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Computational Resources: Framenet and Constructicon

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34.1 Introduction

This chapter discusses how ideas, concepts, and methodologies from cognitive linguistics have been applied to the creation of two specific computational resources for linguistics research.[1] After this introductory section, section 34.2 discusses one of the most prominent computational resources inspired by cognitive linguistics, the FrameNet lexical database (http://framenet.icsi.berkeley.edu), which is structured according to the theory of Frame Semantics (Fillmore 1982). Section 34.3 shows how the FrameNet methodology and representational format for creating lexical entries has been expanded for the creation of a so-called 'constructicon,' aimed at creating entries for grammatical constructions. Section 34.4 briefly outlines how FrameNet and the Constructicon can be used for research in cognitive linguistics.

34.2 From Frame Semantics to FrameNet

34.2.1 Historical Background

Fillmore's seminal 1968 paper 'The case for case' proposed a list of semantic roles aimed at identifying grammatically relevant facets of a verb's meaning in terms of a set of labels such as Agentive, Instrumental, Dative, Factitive, and Locative. These labels served to identify the role played by each of the verb's arguments in the event it denotes. The collection of sets of different semantic roles came to be known as

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case frames, which specify a verb's semantic valency. One of the major ideas behind these semantic roles was that they are ordered in a hierarchy depending on their realization in terms of grammatical function. This hierarchy put the semantic role Agentive at the top, followed by Instrumental, Objective, and other semantic roles. Depending on a verb's valency, different semantic roles are mapped as subject. For example, the case frame of the verb *to open* consists of three semantic roles: Agentive, Instrumental, and Objective. When all three semantic roles are present, the Agentive is realized as the subject (e.g. *Kim opened the door*), but when the Agentive is not present, the next semantic role on the list is realized as the subject (e.g. *The key opened the door*).

Following the initial success of Fillmore's proposals, several problems emerged regarding the status of semantic roles, including issues with the definition and granularity of semantic roles, problems reflecting cross-role generalizations, and problems of one-to-one correspondence (for an overview, see Levin and Rappaport Hovav 2005). As a result, during the 1970s Fillmore moved away from his initial proposal that semantic roles are primary and that there should only be a rather limited set of semantic roles (see Fillmore 1975, 1976, 1977b, 1977c, 1978, 1979). The goal of this move was to develop an elaborated model of the semantics of understanding, in contrast to a truth-conditional semantics, the prevalent approach to linguistic semantics at the time. More specifically, Fillmore suggested that so-called semantic frames should be regarded as primary for the description and analysis of meaning (and its syntactic relevance), and that semantic roles should be defined in terms of their semantic frames. The early 1980s saw the first fully developed version of Frame Semantics, which was articulated as a model based on the full and rich understanding required for the production of a text as well as the understanding of a text (Fillmore 1982). The central idea regarding the status of semantic frames for the understanding of words and texts is summarized by Fillmore and Atkins (1992: 76–77) as follows:

> A word's meaning can be understood only with reference to a structured background of experience, beliefs, or practices, constituting a kind of conceptual prerequisite for understanding the meaning. Speakers can be said to know the meaning of the word only by first understanding the background frames that motivate the concept that the word encodes. Within such an approach, words or word senses are not related to each other directly, word to word, but only by way of their links to common background frames and indications of the manner in which their meanings highlight particular elements of such frames.

One of Fillmore's examples illustrating the central role played by semantic frames concerns the meaning of the term *bachelor*. Fillmore points out that while this term typically refers to an unmarried man, not all unmarried men such as *the pope* or *Tarzan* would typically be characterized as

bachelors. The reason, according to Fillmore, is that the meaning of *bachelor* makes reference to other extrinsic entities, values, and concepts, such as religious customs (e.g. certain societies and religious institutions do not allow certain people to marry) and more general cultural knowledge. For example, the figure of Tarzan, though living with a female (*Jane*), would not fit the description of *bachelor*, since the cultural norms of Western society as captured by the `Personal_Relationship` frame do not apply to his living environment (*the jungle*).[2]

These observations led Fillmore to the insight that it is necessary to characterize the meanings of words in terms of experience-based schematizations of events and objects in the speaker's world (see Petruck 1996, Croft and Cruse 2004, Boas 2013c). Thus, the semantic frame evoked by the word *bachelor* is much more complex than that suggested by simple dictionary definitions or checklists of semantic features. The reference to extrinsic knowledge structured in terms of semantic frames can be of various sorts and levels of complexities. For example, they may refer to events, such as `Giving_birth` (to *birth*, to *bear*) or `death` (to *croak*, to *die, death*); relations, such as `Personal_relationship` (*friend, bachelor*); states, such as `Being_located` (*to find, situated*); entities, such as `Gizmo` (*appliance, device, machine*); scales, such as `Temperature` (*hot, freezing*); and person and spatial deixis.[3]

The verb *to avenge* is an example of an event. In order for a speaker of English to be able to interpret a sentence such as *Rick avenged the death of his pet armadillo by killing the coyote*, one must have knowledge about the various events leading up to the point in time when the sentence is uttered. This knowledge is captured by the Revenge frame, which is evoked by the Lexical Unit (LU; a 'word' in one of its senses[4]) *to avenge*, as well as other semantically related LUs such as *to revenge, revengeful*, and *revenger*. The frame definition of a frame is a prose description of a situation involving various participants and other conceptual roles, each of which constitutes a Frame Element (FE), marked in small caps.

> The `Revenge` frame
>
> One person (we call him the OFFENDER) did something to harm another person (what he did we call the INJURY and his victim we call the INJURED_PARTY); reacting to that act, someone (the AVENGER, possibly the same individual as the INJURED_PARTY) acts so as to do harm to the OFFENDER, and what he does we call the PUNISHMENT.

Frames such as the `Revenge` frame capture the rich knowledge that speakers associate with words. The items in small caps are the so-called Frame Elements (FEs), which are situation-specific types of more general

[2] Following standard practice in Frame Semantics, names of frames are given in Courier New font.

[3] Fillmore's use of the term 'frame' is somewhat related to work in artificial intelligence as found in Minsky (1977) and psychology (Schank and Abelson 1977). For an extensive discussion of the use and various meanings of the term 'frame,' see Ziem (2008) and Busse (2012).

[4] A LU can also consist of a multiword expression, such as *give the slip* or *put into words*.

semantic roles such as AGENT, PATIENT, or INSTRUMENT (see section 34.2.2.2 for details on the frame hierarchy allowing for generalizations).[5] The FEs, which are participants in the frame, are also explicitly defined. For example, the AVENGER is the person who enacts revenge (*Rick* in the example above), the OFFENDER is the original offender (not mentioned in the example above), the INJURED_PARTY is the offender's victim (also not mentioned in the example), the INJURY is the result of the offender's act (*the death of his pet armadillo*), and the PUNISHMENT is the avenger's act (*by killing the coyote*). Applying the FE labels to the individual constituents in our example sentences yields the following representation:

(1) [$_{\text{<Avenger>}}$Rick] avenged^{tgt} [$_{\text{<Injury>}}$the death of his pet armadillo] [$_{\text{<Punishment>}}$by killing the coyote]. [$_{\text{<Offender>}}$DNI] [$_{\text{<Injured\_Party>}}$ DNI]

The LU evoking the semantic frame is called the target LU, indicated by the superscripted 'tgt' following *avenged* in (1). Each constituent representing an FE of the frame evoked by the target LU is in square brackets, with the name of the FE in subscript following the opening bracket. One important feature of Frame Semantics is that it is also concerned with documenting the types of FEs that can be omitted under certain circumstances (Fillmore 1986). The phenomenon known as Null Instantiation (NI) covers three different subtypes.

First, it covers Definite Null Instantiation (DNI), which is lexically specific, understood from discourse, and for which knowledge of the missing material is required for determining the referent. In (1) above, both OFFENDER and INJURED_PARTY are characterized as DNI, since their identity can be construed from discourse. Second, Indefinite Null Instantiation (INI) involves lexically specific, intransitive uses of transitive verbs such as *eat, drink, sew*, and *bake*, as well as knowledge about the category of missing material, even if it is not mentioned in the previous discourse or if it is not recoverable from context, as in *John baked again*. Third, Constructional Null Instantiation (CNI) describes situations in which particular grammatical constructions such as the imperative or agentless passive may license the lexical omission. Frame Semantics and FrameNet, as shown below, are interested in documenting null instantiation properties because they are crucially important for our understanding of how the semantics of frames may be realized syntactically.[6] We now turn to a discussion of how the principles of Frame Semantics have been applied in the creation of FrameNet.

[5] Earlier work by Fillmore distinguishes between frames, scenes, and scenarios. However, since the mid-1990s, the term 'frame' has become the main concept around which Frame Semantics and FrameNet have evolved. For a discussion of the similarities and differences between these terms, see Schmidt (2009).

[6] For further references, see Lambrecht and Lemoine (2005), Ruppenhofer and Michaelis (2010) and Lyngfelt (2012).

34.2.2 FrameNet

The FrameNet project, founded in 1997 at the International Computer Science Institute in Berkeley, is primarily concerned with compiling FrameNet (framenet.icsi.berkeley.edu/fndrupal/), a lexicographic database according to the principles of Frame Semantics. Its aim is to provide rich frame semantic knowledge about the core English vocabulary based on manually annotated corpus data, including valence descriptions for each item analyzed (Fillmore, Johnson, and Petruck 2003).[7] FrameNet, which is freely available for academic research, currently contains about 1,200 frame definitions (including definitions of their respective Frame Elements), together with lexical entries for more than 13,100 Lexical Units evoking frames, more than 200,000 annotated corpus examples, and nearly 1,800 frame-to-frame relations illustrating how semantic frames are connected to each other via a hierarchy (as of September 2015). The following sections provide more details about (1) the workflow of the FrameNet project, (2) the structure of frames and lexical entries in the FN database, and (3) the frame hierarchy.

34.2.2.1 FrameNet Workflow

The workflow of the FrameNet project consists of three main stages. At the first stage, the FN staff proposes new semantic frames and LUs that evoke them. This process typically involves the identification of a particular sense of a specific word that represents the prototypical meaning of that word and the frame more generally. An example is the LU *avenge*, discussed above, whose meaning expresses the prototypical meaning of the Revenge frame. FN lexicographers arrive at preliminary frame descriptions by first comparing definitions of prototypical LUs in various dictionaries, and then discussing these definitions and comparing them with their own intuitions. At that point, FN lexicographers also carefully study the contexts in which the relevant LUs appear in electronic corpora such as the British National Corpus and the American National Corpus. This empirical verification helps FN lexicographers with arriving at clearer initial definitions of semantic frames and their FEs. Next, FN lexicographers search for other LUs evoking the same frame including verbs, nouns, and adjectives. The basic criterion for defining the boundaries of a frame is that all LUs should evoke the same type of event and share the same inventory and configurations of FEs (see Atkins, Rundell, and Sato 2003, Petruck et al. 2004, Ruppenhofer et al. 2010, Ruppenhofer, Boas, and Baker 2013). A combination of objective criteria, such as dictionary definitions, entries in thesauruses or in other databases such as WordNet and PropBank, and corpus examples, together with the lexicographer's linguistic intuitions,

[7] FrameNet has also produced frame-semantic annotation of continuous texts to show how semantic frames can contribute to the understanding of full texts. For details, see https://framenet.icsi.berkeley.edu/fndrupal/index.php?q=fulltextIndex.

form the basis for careful discussions about defining the boundaries of frames and identifying the LUs that evoke it. Based on the frame description and the list of LUs evoking the frame, FN staff extracts examples sentences from electronic corpora for each target LU (see Atkins, Rundell, and Sato 2003, Fillmore, Johnson, and Petruck 2003, Boas 2005b).

The second stage of the FN workflow consists of annotating example sentences that FN lexicographers extracted from electronic corpora. To achieve this goal, trained annotators use a software called the FN Desktop to manually annotate about ten to twenty sentences per LU (Ruppenhofer et al. 2010, Fillmore, Johnson, and Petruck 2003). The number of sentences suitable for annotation depends on the frequency of a particular LU in the corpus, as well as on the syntactic complexity of sentences in which a given LU occurs. For example, since FN's main emphasis is on compiling a lexicographic database, annotators typically do not chose to annotate complex sentences involving multiple complex grammatical constructions. As shown in Figure 34.1, the FN desktop software allows annotators to choose between different frames, which are displayed in an alphabetically ordered list on the left. By clicking on the name of a frame, annotators see the list of FEs as well as the list of LUs. Clicking on a specific LU such as *to avenge* pulls up the relevant subcorpora (based on syntactic contexts) available for annotation.

Clicking on one of the subcorpora displays its contents in the upper part of the screen. When none of the sentences in a subcorpus are annotated, only the target LU evoking the frame (here: *to avenge*) is marked in black (as

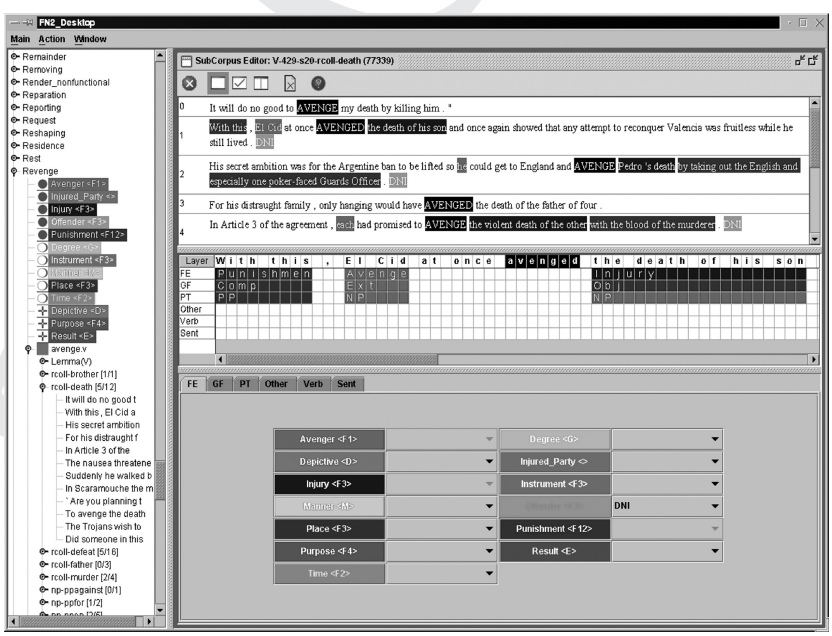


Figure 34.1 Subcorpora of *avenge* for annotation in the FN Desktop

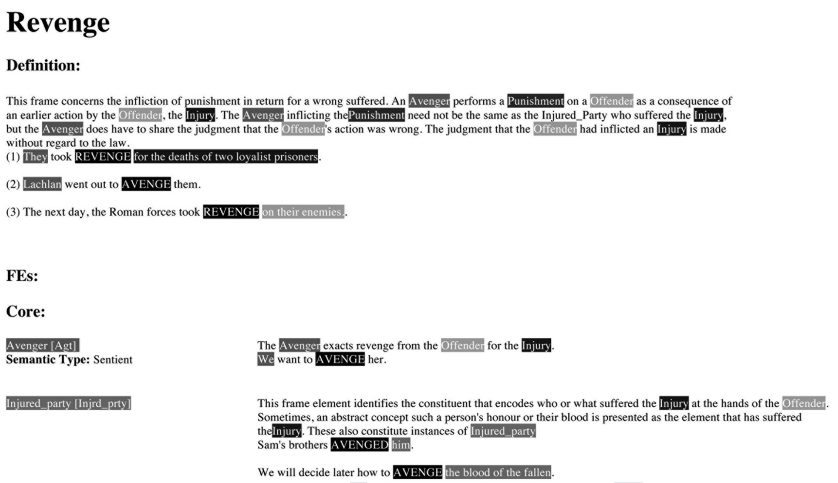
in the top line in Figure 34.1). Clicking on one of the sentences in the top part of the screen leads to it being displayed in the middle part of the screen, with the sentence ready for annotation (here: the sentence *With this, El Cid at once avenged the death of his son. . .*). Annotators then read the sentence and identify, for each relevant constituent, its FE status; they then scroll with the mouse over the constituent to mark it, and then they choose from the list of FE names in the lower part of the screen the proper labels for each FE. Clicking on it marks the constituent as a particular FE. Only the dependents of one frame-evoking target LU are annotated per example sentence. Automated scripts then fill in additional information for each FE, specifically labels for Grammatical Function (GF) and Phrase Type (PT), which can be corrected by the annotator if necessary. As a result, each relevant constituent is annotated with three layers of information. For example, the phrase *With this* at the beginning of the sentence in Figure 34.1 is annotated with the FE label PUNISHMENT, the GF label COMPLEMENT (Comp), and the PT label PP. The constituent *El Cid* is annotated with the FE label AVENGER, the GF label External Argument (Ext), and the PT label NP. Finally, the constituent *the death of his son* is labeled with the FE label INJURY, the GF label Object (Obj), and the PT label NP. The resulting annotation thus consists of three layers combining, for each relevant constituent, information about FE, GF, and PT status. Once annotators have labeled for each LU in a frame ten to twenty example sentences, the annotation phase of the workflow is completed.[8] Based on this information, a set of scripts automatically summarizes the valence of each LU by abstracting over the annotated corpus examples (Ruppenhofer et al. 2010).

The third stage of the FN workflow consists of producing lexical entries for each LU, based on the information contained in the FN database (see Baker, Fillmore, and Cronin 2003). To achieve this goal, automated scripts generate lexical entries that include a brief definition of the LU, the name and definition of the frame it evokes, valence tables summarizing the exhaustive information about every attested combinatorial possibility of FEs and their syntactic realizations (i.e. GF and PT), and annotated example sentences. The following section details the structure of lexical entries from the perspective of a user accessing the FrameNet database online.

34.2.2.2 FrameNet Data

There are different methods of accessing the data in FrameNet. The first method is the download of FN data as a stable data release (see Baker 2012). This method requires registration with FrameNet. The second and perhaps

[8] The description of the FN workflow may sound linear, but it is not. For example, when compiling lists of LUs evoking a semantic frame, the group of FN lexicographers has to take into consideration what types of subcorpora (based on syntactic contexts) will be used for annotation later on. Similarly, when annotators apply the frame descriptions and FE definitions, compiled by the FN lexicographers, to corpus examples, they may discover inconsistencies, which in turn need to be discussed with the FN lexicographers. The result of this exchange may lead to updated frame definitions, the definition of new frames that are closely related to the original frame, and the re-assignment of LUs to other frames.



Revenge

Definition:

This frame concerns the infliction of punishment in return for a wrong suffered. An Avenger performs a Punishment on a Offender as a consequence of an earlier action by the Offender, the Injury. The Avenger inflicting the Punishment need not be the same as the Injured_Party who suffered the Injury, but the Avenger does have to share the judgment that the Offender's action was wrong. The judgment that the Offender had inflicted an Injury is made without regard to the law.
(1) They took REVENGE for the deaths of two loyalist prisoners.

(2) Lachlan went out to AVENGE them.

(3) The next day, the Roman forces took REVENGE on their enemies.

FEs:

Core:

Avenger [Actl]
Semantic Type: Sentient

The Avenger exacts revenge from the Offender for the Injury.
We want to AVENGE her.

Injured_party [Injrd_prty]

This frame element identifies the constituent that encodes who or what suffered the Injury at the hands of the Offender. Sometimes, an abstract concept such a person's honour or their blood is presented as the element that has suffered the Injury. These also constitute instances of Injured_party
Sam's brothers AVENGED him.

We will decide later how to AVENGE the blood of the fallen.

Figure 34.2 Description of Revenge frame

more popular method is the direct online access via FN's website at http://framenet.icsi.berkeley.edu/fndrupal/. This method does not require any registration and offers the user the most updated version of the FN database as well as multiple ways of viewing FN data. The search option on FN's home page is the most prominent way of finding a lexical entry. For example, a search for *to avenge* returns a table including the closest match, in this case the frame Revenge, which is evoked by *avenge*. In the case of polysemous words, this table includes multiple search results, one per LU/semantic frame.

Clicking on the name of the frame leads to the display of the so-called frame report, which contains the frame's description, the definition of FEs, and the list of LUs evoking the frame. As can be seen in Figure 34.2, illustrating the Revenge frame, the frame description consists of a few lines of prose text explaining how the individual FEs, which are color coded, relate to each other in different ways. The frame description is augmented by a few clear examples from the corpus, which are color coded according to the FEs they contain.

The frame description is followed by a list of FE definitions, typically differentiating between core and non-core FEs. Each FE definition is exemplified by a corpus example illustrating the use of the FE in a specific context. Core FEs are those types of FEs that uniquely define a frame, such as the FEs AVENGER, OFFENDER, and INJURED_PARTY in the Revenge frame. Non-core FEs are peripheral FEs used to describe aspects of events more generally, such as TIME, PLACE, and MANNER. In contrast, so-called extra-thematic FEs do not conceptually belong to the frame in which they occur, that is, they situate an event against the backdrop of another state of affairs (Boas 2013b). For example, in *Sue baked the cookies for me*, the PP for me is an extra-thematic RECIPIENT FE, which is not an important part of

a situation in which some edible entity is created (for details, see Fillmore and Baker 2010 and Ruppenhofer et al. 2010).

Following the definitions of Fes, we find specifications about so-called frame-to-frame relations, which specify how a particular frame is related to other frames in the FN hierarchy. In the case of the `Revenge` frame, we learn that it inherits from a more general frame `Rewards_and_Punishments`. The last part of the frame report contains a list of LUs evoking the Revenge frame, together with links to their lexical entry reports and their annotation reports.[9] Clicking on the annotation report link for *avenge* displays all sentences that have been annotated with frame-semantic information (color-coded FEs), and which form the basis for the lexical entry report. Clicking on the lexical entry report link for *avenge* opens up a new web page with more details. Figure 34.3 presents the first part of the lexical entry report of *avenge*.

The first lines at the top of the lexical entry report identify the part of speech as verb and the frame it evokes as the Revenge frame. The relatively short prose definition is followed by a table illustrating how the FEs of the Revenge frame are syntactically realized. The column on the left lists the name of the respective FEs, the middle column displays the total number of annotated example sentences containing that FE found in the annotation report (see below), and the column on the right presents the full range of syntactic realizations for each FE.[10] For example, the FE AVENGER occurs in thirty-three annotated example sentences, and in these sentences it is realized syntactically either as an external noun phrase (NP.Ext) (e.g. *Swegen is also said to have invaded England later to avenge his brother*), as an external possessor phrase (Poss.Ext) (e.g. *Though Satan's motive for avenging against God is not made quite clear. . .*), or it is not overtly realized because it is constructionally null instantiated (CNI) (e.g. *I want Leila avenged*). Clicking on a hyper-linked number will display the annotated example sentence(s) containing that FE in the lower part of the screen. Scrolling down to the second part of the lexical entry report presents the user with a table listing the valence patterns of that LU, as shown in Figure 34.4.

The valence table records all the attested combinations of FEs and their various syntactic realizations as they occur in the annotated corpus sentences. The column on the left lists the total number of annotated example sentences illustrating a particular Frame Element Configuration (FEC). Clicking on a hyperlink will display the corresponding annotated example sentence(s) in the lower part of the screen. The valence table for *avenge* lists a total of six FECs, together with their various syntactic realizations. For

[9] FrameNet also documents multiword expressions such as phrasal verbs (e.g. *pick up, take off, take up*), words with selected prepositional complements (e.g. *depend on, object to, proud of, fondness for*), support constructions (e.g. *take comfort in, put emphasis on, at risk, under arrest*), combinations in which selected prepositional complements are combined with a particle or a noun (e.g. *put up with*, i.e., *tolerate, take comfort in, take under consideration*), and transparent nouns (e.g. *my gem of a wife, in a part of the room, on this part of the shelf*) (see Fillmore 2008).

[10] As a lexicographic database, FrameNet does not provide information about the LU's frequencies.

Lexical Entry

avenge.v

Frame: Revenge

Definition:

FN: inflict harm on somebody in return for an injury or wrong suffered

Frame Elements and Their Syntactic Realizations

The Frame Elements for this word sense are (with realizations):

Frame Element	Number Annotated	Realization(s)
Avenger	(33)	CNI.-- (7) NP.Ext (25) Poss.Ext (1)
Injured_party	(14)	NP.Ext (3) NP.Obj (11)
Injury	(21)	NP.Ext (4) PP[for].Dep (1) PP[of].Dep (1) NP.Obj (14) DNI.-- (1)
Instrument	(1)	PP[in].Dep (1)
Offender	(32)	DNI.-- (25) PP[on].Dep (2) INI.-- (4) PP[against].Dep (1)
Punishment	(32)	INI.-- (23) PP[by].Dep (1) PPing[by].Dep (6) PP[with].Dep (2)
Purpose	(1)	VPto.Dep (1)
Time	(1)	AVP.Dep (1)

Figure 34.3 First part of lexical entry report of *avenge*

example, the first FEC consists of [AVENGER, INJURED_PARTY, INJURY, OFFENDER, PUNISHMENT] while the second FEC consists of [AVENGER, INJURED_PARTY, INSTRUMENT, OFFENDER, PUNISHMENT]. Each FEC lists the range of syntactic realizations: the first FEC has two different syntactic realizations, the second FEC has only one particular way in which the FEs are realized syntactically, and the third FEC [AVENGER, INJURED_PARTY, OFFENDER, PUNISHMENT] has a total of four syntactic realizations. The valence table for avenge contains a total of seventeen different options for the syntactic realization of the Revenge frame's FEs.

Providing such detailed information makes it possible to investigate similarities and differences between LUs evoking the same frame. For example, if one wants to find out how verbal LUs such as *avenge, get back at, get even, retaliate*, and *revenge* realize the Revenge frame's FEs, one can compare the variation of the FE's syntactic realizations. Table 34.1 shows

Valence Patterns:

These frame elements occur in the following syntactic patterns:

Number Annotated	Patterns				
2 TOTAL	Avenger	Injured_party	Injury	Offender	Punishment
(1)	NP Ext	NP Obj	PP[for] Dep	INI --	PPing[by] Dep
(1)	NP Ext	NP Obj	PP[of] Dep	DNI --	PPing[by] Dep
1 TOTAL	Avenger	Injured_party	Instrument	Offender	Punishment
(1)	NP Ext	NP Obj	PP[in] Dep	INI --	INI --
10 TOTAL	Avenger	Injured_party	Offender	Punishment	
(2)	CNI --	NP Ext	DNI --	INI --	
(1)	CNI --	NP Ext	PP[on] Dep	INI --	
(5)	NP Ext	NP Obj	DNI --	INI --	
(1)	NP Ext	NP Obj	DNI --	PPing[by] Dep	
(1)	NP Ext	NP Obj	PP[on] Dep	PPing[by] Dep	
1 TOTAL	Avenger	Injured_party	Time		
(1)	NP Ext	NP Obj	AVP Dep		
18 TOTAL	Avenger	Injury	Offender	Punishment	
(3)	CNI --	NP Ext	DNI --	INI --	
(1)	CNI --	NP Ext	INI --	PP[by] Dep	
(8)	NP Ext	NP Obj	DNI --	INI --	
(2)	NP Ext	NP Obj	DNI --	PP[with] Dep	
(2)	NP Ext	NP Obj	DNI --	PPing[by] Dep	
(1)	NP Ext	NP Obj	INI --	INI --	
(1)	Poss Ext	DNI --	PP[against] Dep	INI --	
1 TOTAL	Avenger	Injury	Offender	Punishment	Purpose
(1)	NP Ext	NP Obj	DNI --	INI --	VPto Dep

Figure 34.4 Second part of lexical entry report of *avenge*

the comparison of the variation in syntactic realization of the five verbal LUs evoking the Revenge frame.

Table 34.1 shows how the verbal LUs evoking the Revenge frame realize its FEs in different ways. The comparison suggests that there are some general syntactic realization patterns that are shared by all LUs; fo example, the AVENGER is realized as the external NP (and it can also be

Table 34.1 Syntactic variability of FEs with verbal LUs evoking the Revenge frame[11]

	Avenger	Depictive	Injured_ Party	Injury	Manner	Instrument	Offender	Punishment	Purpose	Time
NP.Ext	*avenge* *retaliate* *get back* *get even* *revenge*		*avenge*	*avenge*						
Poss.Ext	*avenge*									
CNI	*avenge* *retaliate* *get back* *get even* *revenge*									
DNI				*avenge* *retaliate* *get back* *get even*			*avenge* *retaliate* *get even*	*retaliate*		
INI				*get even*			*avenge* *get even* *revenge*	*avenge* *retaliate* *get back* *get even* *revenge*		

[11] Table 34.1 lists only the syntactic variability of FEs with verbal LUs evoking the Revenge frame. Similar tables comparing the syntactic variability in the realization of FEs in the Revenge frame can be compiled for other parts of speech; for example, the adjectives *retributive, retributory, revengeful, vengeful*, and *vindictive*, as well as for the nouns *avenger, payback, retaliation, retribution, revenge, revenger, sanction*, and *vengeance*.

NP.Obj		*avenge* *revenge*	*avenge*					
PP[for].Dep			*avenge* *retaliate* *get back* *get even*					
PP[of].Dep			*avenge*					
PP[in].Dep				*get back*	*avenge*		*retaliate*	
PP[on].Dep		*retaliate*				*avenge* *retaliate* *revenge*		
PP[against].Dep			*retaliate*			*avenge* *retaliate*		
PP[by].Dep	*revenge*						*avenge*	
PP[with].Dep						*get even*	*avenge* *retaliate*	
PPing[by].Dep							*avenge* *retaliate*	
PPing[for].Dep			*revenge*					
VPto.Dep								*avenge*
AVP.Dep				*retaliate*			*retaliate*	*avenge* *retaliate*
AJP.Dep	*revenge*							

constructionally null instantiated), and the PUNISHMENT can be null instantiated (INI). However, this is where the commonalities between the LUs end. As the data in Table 34.1 show, most syntactic realizations of a particular FE occur with only one, two, or sometimes three verbal LUs. In other words, there is only little overlap between a frame's FEs and how they are realized syntactically with different LUs evoking that frame.[12]

These observations may appear rather tedious at first glance.[13] However, they have important ramifications for investigating linguistic phenomena such as linking between semantics and syntax (cf. Pinker 1989, Rappaport Hovav and Levin 1998, Boas 2008a), profiling of verbal participant roles to account for their syntactic distribution (Goldberg 1995, Nemoto 1998, Boas 2003b/2011a, Croft 2012), and verb classification (Levin 1993, Baker and Ruppenhofer 2002, Croft 2003, Boas 2008b, 2011b, Engelberg et al. 2011, Faulhaber 2011). In other words, the detailed information in the lexical entries of FN offers valuable insights into determining whether semantically related verbs (or adjectives/nouns) exhibit similar syntactic distributions or whether they differ and how. These insights, in turn, have important implications for our understanding of how lexical information is organized and how it interacts with other types of linguistic processes.

The information in valence tables such as those in Figure 34.4 above are also helpful for research in Construction Grammar, specifically in the area of argument structure constructions. Goldberg's (1995) seminal work emphasizes the importance of argument structure constructions for the licensing of particular syntactic phenomena such as ditransitive, caused-motion, resultative, and other related constructions. On this view, lexical entries of verbs may fuse with independently existing meaningful argument structure constructions, which then contribute additional meaning to a verb's lexical entry, thereby licensing the different argument structures commonly found with verbs. However, the fusion of lexical entries with Goldberg's argument structure constructions is sometimes problematic. Various authors such as Boas (2003b, 2005b), Nemoto (2005), Iwata (2008), and Herbst (2011) have pointed out that it is often not possible to easily restrict the fusion of verbs and constructions because of the sparse amount of information contained in Goldberg's lexical entries. The alternative view, known as the lexical-constructional approach, holds that information in lexical entries should be more detailed in order to allow for a more regulated process of fusion between constructions and lexical entries. More recently, various researchers have suggested combining the two approaches, thereby arriving at a network of interrelated constructions spanning from low-level so-called mini-constructions representing

[12] Recall that even though the BNC is a relatively large corpus, it is not exhaustive. This means that FrameNet does not make any claims about complete coverage, but only about the distribution of LUs as they occur in the BNC.

[13] The valence tables of LUs evoking frames with many more LUs, such as the Self_motion frame, exhibit an even greater degree of variability regarding how FECs may be realized syntactically. See Boas (2001, 2008c).

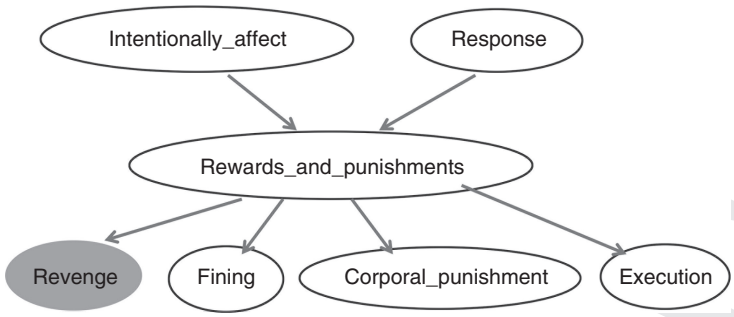


Figure 34.5 Partial FrameGrapher representation of Revenge frame

individual senses of words (comparable with FN-like entries, together with additional information) to higher-level schematic argument structure constructions (see Welke 2009, Boas 2010a, 2011b, Herbst 2014).

Besides the lexical entry reports and annotation reports, there are other ways of accessing FN data. One alternative way of accessing FN data is via the FrameGrapher visualization tool (see https://framenet.icsi.berkeley.edu/fndrupal/FrameGrapher). While some of this information is also available as a part of the lexical entry report, the FrameGrapher allows for a much more intuitive method for exploring how frames and their frame elements are connected to each other in the frame hierarchy. Recall that the status and granularity of FEs in FN are quite different from those of the original semantic roles proposed by Fillmore (1968). Instead of positing a small set of semantic roles ordered in a strict hierarchy, FN currently contains more than 1,200 frame descriptions including definitions of the frame-specific FEs. The number of FEs is growing exponentially as new frames are added to the FN database, and they are systematically related to each other via so-called frame-to-frame relations, such as those representing complex events (SUBFRAME, PRECEDES), 'systematic' relations (CAUSATIVE OF, INCHOATIVE OF), and generalizations (PERSPECTIVE ON, INHERITANCE, USING). For details, see Fillmore and Baker (2010) and Ruppenhofer et al. (2010). The FrameGrapher tool allows users to explore the hierarchy of frames in which some frames are instances of others; some are components of others, etc., thereby allowing for systematic accounts of how the semantics of frames that are instances of each other are realized similarly at the semantic level; see, e.g. Boas (2010b). Another advantage of the FrameGrapher visualization tool is that it allows researchers to identify situation-specific frames and their FEs as instantiations of high-level frames such as `Event`, `Action`, and `Intentionally_act`, together with their more general semantic roles such as AGENT, PATIENT, INSTRUMENT, etc. These insights can be used for research on linking (for details, see Van Valin and Wilkins 1996, Ziem 2008, and Fillmore and Baker 2010); for example, using the FrameGrapher to display the

relationships holding between the Revenge frame and other related frames yields the following graphic representation.

Figure 34.5 shows the Revenge frame inheriting from the Rewards_and_Punishment frame, which in turn inherits from the Intentionally_affect and Response frames. Other frames inheriting information from the Rewards_and_Punishment frame include the Fining, Corporal_punishment, and Execution frames. Note that the display of information in Figure 34.5 is optimized for size and layout, that is, the FrameGrapher only displays two parent generations of the Revenge frame. If interested in learning more about higher-level generations, a user may also display that information. In the case of the Intentionally_affect frame (one of the parent frames of the Revenge frame), this includes the Intentionally_act and Event frames, which can be regarded as higher-order parent frames of the Revenge frame.[14]

Users may also view FN data with the FrameSQL search tool, which allows systematic searches of FN frames for specific combinations of parts of speech, phrase types, and grammatical functions (http://sato.fm.senshu-u.ac.jp/frameSQL/fn2_15/notes/) (Sato 2008). One important feature of the FrameSQL search tool is its ability to also access the databases of FrameNets for other languages, such as Japanese, German, and Spanish. This enables users to compare semantic frames and their syntactic realizations with different LUs across languages, thereby serving as a valuable comparative database for contrastive and cross-linguistic research, as section 34.2.3 shows.

34.2.3 FrameNets for Other Languages

Initial research in the 1990s explored the feasibility of applying frame-semantic insights to the systematic analysis of the lexicons of languages other than English (Heid 1996, Fontenelle 1997). Subsequent research demonstrated in greater detail how semantic frames derived on the basis of English data could be employed for the creation of FrameNets for other languages (Fillmore and Atkins 2000, Boas 2001, 2002, 2005b, Petruck and Boas 2003). The results of this research inspired the creation of FrameNets for other languages, most notably Spanish (Subirats and Petruck 2003, Subirats 2009), Japanese (Ohara et al. 2004, Ohara 2009), German (Burchardt et al. 2009), and Swedish (Borin et al. 2010). While the technical resources and workflows of the non-English FrameNets differ slightly from each other, they all produce FN-style entries similar to the English original discussed above, including detailed information about how the semantics of a given frame are realized syntactically by different LUs evoking that

[14] FN has also conducted full text annotations, in which all frame-evoking LUs in a given sentences were analyzed according to the semantic frames they evoke. See the FrameNet homepage for full text annotations.

frame in different languages.[15] This information allows researchers to systematically conduct contrastive and comparative research on topics in lexical semantics such as polysemy (Fillmore and Atkins 2000, Boas 2005c, Willems 2012), typological differences in profiling properties (Ohara 2009, Petruck 2009), and the interface between the lexicon and syntax (Hasegawa et al. 2010, Bouveret 2012). The multilingual data contained in the FrameNets for various languages is also relevant for cross-linguistic research on argument structure constructions, as shown by Boas (2003a), Leino (2010), and Timyam and Bergen (2010), among others.[16]

34.3 The Constructicon

While the primary focus of the lexicographic work by FrameNet researchers is on the semantic and syntactic properties of lexical items, there has also been considerable interest in exploring ways of creating a so-called *constructicon*, a database of English grammatical constructions, annotating sentences by noting which parts of them are licensed by which specific constructions (Fillmore 2008). This idea is a natural extension of FN's work on the lexicon, because in Construction Grammar (CxG), the sister theory of Frame Semantics, there is no strict separation between the lexicon and syntax. In this view, language consists of a large structured inventory of constructions, pairings of forms and meanings (where frames constitute the semantic side of constructions), which vary in size and complexity. These include, among others, non-lexical constructions such as highly schematic constructions and meaningful argument structure constructions, as well as (partially) idiomatic constructions, complex words, words, and morphemes (Goldberg 2006). Over the past thirty years, construction grammarians have identified and analyzed numerous constructions in an array of languages.[17]

A one-year long pilot study from 2007 to 2008, known as 'Beyond the Core,' permitted investigation of the feasibility of extending FN's analytical and technical apparatus for lexical analysis to investigate and document grammatical constructions. To allow for a systematic analysis of grammatical constructions in corpus examples, FN programmers modified the structure of the FN database and revised the annotation software to allow for the localization and annotation of sentences in the FN corpora in terms of the grammatical rules that licensed the structures

[15] For an overview, see the contributions in Boas (2009).

[16] For an overview, see the contributions in Boas (2010a). There are also a number of domain-specific FrameNets, such as one for soccer language (Schmidt 2009), biomedical language (Dolbey 2009), and legal language (Bertoldi and de Oliveira Chishman 2011). More recently, an effort has been under way to create a FrameNet-like resource for teaching German as a foreign language at colleges in the United States; see http://coerll.utexas.edu/frames/, Boas and Dux (2013), and Boas, Dux, and Ziem (in press).

[17] For an overview, see the contributions in Hoffmann and Trousdale (2013).

found in them. The modified database and annotation software enabled FN researchers to identify, analyze, and annotate constructions in a very similar way as LUs. This is because LUs, too, are (lexical) constructions whose form pole is one or more word-forms, and whose meaning pole is usually represented as a specific semantic frame. Similarly, non-lexical constructions such as the subject-predicate construction or the genitive construction are also form-meaning pairings in which there is a clear form side of the construction. They differ, however, from lexical or partially idiomatic constructions in that the meaning evoked is either extremely vague or underspecified (cf. Baker 2012, Boas 2011c).

Consider an example such as the construct *Kim doesn't like citrus fruit, let alone grapefruit*. A construct is a linguistic form that instantiates one or more constructions. In this example, the construct instantiates the `Let-alone` construction,[18] in which the phrase *let alone* functions as a conjunction with very specific semantic-pragmatic constraints on the pieces that it joins (Fillmore, Kay, and O'Connor 1988). The construct also instantiates other constructions, such as the non-lexical *Subject-predicate* and *Negation* constructions and the individual words (except *let alone*), which are lexical constructions (i.e. LUs evoking a particular semantic frame). Finding and annotating constructions follows roughly the same steps as the lexicographic workflow in FN, that is, just like lexicographers first chose a frame to analyze, construction grammarians first chose a construction and then search for corpus data that enables them to arrive at an adequate description.

The first step in this process often builds on existing research in CxG, which over the past thirty years has already compiled a rich description and analysis of grammatical constructions. This step involves the formulation of a prose description of the construction, together with a definition of construct elements (CEs), parallel to that of frames and their corresponding FEs. Then, construction grammarians conduct corpus searches to extract relevant example sentences for annotation, which are then annotated with the revised FN Desktop software also used for lexical annotation. The annotation of constructions in corpus examples involves a procedure very similar to that of LUs discussed in section 34.2.2.1 above. Recall that in lexical annotation, the frame-evoking LU is already identified in a sentence. In construction annotation, annotators may find a counterpart in the so-called construction-evoking element (CEE), which is specific lexical material central for evoking the construction, such as the phrase *let alone*. Then, annotators identify and use the FN desktop software to mark CEs such as, in the case of the `Let-alone` construction, FIRST_CONJUNCT (*citrus fruit*) and SECOND_CONJUNCT (*grapefruit*), which are constituent parts of a construction, similar to FEs in lexical annotation. In some cases, however, there may not be any CEE, as in abstract constructions such as

[18] Following Fillmore, Goldman, and Rhomieux (2012), names of constructions are represented in italicized Courier New font.

Table 34.2 Lexical and constructional description and annotation compared (Fillmore 2008: 9)

Lexical FrameNet	Construction
Frame descriptions describe the frames and their components, set up FE names for annotation, and specify frame-to-frame relations; lexical entries are linked to frames, valence descriptions show combinatory possibilities, entries link valence patterns to sets of annotated sentences.	Constructicon entries describe the constructions and their components, set up construction elements (CEs, the syntactic elements that make up a construct), explain the semantic contribution of the construction, specify construction-to-construction relations, and link construction descriptions with annotated sentences that exhibit their type.
The FEs are given names according to their role in the frame, and provide labels for the phrases in the annotations that give information about the FE.	The CEs are named according to their function in the constructs, they provide the labels on words and phrases in annotated sentences.
The syntactic properties – grammatical functions and phrase types – are identified for all constituents that realize frame elements.	Phrase types are identified for constituents that serve as CEs in a construct; for constructions that are headed by lexical units, grammatical function labels will also be relevant.
Example sentences are selected that illustrate the use of the lexical units described.	Example sentences are selected and annotated for the ways they illustrate the use of the construction.
Annotations identify the LU, the FEs, and the GFs and PTs of the segments marked off.	Annotations contain labels for the CEs and identify, for lexically marked constructions, the relevant lexical material.
Valence patterns are identified, and linked to the annotations.	Varieties of construct patterns are identified and linked to the annotations.
Frame-to-frame relationships are documented and displayed in a separate resource.	Construction-to-construction relationships are identified and (will eventually be) displayed

Subject_Predicate, *Gapping*, and *Right_Node_Raising*, which have no overt lexical material signaling the presence of a construction. In such cases, annotators only employ the CE labels to identify the different parts of the construction. Besides the identification of CEs, annotations on different layers may also include information about grammatical functions and phrase types, parallel to FN's lexical annotation. These added annotation layers are intended to capture possible variations in the realization of a construction.[19] Table 34.2 compares the similarities between lexical and constructional description in the FN lexicon and the FN constructicon.

After the annotation process is complete, the construction descriptions, together with their annotated example sentences, are stored in the Constructicon, an extension of the original FN database. It currently consists of roughly seventy-five construction entries documenting different

[19] For more details on the formulation and annotation of constructions, see Fillmore (2008) and Fillmore Lee-Goldman, and Rhomieux (2012).

Way_manner
Evokes the Motion frame.
Inherits Way_neutral.
• A verb exceptionally takes ***one's way*** (the CEE) as a direct object, where ***one's*** is a possessive pronoun coindexed with the external argument of the verb. Together, they indicate that some entity moves while performing the action indicated by the manner verb. The manner verb is either transitive or intransitive, and thus labeled either Transitive_manner_verb or Intransitive_manner_verb). Following ***one's way*** is an obligatory frame element indicating some core aspect of motion (Source, Path, Goal, Direction).
• The semantics of this construction is identical (or at least very close to) that of the frame Motion: A Theme moves under its own power from a Source, in a Direction, along a Path, to a Goal, by a particular means. In many cases the path traversed by the Self_mover is also created by them as they go, in a particular manner (i.e., while performing some temporally coextensive action) (as in ***he whistled his way through the plaza***).
• [$_{the}$ She] [$_{t\_man}$ whistled] [$_{cee}$ her way] [$_{Path}$ down the lane] [$_{goal}$ to the silo].
• References:
• Goldberg, Adele E. 1995. Constructions: A Construction Grammar Approach to Argument Structure. Chicago: Chicago University Press.
• Kuno, Susumu and Takami Ken-ichi. 2004. Functional Constraints in Grammar: On the Unergative-Unaccusative Distinction. Amsterdam: John Benjamins Publishing Company.

Figure 34.6 First part of `Way_manner` construction entry

types of constructions according to the kinds of constructs they create. These include frame-bearing constructions, valence-augmenting constructions, constructions without meanings, contextually bound constructs, pumping constructions, exocentric and headless constructions, and clause-defining constructions.[20]

Using FN's FrameSQL search interface, users can search for specific construction entries. Each construction entry consists of a construction description, together with definitions of the CEs, and a list of annotated example sentences together with summary tables highlighting the different ways that a construction's CEs are realized. To illustrate, consider a sentence such as *She elbowed her way into the meeting*, in which the verb *to elbow* appears with a possessive pronoun and the noun *way*. Goldberg (1995) offers a detailed treatment of the so-called *way*-construction in terms of an argument structure construction with its own meaning that is capable of fusing with verbs that can be interpreted as denoting motion.

The first part of the construction entry for the `Way_manner` construction is illustrated in Figure 34.6. Above the construction description we see that this construction evokes the Motion frame, and it inherits from the `Way_neutral` construction. This information is followed by a general prose description, including the semantics of the construction. Beneath the description we find references to publications on the `Way_manner` construction.

Under the construction description we find the definitions of CEE(s) and CEs, as in Figure 34.7. Non-lexical constructions without meaning (or without very little clearly identifiable meaning) such as `Subject_Predicate`, `Gapping`, and `Right_Node_Raising` are not evoked by a CEE. Lexical constructions, (semi-)idiomatic constructions,

[20] Like the frame hierarchy, constructions are also hierarchically organized, according to constructional inheritance and CE inheritance. For details, see Lee-Goldman and Petruck (in prep.).

• **CEE**(cee): The construction-evoking element is the noun phrase ***one's way***, where ***one's*** is coindexed to the Theme.
ex.: She whistled [$_{cee}$ her way] down the lane to the silo. TRANSLATIONS
• **Direction**(dir): The direction that the Theme heads in during the motion.
ex.: She whistled her way down the lane [$_{dir}$ towards the silo]. TRANSLATIONS
• **Goal**(goa): Goal is used for any expression which tells where the Theme ends up as a result of the motion.
ex.: She whistled her way down the lane [$_{goa}$ to the silo]. TRANSLATIONS
• **Intransitive_manner_verb**(i_man): The Intransitive_manner_verb takes the CEE as its object, and indicates the action performed by the Theme while it moves.
ex.: She [$_{i\_man}$ whistled] her way down the lane to the silo. TRANSLATIONS
• **Manner**(man): Any expression which describes a property of motion which is not directly related to the trajectory or rate of motion expresses the frame element Manner. Descriptions of steadiness, grace, means of motion, and other things count as Manner expressions.
ex.: She [$_{man}$ gracefully] whistled her way down the lane to the silo. TRANSLATIONS
• **Means**(mea): An action which enables the Theme to move.
ex.: She laughed her way home [$_{mea}$ by not thinking about all the horrible things that had happened]. TRANSLATIONS
• **Modifier**(mod): The ***way*** in the CEE may be modified by an adjective. It often depicts a state of the Theme related to or resulting from their motion, but in some cases it modifies the path taken, motion event itself, or (rarely) a trait of the Theme unrelated to the fact that it is in motion. The Modifier is always indicated on the second layer.
ex.: She whistled her [$_{mod}$ cheerful] way down the lane to the silo. TRANSLATIONS
• **Path**(pat): The space traversed by the Theme between the Source and Goal.
ex.: She whistled her way [$_{pat}$ down the lane] to the silo. TRANSLATIONS
• **Source**(sou): Source is used for any expression which implies a definite starting-point of motion. In prepositional phrases, the prepositional object expresses the starting point of motion. With particles, the starting point of motion is understood from context.

Figure 34.7 Second part of `Way_manner` construction entry (partial)

04	Theme	Intransitive_manner_verb	CEE	Direction	
01	NP.Ext	VPbrst._	NP._	AVP.Dep	
01	NP.Ext	VPbrst._	NP._	PP.Dep	
02	NP.Ext	VPing._	NP._	PP.Dep	
01	Theme	Intransitive_manner_verb	CEE	Direction	Path
01	NP.Ext	VPfin._	NP._	AVP.Dep	PP.Dep
07	Theme	Intransitive_manner_verb	CEE	Path	
01	NP.Ext	VPbrst._	NP._	PP.Dep	
03	NP.Ext	VPfin._	NP._	PP.Dep	
03	NP.Ext	VPing._	NP._	PP.Dep	
01	Theme	Intransitive_manner_verb	CEE	Source	
01	NP.Ext	VPfin._	NP._	PP.Dep	
05	Theme	Intransitive_manner_verb	CEE	Goal	
01	NP.Ext	VPbrst._	NP._	PP.Dep	
03	NP.Ext	VPfin._	NP._	PP.Dep	
01	NP.Ext	VPing._	NP._	PP.Dep	
01	Theme	Intransitive_manner_verb	CEE	Goal	Goal
01	NP.Ext	VPfin._	NP._	AVP.Dep	PP.Dep
01	Theme	Intransitive_manner_verb	CEE	Manner	Path

Figure 34.8 Third part of `Way_manner` construction entry: partial summary

argument structure constructions, and other meaningful constructions will list a specific CEE. In the case of the `Way_manner` construction, this is the noun phrase *one's way*, where *one's* is coindexed to the Theme. One special feature of the `Way_manner` construction is the fact that its CEs are directly linked to the FEs of the `Motion` frame.

The third part of a construction entry provides a summary of how the construction's CEs are realized syntactically. This summary is based on the annotated example sentences that accompany each construction entry.[21] While the types and granularity of information displayed differs from construction to construction, they are still parallel to the valence tables found in the FN lexical entries (see Figure 34.3 above). In the case of the *Way_manner* construction, Figure 34.8 shows that the THEME is always realized as an external NP, and that the INTRANSITIVE_MANNER_VERB appears in different forms such as finite (VPfin) and the progressive form (VPing). The CEE is always a NP, while the Direction is realized as a dependent ADVP or PP.

34.4 Using FrameNet and the Constructicon for Research in Cognitive Linguistics

The wealth of lexical data contained in FrameNet has served as the basis for a broad spectrum of research in cognitive linguistics. One major area is metaphors, which have been at the center of Conceptual Metaphor Theory since Lakoff and Johnson (1980a). Understanding the internal meaning of metaphors is quite difficult since Conceptual Metaphor Theory does not provide tools for systematically defining metaphoric concepts and their components. More recently, Croft (2009a), Sullivan (2013a), and Gemmell (2015) developed alternative proposals by employing frame-semantic data and criteria to arrive at more systematic analyses of metaphors (see also Sullivan this volume Ch. 24). FrameNet data have also been instrumental in the design and operations of a large-scale research project called MetaNet, which is concerned with creating a computational system capable of understanding metaphors in a variety of languages.[22] By using FrameNet data, the MetaNet project is capable of extracting linguistic manifestations of metaphor from texts and understand them automatically (see David this volume Ch. 35).[23]

As discussed in section 34.2.2.2 above, FrameNet data have also been used in other research relevant to cognitive linguistics, such as verb classification, profiling of verbal participant roles, and the licensing of argument structure constructions. The recurring theme in most research on these topics is the significance of access to detailed lexical information about a word's semantic and syntactic properties. Time and again, researchers relying on frame-semantic information in FrameNet have found that previous accounts of these linguistic phenomena were

[21] Because of space limitations, the annotated example sentences contained in the construction entry have been omitted here.

[22] See www.icsi-berkeley.com/icsi/projects/ai/metanet.

[23] For a novel way of applying semantic frames to the study of oral poetics, see Boas (in press).

inadequate because they were too coarse-grained, missing important frame-semantic details relevant for a systematic account.

On a more general level, the data contained in FrameNet (as well as FrameNets in other languages) can be regarded as a multipurpose repository of detailed frame-semantic information for research in Construction Grammar. Recall that constructions are combinations of form and meaning, and that the meaning pole of constructions can be represented by semantic frames and the LUs evoking them. The systematic integration of semantic frames into the analysis of grammatical constructions is first demonstrated by Fillmore (1988: 43), who shows that "The semantic interpretation of a sentence will be accomplished by unifying ... semantic information from the semantic frames activated by the predicator with those introduced by the obligatory and optional companions (the complements and adjuncts) of the predicators." In subsequent constructional research such as Fillmore and Kay (1993), Kay and Fillmore (1999), Michaelis and Ruppenhofer (2001), Boas (2003a), Iwata (2008), Croft (2009a), Hasegawa et al. (2010), frame-semantic information of the type contained in FrameNet plays a crucial role in the representation and licensing of a variety of constructions.

Frame Semantics has also played an important role for Translation Studies, as a means of analysis as well as a method for finding correct translations (Vannerem and Snell-Hornby 1986, Kussmaul 2010). In contrast to other theories of meaning, which are more logic- and truth-oriented, Frame Semantics explicitly includes cultural background knowledge into its considerations. Furthermore, the notion of perspectivization is significant in Frame Semantics, a notion also crucial to translation which often involves shifts in perspective. As Ellsworth et al. (2006) note, many of the semantic translation shifts they find in the analysis of translations of the *Hound of the Baskervilles* (first published in 1902), include shifts in perspective. Interestingly, at least some of the mismatching frames instantiated in the original and the translation can be linked to each other by means of frame-to-frame relations, indicating at least semantic similarity, if not an exact match between original and translation. Also, the authors add that despite these shifts in perspective, readers will be able to reconstruct a similar overall scene in different languages. Frame Semantics has also been used to analyze originals and translations with respect to cultural differences; for example, with regard to differences in institutional or interpersonal relations (Rojo 2002).

Construction Grammar has recently also been adopted in Translation Studies. Rojo and Valenzuela's (2003) study of the translation of constructions goes so far as to analyze the effect of construction shifts on the translation process. Measuring reading and production times using keystroke logs and eyetracking, they find that translating a resultative construction from English into a predicative construction in Spanish takes

significantly longer than translating an English predicative construction into a Spanish one.

Another approach aims at combining frame semantic and constructional analysis in order to assess how far different constructional constraints between two languages affect not only form, but also meaning (Čulo 2003). Central to this approach is the function of a construction. The notion of function, though usually on a more abstract text level, is a pervasive one in Translation Studies. A construction such as the direct object in sentence initial position has the (micro-linguistic) function of highlighting an element, or in other words guiding the readers' attention. This function can be reproduced to various degrees in a translation, or, if of minor relevance in the context, can be ignored. As stated above, there is a variety of constructions which can reproduce this focus in English, such as clefting or topicalization. In some cases, though, this leads to syntactic and lexical adaptions which may change the main verb (and thus the central frame) of a sentence. The frame shifts which are induced can, however, be analyzed and described in a similar manner as in Ellsworth et al.'s (2006) above-mentioned analysis. Often, the frames used in original and translation can be related to each other by means of frame-to-frame relations as defined in FrameNet (see Boas 2013c).

More recently, two major efforts have begun to integrate frame-semantic information into more formalized versions of Construction Grammar. While these efforts do not explicitly refer to FrameNet, it is obvious that the types of frame-semantic representations proposed by the various initiatives have in mind the types of information contained in FrameNet. The first is Sign-Based Construction Grammar (SBCG) (Sag 2012, Michaelis 2013), which is inspired by Berkeley Construction Grammar (Fillmore 2013) and Head-Driven Phrase Structure Grammar (Pollard and Sag 1994). Regarding grammar as an inventory of signs, SBCG emphasizes the importance of frame-semantic information by co-indexing names of FEs from the meaning part of a construction with information about the construction's argument structure.[24]

The second constructional approach integrating frame-semantic information is Embodied Construction Grammar (ECG) (Bergen and Chang 2013), which has a much broader scope than SBCG. ECG is interested in determining the cognitive and neural mechanisms involved in the usage of human language. By incorporating constructions into models of language use (as opposed to languages as mere descriptive objects), ECG aims to validate the status of constructions through observations of behavior in natural and experimental settings, including the computational implementation of the ECG formalism that allows it to be predictive of language use. Part of the formalism involves the architecture of constructions, in

[24] For specific accounts integrating frame-semantic information into SBCG, see Hasegawa et al. (2010), Fillmore, Lee-Goldman, and Rhomieux (2012), Kay and Sag (2012), and Sag (2012).

which the meaning block (using frame-type semantic roles) is bound together with the form block, thereby allowing for the possibility of binding different schemas to each other (see, e.g., Bergen and Chang 2005, Chang 2008).[25]

The FrameNet Constructicon also represents a significant resource for research in cognitive linguistics. It presents, for the first time, a corpus-based inventory of different types of constructions whose descriptions are based on one of the basic principles of CxG, namely the idea that a difference in form signals a difference in meaning. This principle has been crucial for the identification and description of individual constructions currently contained in the Constructicon. While the current inventory of roughly seventy-five constructions in the Constructicon is only a small number, it nevertheless confirms that the methodology underlying the creation of the Constructicon is systematic and yields clearly identifiable results that can be systematically organized in a hierarchy of constructions (similar to the hierarchy of frames). Using the same methodology from the one-year-long pilot project on the Constructicon, it should in principle be possible to identify and describe most, if not all, remaining constructions of English.[26] What is more, the Constructicon provides researchers, for the first time, with a broad array of corpus data illustrating the distribution and variability of constructions. This is a major departure from traditional research in cognitive linguistics during the twentieth century, which typically relied on only very few examples to arrive at hypotheses.

[25] For a different approach that heavily relies on formalisms from traditional computational linguistics, see Steels (2013) on Fluid Construction Grammar (see also www.fcg-net.org). For differences between Fluid Construction Grammar and Sign-Based Construction Grammar, see Van Trijp (2013).

[26] For a similar project focusing on the compilation of constructions in Swedish, see Forsberg et al. (2014). For proposals regarding the systematic creation of a Constructicon for German, see Boas (2014).