditransitive is extended to new verbs, as in (26), but the subtype 'SBJ enable OBJ1 to receive OBJ2' is restricted to a subset of enabling verbs and does not extend to other verbs with that meaning (Goldberg 1995:129, 130):

(26) Chris e-mailed/radioed/arpanetted him a message.
(27) a. Sally permitted/allowed Bob one kiss.
b. *Sally let/enabled Bob one kiss.

Finally, one must also differentiate between productive syntactic schemas and default syntactic schemas, used, for example, in borrowing. Many languages, particularly languages with complex verbal morphology, do not directly incorporate borrowed verbs into the productive native syntactic constructions of the language. Instead, they use a default construction, combining an invariant form of the borrowed verb with an inflected native verb (often meaning 'make, do') in a construction [BORRVERB 'make' . . .]. An example of this phenomenon can be found in K'iche' Mayan, which uses the verb *ban* 'make' with the infinitive form of borrowed Spanish verbs, as in (28) (Mondloch 1978:117):

(28) x- Ø- in- ban engañar lē achi
PST- 3SG.ABS- 1SG.ERG- make deceive the man
'I deceived the man.'

The generalization of the notion of type/token frequency for constructions of varying degrees of schematicity allows us to make predictions about syntactic regularity and irregularity based on the usage-based model of morphology, and to seek evidence for those predictions.

11.3.2 Product-oriented syntactic schemas

In the usage-based model, word forms are not the output of rules but instances of schemas. In §11.2.3, it was noted that source-oriented schemas capture the same relationships between word forms as rules in the rule-based model. Evidence was presented there for product-oriented morphological schemas. Product-oriented morphological schemas are generalizations over word forms that would be analyzed as the output of a morphological rule in the rule-based model, but cannot be so analyzed because each word form would require a different 'rule' deriving the output. However, the 'outputs' have a phonological coherence that is greater than that of the 'input.' The example of a product-oriented morphological schema given in §11.2.3 is the [. . . ɹŋ] schema for the Class VIb irregular past tense verbs of English (Bybee and Slobin 1982). In this section, we will discuss possible cases of product-oriented syntactic construction schemas.

The classic rule-based model of syntactic representation is transformational generative grammar. In transformational grammar, a construction is describable as the product of general rules. The effect of these rules is to insert, move or (in earlier versions) delete syntactic elements from the source structure to yield a target structure. Although current generative theories use a variety of formal devices, and some theories eschew syntactic movement rules, a systematic relationship between constructions such as the active and passive voice is still recognized as a rule-based relationship.

In construction grammar, some construction schemas can be thought of as source-oriented. For example, the English active transitive and passive construction schemas can be described as in (29):

(29) a. Active: [SBJ$_i$ VERB$_k$-TNS OBJ$_j$]
b. Passive: [SBJ$_j$ *be*-TNS VERB$_k$-PP *by* OBJ$_i$]

In these constructions, systematic correspondences can be established between the elements of the two constructions (indicated by the indices on the elements), which can then be used to formulate a rule in the rule-based model that derives the product construction (the passive) from the source construction (the active, or some underlying structure from which both are derived).

Product-oriented syntactic construction schemas, on the other hand, would be construction schemas that have a coherent syntactic structure but would require different 'rules' for each type of 'input construction' in transformational-generative terms. Thus, a product-oriented construction schema is a schema subsuming

the outputs of different 'rules' and 'input constructions.' Of course, since the syntactic constructions in question are themselves schematic, rules can be devised for each construction type. But this is no different than having a 'rule' for each word in morphology; it is the same phenomenon but at a higher level of schematicity. The crucial point is that there is a higher degree of structural coherence defining the product-oriented schema than its counterpart 'source' schema(s).

There are some strong candidates for product-oriented syntactic schemas in English. One is the pair of interrogative and negative construction types discussed in §11.3.1. A very general schema can be formed for each: [AUX SBJ . . . ?] and [SBJ AUX-*n't* . . .]. However, there would have to be at least two rules linking a source schema to the interrogative or negative product schema: a rule inserting the auxiliary *do* for sources without an auxiliary, and a rule applying to the (first) auxiliary for sources with an auxiliary. The different source-product correspondences are illustrated for the question schema in (30)–(32):

(30) a. She found it. b. Did she find it?
(31) a. She will come. b. Will she come?
(32) a. She could have eaten already. b. Could she have eaten already?

There is more structural coherence to the product constructions in (30b)–(32b) than to the 'source' constructions in (30a)–(32a). And of course, the product-oriented schema is productive.

Another relatively clear case of a product-oriented schema in English is the most general declarative construction. In the simple declarative construction, there must be a preverbal subject phrase; the schema must be something like [. . . SBJ (AUX) VERB . . .]. In this case, the 'sources' are varied, as well as the 'rules' that would produce the output constructions. In the canonical case, the subject argument occurs in preverbal position, as in (33a). In the case of certain verbs which are often analyzed as lacking a subject participant, such as weather verbs, a neuter subject *it* is put in preverbal position, as in (33b). In the case of certain constructions in which a subject argument is not in preverbal position, the neuter pronoun is put in preverbal position, leading to the appearance of two 'subject phrases,' as in (33c):

(33) a. It's in the cupboard.
b. It's raining.
c. It is amazing how often it rains in Manchester.

Other analyses have been proposed for the constructions in (33b–c): some have argued that *it* in (33b) refers to the general ambience, and others have argued that there is only one 'surface' subject phrase in (33c), the 'underlying' subject having been extraposed to a different syntactic position. However, whatever rule-based

analysis is proposed to derive (33a–c), the result is a coherent product-oriented construction schema for the constructions exemplified in (33a–c), in which there is a subject phrase in preverbal position. And this construction has been gradually spreading in the history of English, replacing constructions in which the subject could appear in different positions.

Another class of syntactic constructions that are easily analyzable as product-oriented schemas are the so-called extraction constructions, in which an extracted element, such as the question word in information questions, the head of a relative clause, or the clefted noun phrase in a focus cleft construction, is positioned at the beginning of the construction:

(34) a. Who (*did) met Jill yesterday?
b. the man that/who/*Ø met Jill yesterday
c. It was Ed that/who/*Ø met Jill yesterday.

(35) a. Who did Jill meet yesterday?
b. the man (that) Jill met yesterday
c. It was Ed that Jill met yesterday.

(36) a. Who did Jill talk to yesterday?
b. the man (who) Jill talked to yesterday
c. It was Ed that Jill talked to yesterday.

(37) a. What did Jill open the box with?
b. the hammer (that) Jill opened the box with
c. It was a hammer that Jill opened the box with.

The analysis of extraction constructions in rule-based models allows for movement (or the equivalent thereof) of the question word/relative clause head from any position in the sentence to initial position.[7] Syntacticians are accustomed to formulating a WH-movement rule as 'move from anywhere to a particular position': it is not generally observed that the movement rule is slightly different depending on the position from which it is moved; what the extraction constructions all have in common is the target structure, that is, the product of the different rules. In fact, the rule for English subject questions, relatives and clefts must be slightly different from the rule for the other types of extraction, since the subject question does not have an auxiliary (34a), and the subject relative and cleft prohibit deletion of the relative pronoun in most dialects (34b).

Moreover, other languages have substantially different 'rules' for the formation of information questions, relative clauses and focus (cleft) constructions for

[7] We disregard here the existence of constraints on the 'path of movement' (as it would be described in a rule-based transformational model). Although it is widely assumed that the constraints must be formulated in syntactic terms (beginning with Ross 1967), there are many counterexamples, and alternative accounts have been formulated in semantic/pragmatic terms (see Deane 1991 and references cited therein).

different arguments. In K'iche', for example, questions, relatives and focus constructions formed on the ergative (transitive subject) argument require the *-Vn* focus antipassive verb form (see example [38]; Mondloch 1978:74); those formed on the absolutive (intransitive subject or transitive object) argument retain the active voice verb form ([39]; Larsen and Norman 1979:357); those formed on the instrument require the *-bej* focus antipassive form ([40]; Norman 1978:462); and those formed on locative/directional phrases retain the active voice form but leave the demonstrative pronoun *wih* in the normal oblique position ([41]; Mondloch 1978:42):

(38) jachin x- Ø- cun **-an** lē yawab?
who PF- 3SG- cure -antipass the sick.one?
'Who cured the sick one?'

(39) jachin x- Ø- u- ch'ay **-Ø** lē achi
who PF- 3SG.ABS- 3SG.ERG- hit -ACT the man
'Who did the man hit?'

(40) jas x- Ø- u- rami **-bej** lē achih
what PF- 3SG.ABS- 3SG.ERG- cut -INST.PASS the man
r- ē le chē?
3SG.POSS- GEN the tree
'What did the man use to cut the tree?'

(41) jawi? c- at- bē **wi**?
where IMPF- 2SG.ABS- go WI
'Where did you go?'

Nevertheless, in K'iche' as in English, there is a coherent product-oriented schema such that the questioned, relativized or focused, phrase is put in initial position, whatever happens to the rest of the sentence. This generalization is also productive, and is another example of a product-oriented schema.

Another example of a product-oriented schema is the Japanese passive. The Japanese passive construction is characterized by: (i) a subject NP which may be marked with *ga* ('subject'), *wa* ('topic'), or may be absent altogether if highly topical; (ii) an oblique agent NP marked with *ni*, which is optional; and (iii) a verb form in *-(r)are*. The subject of a Japanese passive need not be merely the object of the corresponding active, as in (42) (Tsukiashi 1997:18; all examples are attested):

(42) Dietrich ga hangyakuzai de jusatu **sare**ru
Dietrich SBJ treason for shoot.to.death do:PASS
'Dietrich is shot to death for treason.'

The subject of the passive construction may correspond to the indirect object of the active verb ([43]; Tsukiashi 1997:25), the possessor of the direct object of the active verb ([44]; 1997:30–31), the subject of the complement of the active verb ([45]; 1997:36), another NP somewhere in the sentence ([46]; 1997:38), or a referent that is not a participant in the event at all ([47]; 1997:39; note that *hiku* is intransitive only):

(43) 'neetyan beppin dana' to iwa**re**ta
girl beautiful are COMP say:PASS:PST
'I was told, "you are a beautiful girl"'

(44) watasi wa sitagi o tora**re**te-simatta
I TOP underwear OBJ steal:PASS:PERF
'I have had my underwear stolen.'

(45) tamago wa zenmetu -ka to omowa**re**ta
egg sbj all.broken -QUES COMP think:PASS:PST
'The eggs were thought to be all broken.'

(46) ushiro-no seki de wakarebanasi o sa**re**tari suruto
behind table LOC break.up.story OBJ do:PASS if
'if I have people talking about their breaking up at the table behind me'

(47) karako no sugata ni hika**re**te . . .
Chinese.doll GEN figure NI attract:PASS:CONJ
'I was attracted by the figure of the Chinese doll.'

As with the extraction constructions in (34)–(41), the product construction for the Japanese passives in (43)–(45) has a coherent structural schema, namely [(NP *ga/wa*) (NP *ni*) VERB-*(r)are* . . .]. A similar argument can be made for the Bantu passive-applicative patterns, as found in Kinyarwanda (Kimenyi 1980; see also Hawkinson and Hyman 1974). The various passive-applicative constructions in Kinyarwanda resemble the various K'iche' extraction constructions, in that a different applicative suffix must be added to the verb depending on the role of the oblique argument that is ultimately passivized. But all of them have in common a subject NP and a passive verb form.

All of these examples can be analyzed as product-oriented construction schemas in a usage-based model of construction grammar, in terms of their 'syntactic' or symbolic grammatical structure (see §11.2). There is also a plausible candidate for a product-oriented schema in English based on the phonological structure of a family of construction schemas. These are the so-called quasimodals, or recently grammaticalized constructions that have developed tense-aspect-mood functions but are syntactically distinct from the older auxiliary category of English. All of the quasimodal forms end in an alveolar consonant followed by schwa, although this ending represents the reduction of different source forms, as in (48):

(48) a. She coulda done it. [from *could have*; also *shoulda*, *woulda*]
b. She oughta do it. [from *ought to*; also *gotta*, *hadda*, *hafta*, *useta*]
c. She oughta done it. [from *ought to have*; also *gotta*, *hadda*]
d. She's gonna do it. [from *-ing to*; also non-third singular *wanna*]
e. She betta do it. [from *had better*]

We may describe the overall schema as [SBJ QUASIMODAL . . . C_{alv}ə VP]. This pattern seems to be mildly productive, in that almost all of the grammaticalizing quasimodals have reduced to forms ending in [. . . C_{alv}ə]; of course, there is a relatively low type frequency to this construction.

It should be pointed out that in the past two and a half decades of generative syntactic research, emphasis has shifted from the description of rules to the descriptions of constraints ('principles') on the output of rules (see, for example, Chomsky 1981:3–4; 1993:5). To the extent that the principles and constraints of generative grammar describe the structure of the 'product' schema, then generative grammar constraints are handling essentially the same kind of phenomena as product-oriented schemas in the usage-based model. However, current generative syntactic models utilize abstract syntactic structures and derivational processes, and generate a wide range of outputs, many of which are invalid ('crash'; Chomsky 1993:5) and only a few of which are actually occurring linguistic expressions ('convergence'; ibid.). In contrast, the usage-based model represents schemas abstracted inductively from actually occurring utterances; in syntax, as in morphology, the usage-based model does not posit underlying structures or nonexistent structures that are filtered out (see also footnote 7).

11.3.3 Relevance and the organization of construction networks

In the usage-based model of morphology, semantic connections are argued to be much stronger than phonological connections. Moreover, degree of semantic similarity predicts aspects of morphological structure, in particular the likelihood of suppletion and other morphophonological irregularities. The degree of relevance of semantic relations allows one to impose a roughly hierarchical structure on a taxonomic network (see the diagram in [13] above).

The notion of relevance (relative semantic similarity) allows us to construct hypotheses about the organization of syntactic knowledge as well. In this section, we will examine the hypothesis that the simple relevance hierarchy in (49) governs some aspects of the organization of syntactic knowledge of sentences (see Clausner 1991 for discussion of a more detailed hypothesis):

(49) illocutionary force < predicate type < participant type

We first offer semantic arguments for the relevance ranking in (49). Relevance of sentences pertains to the meaning of the utterance in context. The illocutionary force of an utterance has the greatest semantic effect on the meaning of a sentence, since it alters the speaker's intention and the hearer's response to a proposition if it is presented as an assertion, question, command or other speech act. Predicate type is definable at two levels. At a general level, predicate type distinguishes predicating an action (verbal predication) vs. describing, classifying, locating or identifying a referent (various types of nonverbal predication). At a more specific level, predicate type distinguishes the different kinds of states of affairs described by different predicates (e.g. *run*, *talk*, *dance*, *sleep* etc.). Differences in predicate type effect the greatest semantic changes in a proposition since they alter the state of affairs; this is a more dramatic change to the semantic representation than merely changing the identities of the participants for a given state of affairs.

Evidence in favor of the relevance ranking in (49) would be a greater likelihood of significant differences in the phonological pole of a construction for semantically more distant – that is, less similar/less strongly connected – construction types. In morphology, evidence for semantic distance has been drawn from changes in the phonological substance of word forms. In syntax, we are dealing with largely schematic constructions, so evidence for distance will be drawn from the symbolic organization of grammatical form, that is, the syntactic elements of constructions, their presence/absence, and their order. Among the most significant structural differences between sentence types are changes of word order, insertion of additional units, and units positioned in first or last position, the two most salient positions of the word string (see Clausner 1991).

Differences in illocutionary force are associated with sentence types, such as the traditional categories of declarative, interrogative and imperative. Cross-linguistic surveys indicate that there are substantial syntactic differences in the order and presence/absence of syntactic units in different sentence types (Sadock and Zwicky 1985; Clausner 1991). Interrogatives typically involve the repositioning of the questioned element, either to sentence-initial or preverbal position, and the addition of a question morpheme. Imperatives typically lack the subject (addressee) element, and have a stripped-down verb form.

In contrast, differences in predicate type, that is, verbal vs. nonverbal predication, rarely involve any change in word order, although they may involve the presence of an additional element (the copula), and the reduction or absence of 'verbal' inflectional categories on the nonverbal element (Croft 1991, chapter 2; Stassen 1997). Finally, differences in the participants in events rarely involve a significant change in the structure of the sentence. The most common differences are the employment of special case markings for certain participant types found in many languages, such as the dative case for experiencers of mental state verbs (*I* in *I like Mozart*) and the instrumental case for inanimate forces (*the wind* in *The wind knocked down the tree*). And even these changes are more accurately described as dependent on the differences in the type of predicate (state of affairs) which requires special case marking of experiencers or inanimate forces.

Another sort of evidence for semantic distance in syntactic organization is analogical changes of syntactic constructions. One example from the history of English suggests that illocutionary force is more relevant than predicate type (and also that polarity is intermediate in relevance between illocutionary force and predicate type). This conclusion can be drawn by examining the constructional paradigm given in (50):

(50)

	Declarative	*Imperative*	*Prohibitive*
Verbal	a. He jumped.	c. Jump!	e. Don't jump!
Nonverbal	b. He is brave.	d. Be brave!	f. Don't be cruel!
			<g. Be not cruel!

English forms prohibitive (negative imperative) sentences from verbal predicates by preposing *Don't* to the bare verb stem, as in (50e); compare the imperative form in (50c). Among nonverbal prohibitives, the construction with *Be not*, as in (50g), gave way in the latter parts of the early Modern English period to a construction preposing *Don't* to *be*, as in (50f) (Denison 1998:252).

The construction [*Don't be* ADJ] is odd in the broader perspective of English syntax because a stative predicate normally does not take *do*, and *do* does not combine with *be* in any other construction, either declarative or (positive) imperative.[8] Yet the emergence of [*Don't be* ADJ] realigns the constructional paradigm in (50) so that the illocutionary force constructions are more distinct from each other and a single illocutionary force type is more uniform. The result of the change from (50g) to (50f) is that the new nonverbal prohibitive construction [*Don't be* ADJ] is now structurally more different from nonverbal declarative and imperative constructions than the old construction [*Be not* ADJ]; compare (50f–g) to (50c). However, [*Don't be* ADJ] is structurally more similar to the verbal prohibitive construction; compare (50f–g) to (50e). The constructions in (50e–f) are describable with a single coherent construction schema [*Don't* PRED]. In other words, the change has led to a greater similarity within a single illocutionary force type and greater differences between sentences of the same predicate type. This is what is predicted by the semantic distance hypothesis, since differences in predicate type are less relevant than differences in illocutionary force.

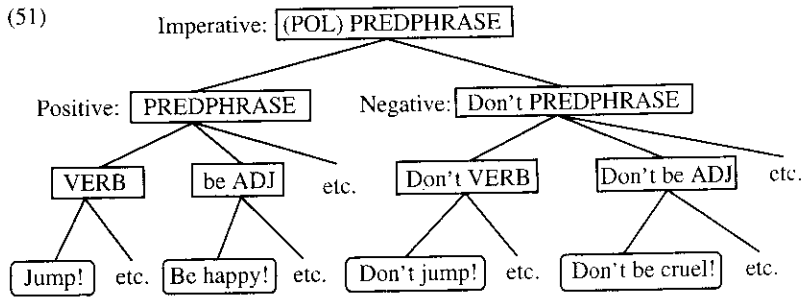
Additional evidence supporting the greater semantic distance between predicate types than between participant types is found in language acquisition. Children acquiring English tend to be very conservative in using verbs in different argument structure constructions, but very liberal in substituting a range of nouns in argument position in a given verbal construction (see §11.3.4 and references cited therein). That is, a child learning the verb *break* will first learn to substitute different participants in an argument position, such as *Mommy break*, *Daddy break*

[8] *Do* is sometimes found with the positive imperative as well (Denison 1998:252).

and so on; and only later will the child learn to use different arguments with the verb, such as *Break cup*, *Mommy break cup*, *Break with stick* and so on. These results imply that children generalize across different participant types quickly and early, but only later generalize across predicate types and the argument structure constructions that characterize them.

The evidence presented here, if it is borne out by further studies, would allow us to restructure the taxonomic organization of sentence-level constructions. Although a taxonomic organization for constructions must allow for multiple parents, we can use degree of semantic similarity to rank the syntactic distinctions and thus form a hierarchy, as was done in example (13) (§11.2.4) for morphological paradigms. Such an organization is illustrated in (51) for the Imperative half of the basic Declarative-Imperative split:

(51)

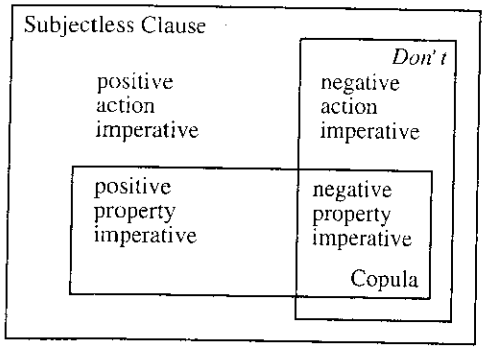


The diagram in (51) is a visual means to represent strength of connections or semantic distance between constructions. Another means to visually represent semantic distance between constructions is employed in typological theory and adopted by Radical Construction Grammar (§10.2.4). This is the **semantic map model** (see Croft 2001:92–98; 2003b:133–39; Haspelmath 2003, for references and general explication). In the semantic map model, semantic distance is represented in a multidimensional **conceptual space**, whose dimensions correspond to semantic properties. In the example in (50), the semantic dimensions are declarative-imperative, positive-negative and verbal-nonverbal (semantically defined as actions-properties etc.). Such a mapping is reduced by convenience to two dimensions. In this case, it corresponds roughly to the spatial arrangement of a morphological or constructional paradigm such as that in (50). For illustration, we will restrict ourselves to the imperative half of the paradigm in (50), that is, (50c–f).

Constructions in a single language (or across languages, for cross-linguistic comparison) are mapped onto the regions of the conceptual space according to their use. For example, one may map the English Copula construction, the prohibitive *Don't* construction, and the imperative Subjectless Clause construction on the

conceptual space corresponding to the imperative paradigm in (50), as in (52):

(52)



The lowercase labels 'positive action imperative' and so on designate points in conceptual space that can be expressed by constructions in a language such as English. The horizontal dimension of the space corresponds to positive-negative polarity and the vertical dimension to the action-property lexical semantic classes. The boxes map the occurrence of different English constructions in the conceptual space (compare the examples in [50c–f]).

The basic principle guiding the structure of conceptual space and semantic maps is formulated in the Semantic Map Connectivity Hypothesis: constructions must map onto a continuous region of conceptual space (Croft 2001:96; 2003b:134). This is one manifestation of the effect of semantic distance on formal structure: constructional uses must be semantically connected, at least historically. There is a dynamic hypothesis as well, namely that constructions are extended in use along connected paths in conceptual space (Croft 2001:101–2). In the example above, for instance, the *Don't* imperative was historically extended from the negative action imperative to the negative property imperative.

Typologists have applied this model cross-linguistically, so that the Semantic Map Connectivity Hypothesis is a universal hypothesis. Patterns of semantic maps across languages also suggest that the internal structure of grammatical categories, that is, relations among exemplars, is universal, while boundaries are language-specific (Croft 2001:103; compare chapter 4). Hence, the typological evidence indicates that at least the broad structure of the conceptual space is universal and therefore makes up part of human cognition, although boundaries are variable and hence less constrained by the nature of human cognition (Croft 2001:105; 2003b:138–39).

The semantic map model represents semantic relationships between constructions. Formal taxonomic relationships can be superimposed on the semantic map model. Relative semantic distances implied by the relevance hypothesis can be represented by relative distance in the conceptual space: (in [52], for example, the negative functions are closer to each other than either is to their positive counterparts). These relative distances impose constraints on the taxonomic organization of construction (in this case, requiring the positive and negative forms to be grouped together first in the taxonomy; compare [52] to [51]). Further structures must be imposed on conceptual space to allow for the formulation of constraints on the grammatical expression of conceptual structures (see, e.g., Croft 2001:160–61, 163–64, 169–70; 2003b:140–43).

The exploration of semantic relations between constructions and their constraints on formal properties of constructions is still in its infancy. Presumably, further research will allow construction grammarians to impose further structure on the network organization of syntactic as well as morphological knowledge.

11.3.4 The acquisition of syntax and syntactic change

In §11.3.3, we referred to evidence from language acquisition on the organization of the construction network. More generally, recent research in child language development offers evidence for a usage-based, inductive model of the acquisition of syntax.

Evidence from very detailed longitudinal studies of early language development demonstrates that children are in fact extremely conservative language learners (Braine 1976 is an early important study along these lines; for more recent studies, see Tomasello 2000, 2003 and references cited therein). Children's earliest multiword utterances demonstrate that children use verbs and other predicates in only one construction at a time (Tomasello 1992; Lieven, Pine and Baldwin 1997; Tomasello et al. 1997; Pine, Lieven and Rowland 1998).

In other words, children do not utilize schematic categories such as [VERB] or schematic constructions such as the transitive construction [SBJ VERB OBJ] in their early acquisition, whether these schematic structures are innate or not. Instead, children begin with very low-level generalizations based around a single predicate and a single construction in which that predicate occurs, and only later in acquisition learn more schematic categories and constructions.

The main exception to this highly specific acquisition process is that, as noted in §11.3.3, children do substitute different object names in a single participant role in a construction from early on. Tomasello (1992) proposes the Verb Island Hypothesis, namely that verbs and other predicates form 'islands' of a single verb plus a single construction, before joining together the 'islands' into a construction network such as that illustrated in (50) above.

Although children substitute object names or 'nouns' early in acquisition, it does not appear that this implies that children acquire a schematic [NOUN] or

[DETERMINER NOUN] noun phrase category early on. Pine and Lieven (1997) found that at the earliest stage of learning nouns and determiners, children also proceed in a piecemeal fashion. In their study, Pine and Lieven found that, although children use a variety of nouns with both *a* and *the*, the nouns they use with *a* and the nouns they use with *the* overlap very little at first. Instead, it appears that children learned nouns with one determiner, or that the determiner use was associated with larger structures in which the noun and determiner occur, such as [*in the* X] or [*That's a* X].

Pine, Lieven and Rowland (1998) studied the first six months of twelve children's multiword speech and found evidence that children begin with lexically quite specific constructions, but that it was not always verbs that functioned as the 'islands' around which utterances were learned. For example, children produced utterances with the auxiliaries *can*, *do*, *be* and *have*, constituting an average 90.3% of all children's utterances (Pine et al. 1998:818). However, there was very little overlap between the verbs used with each auxiliary for each child (only one child with one pair of auxiliaries had an overlap significantly different from zero; 1998:819). This suggests that the children are learning lexically specific auxiliary-verb combinations and have not yet developed a productive [AUX] or [VERB] category in their utterances.

A still more fine-grained study confirms that early acquisition begins piecemeal and indicates that acquisition is sensitive to token frequency in the input. Rubino and Pine (1998) conducted a longitudinal study of a child learning Brazilian Portuguese, and argued that the acquisition of sentence constructions with subject-verb agreement began in a piecemeal fashion, with the acquisition of singular and plural agreement beginning independently (in fact, in succession). Later, the child began to overregularize the third singular agreement affixes at the time that the child began to produce the third plural agreement affixes (Rubino and Pine 1998:51). This developmental sequence suggests that an initial stage of rote learning was followed by 'joining the islands' of singular and plural agreement to induce a system of number agreement in the third person.

The overall average of errors produced by the child was quite low, which is what one would expect in a model of conservative, inductive language learning. A breakdown of error rates by person and number indicated that frequency of forms in the input defined the course of acquisition of subject-verb agreement. The child acquired correct subject-verb agreement for the most frequent agreement forms in the input first, and the first correct productions of the less frequent subject-verb agreement combinations appeared with high frequency verbs in the input (Rubino and Pine 1998:53). However, frequency in the input does not appear to be the only factor determining acquisition. Gathercole, Sebastián and Soto (1999) examined the acquisition of Spanish verbal forms in two children, and observed the same

piecemeal, incremental acquisition process, and some correlation with frequency of the form in the input. However, it appeared that morphological complexity of the verbal form also played a role in the order of acquisition of verbal forms by the children studied.

These and other language acquisition studies suggest that a careful, detailed examination of the actual course of development of children's language acquisition conforms to the predictions of the usage-based model. Children begin with very narrow construction types, even specific to individual verbs and nouns, and gradually build more schematic grammatical constructions over time. The rate of learning and generalization is influenced by the relative frequency of the constructions in the caregivers' input. The order of acquisition is also sensitive to the semantic distance between constructions, as described in §11.2.4 and §11.3.3.

Similar results are found in the detailed examinations of the paths of syntactic change. As many historical linguists have observed in detailed studies, the birth and growth of a construction proceeds in an incremental fashion, not unlike the expansion from 'islands' of highly specific constructions as in child language acquisition.

One example of a syntactic change, cast in a cognitive linguistic framework, is Israel's analysis of the development of the *way* construction, illustrated in (53) (Israel 1996:218):

(53) a. Rasselas dug his way out of the Happy Valley.
b. The wounded soldiers limped their way across the field.
c. ?Convulsed with laughter, she giggled her way up the stairs.

All of the *way* construction examples given in (53) use a possessed direct object *way* and require a complement describing the path of motion. Example (53a) describes a means of achieving the motion along the path; (53b) describes a manner of motion along the path, and example (53c) describes an incidental activity of the subject as she travels along the path. The *way* construction is also syntactically and semantically idiosyncratic: the verbs in the *way* construction are normally intransitive, and their meaning does not normally entail motion.

Using data from the Oxford English Dictionary and the Oxford University Press corpus of contemporary English, Israel argues that the modern *way* construction grew gradually from two different, more narrowly used *way* constructions, the means and manner constructions (a third source, the acquisition or continued possession of a path, shrank rather than expanded, although it remains in certain common instances such as *find one's way*; Israel 1996:221, n. 3). The manner construction began as a special case of the Middle English [*go one's* PATH] construction, and was originally found with only the most common general motion verbs, no more than sixteen verbs before 1700 (Israel 1996:221). Verbs encoding

manner and path of motion began to be used with the manner *way* construction, and in the nineteenth century, expanded particularly in the domain of laborious motion (*plod, scramble, fumble*) and tortuous path (*thread, worm, insinuate*). At the end of the nineteenth century, the manner *way* construction expanded to verbs expressing noise accompanying motion (*crunch, crash, toot*).

The means *way* construction does not emerge until around 1650, and began with verbs describing path clearing (*cut, furrow out*) and road building (*pave, smooth*), as well as forcible motion (*force out*; Israel 1996:223). Expansion begins with the cutting verbs and extends to fighting verbs starting around 1770. In the nineteenth century, progressively more indirect means of reaching the goal, as in *He . . . smirked his way to a pedagogal desk* (Israel 1996:224, from *New Monthly Magazine* VII.386, 1823). At this point the means and manner *way* constructions appear to merge, and in the late nineteenth century one finds the first examples of incidental activity, which is quite distantly related to motion, as in *He . . . whistled his way to the main front door* (Israel 1996:225, from Blackmore, *Cradock Nowell* xvi, 1866).

At the same time that the class of verbs in the *way* construction is expanding, the overall syntactic form of the construction becomes narrower, from allowing other nouns than *way* and an optional path expression to obligatory *way* and path expression (Israel 1996:221, 226). This (common) pattern in syntactic change illustrates how a new construction emerges from an often highly specific instance of an existing construction schema and then expands in its own direction. A usage-based model can account for this pattern in that it allows for the entrenchment of specific instances of construction schemas, which function as 'islands' from which a new construction expands, establishing and generalizing a new construction schema with its own syntactic and semantic peculiarities.

11.4 Conclusion

In this chapter, the construction grammar model of the representation of grammatical knowledge was linked to the processes that use that knowledge, and to the relationship between the representations and what is represented (utterances in discourse). The relationship between representations and what is represented is essentially one of categorization: categorization of the experience to be communicated and the utterance that is used as instances of the grammatical category of known constructions, symbolizing experiences of the same category. The categorization relation between language use and grammatical knowledge is also sensitive to frequency of use of grammatical constructions at different levels of schematicity, that is, the process of language use influences the structure of the

representation. This model of grammatical representation and the processes that use it is the usage-based model. The formal representation of the usage-based model is as an activation network, in which activation corresponds to the process of language use, and entrenchment (or decay) is the effect of the process on the representation.

A number of general hypotheses about grammatical representation and process have been proposed by researchers into the usage-based model (in addition to those proposed in chapters 9–11). Productivity is hypothesized to emerge from a high type frequency, which can be generalized as the hypothesis that entrenchment of schematic constructions is proportional to the number of discrete instances of that construction. Generalizations are defined as schemas rather than rules producing an output structure from an input structure. In addition to source-oriented schemas that can be modeled by rules, there is evidence for product-oriented schemas in morphology and syntax, which cannot be easily modeled by rules. The organization of constructions is sensitive to their relative semantic distance from each other (relevance/semantic connections), which imposes further structure on the taxonomic network of constructions with multiple parents. This organization can be represented as semantic maps of constructions on conceptual space, the structure of which appears to be universal in large part. Finally, recent research on language acquisition indicates that both morphology and syntax are acquired in a gradual, piecemeal, inductive fashion. Although many of these hypotheses are recent and hence the evidence supporting them is fragmentary, the cognitive linguistic model of grammatical knowledge is an important and expanding strand of cognitive linguistics research.