# FrameNet: Theory and Practice

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# Preface

FrameNet is a lexicographic project housed and administered at the International Computer Science Institute (http://www.icsi.berkeley.edu), in Berkeley, California. We are grateful to the National Science Foundation for funding the work of the project through two grants, IRI #9618838 "Tools for Lexicon Building" March 1997–February 2000, and ITR/HCI #0086132 "FrameNet++: An On-Line Lexical Semantic Resource and its Application to Speech and Language Technology" September 2000–August 2003. (We refer to these two three-year stages in the life of the project as FrameNet I and FrameNet II.) A one-year extension to cover the period August 2003 to August 2004 has been made possible by financial support from the Defense Advanced Research Projects Agency added to two subcontracts with the National Science Foundation.

We gratefully acknowledge the support of Oxford University Press, which, through Timothy Benbow, made it possible for us to use the British National Corpus as the evidential basis for our inquiry into the behavior of English words. Also, through Robert Scriven, OUP gave us permission to select definitions from the Concise English Dictionary to serve as as parts of the FrameNet lexical entries. We are grateful to Bolt Beranek and Newman Corporation for allowing us to use their Identifinder software, which provides high quality named entity recognition as part of our subcorporation process.

We are indebted to the Institut für Maschinelle Sprachverarbeitung of the University of Stuttgart, through the kindness of Ulrich Heid and Oliver Christ, for the IMS Corpus Workbench software, which has made it easy for us to extract, explore, and sort example lines and sentences from the BNC.

Jerome Feldman was Director of ICSI during most of the FrameNet I period, and is currently head of the Artificial Intelligence group at the Institute; Nelson Morgan has been ICSI Director during the FrameNet II period. Their generosity, along with the efficiency of the technical and administrative staff of this Institute, have made ICSI a welcoming environment for our activities. The Institute's Visitors Program has allowed us, further, to profit from visits between a few months and two years on the part of a number of international researchers—from Spain, Germany, Finland, and Singapore—who participated in the work of the project at various levels, in some cases initiating related efforts elsewhere.

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# Contents

# Typographic Conventions

We use the following typographic conventions in this text.

- The first mention of a technical term appears in **bold face**:

  A **semantic frame** is a script-like structure.

- Data not set off from the text appear in *italics*:

  Note that *the children take naps* is not treated as a clause.

- Names of Frames begin with a capital letter.

  The Communication frame is used by numerous other frames.

- Names of Frame Elements are in small caps:

  A Speaker communicates a Message to an Addressee in some Medium.

- In example sentences set off from the text, target words are in **bold face**:

  Bob **told** a story.

- Constituents which represent frame elements are in square brackets:

  [Bob] **told** [a story].

  This shows that *Bob* and *a story* are elements in the frame evoked by the target word *told*.

# Chapter 1

# Introduction to the Project

The Berkeley FrameNet project is creating an on-line lexical resource for English, based on **frame semantics** and supported by corpus evidence. The aim is to document the range of semantic and syntactic combinatory possibilities (valences) of each word in each of its senses, through manual annotation of example sentences and automatic capture and organization of the annotation results. The FrameNet database is in a platform-independent format, and can be displayed and queried via the web and other interfaces.

A 'starter lexicon' became available to the public in May, 2001, and contained approximately 2000 items – verbs, nouns, and adjectives – representative of diverse areas of the vocabulary. The analysis was supported by about 40,000 annotated sentences. At the time of the Fall, 2002 release, the database included approximately 6,000 lexical items, for which there are about 130,000 annotated sentences. The present data release includes an additional 1500 newly created lexical units. In the year since the previous release, we reanalyzed many frames, necessitating the creation and description of new frames, as opposed to annotating new sentences. This process was facilitated by the new in-house developed software.

A **lexical unit** is a pairing of a word with a meaning. Typically, each sense of a polysemous word belongs to a different **semantic frame**, a script-like structure of inferences that characterize a type of situation, object, or event. In the case of **predicates** or **governors**, each annotation accepts one word in the sentence as its **target** and provides labels for those words or phrases in the sentence which fill in information about a given instance of the frame. These phrases are identified with what we call **frame elements (FEs)** – participants and props in the frame whose linguistic expressions are syntactically connected to the target word. A frame semantic description of a predicating word, derived from such annotations, identifies the frames which underlie a given meaning and specifies the ways in which FEs, and constellations of FEs, are realized in structures headed by the word. In the case of **dependents**, most typically nouns, the annotations serve to identify the most common predicates that govern phrases headed by them, and thus to illustrate the ways in which these targets

function as elements within frames evoked by those predicates.

Formally, these are provided as constellations of triples that make up the frame element realization for each annotated sentence, each triple consisting of a frame element (say, PATIENT), a **grammatical function** (say, Object) and a **phrase type** (say, NP). We think of these as three layers of annotation on a tagged constituent, and our annotation software displays them as such. **Valence descriptions** of predicating words are generalizations over such structures.

The annotated sentences are the building blocks of the database: marked up in XML, they form the data from which the lexical entry descriptions are derived. This format supports searching by lexical unit, frame, frame element, and combinations of these.

The FrameNet database serves both as a dictionary and a thesaurus. The dictionary features include definitions (from the Concise Oxford Dictionary, 10th Edition, courtesy of Oxford University Press, or a definition written by a FrameNet staff member), tables showing how frame elements are syntactically expressed in sentences containing each word, annotated examples from the corpus, and an alphabetical index. Like a thesaurus, words are linked to the semantic frames in which they participate, and hence to the other words which evoke those frames; and frames in turn are related to other frames.

The main FrameNet corpus is the 100-million-word British National Corpus (BNC), though several current subprojects are using U.S. newswire texts made available through the Linguistic Data Consortium. The semantic annotation is carried out using software (called "Annotate") developed in-house. The syntactic annotation, which adds grammatical function and phrase type to each annotated phrase, is handled by an in-house tagging program.

The project's deliverables will consist of the FrameNet database itself:

- lexical entries for individual word senses
- descriptions of frames and frame elements, and
- annotated subcorpora

The documentation for the project is distributed in two parts. One is the document you're reading now. It contains discussion and description of frame semantic theory and practice. The second document contains the frame and frame element descriptions contained in our database. Both documents can be downloaded from our web-site:

`http://framenet.icsi.berkeley.edu/~framenet/`

Editing, annotating, and viewing software has been combined into a single software suite which has been released to other researchers. The adaptability of the FrameNet software to a different language has been demonstrated in the Spanish FrameNet project headed by Carlos Subirats. Researchers interested in obtaining tools for doing similar annotation work should contact the FrameNet Project directly.

# Chapter 2

# FrameNet Annotation

## 2.1 Introduction

This chapter describes what we annotate and how we carry out our annotation task.

First, let us briefly consider the Revenge frame, which will serve as our example frame throughout this chapter. The definition of this frame is as follows:

> An AVENGER performs some PUNISHMENT on an OFFENDER as a response to an earlier action, the INJURY, that was inflicted on an INJURED_PARTY. The AVENGER need not be identical to the INJURED_PARTY but needs to consider the prior action of the OFFENDER a wrong. Importantly, the punishment of the OFFENDER by the AVENGER is seen as justified by individual or group opinion rather than by law.

Thus, the frame elements in the Revenge frame are AVENGER, PUNISHMENT, OFFENDER, INJURY, and INJURED_PARTY.

Lexical units in this frame include *avenge.v, avenger.n, get even.v, retaliate.v, retaliation.n, retribution.n, retributive.a, retributory.a, revenge.v, revenge.n, revengeful.a, revenger.n, vengeance.n, vengeful.a*, and *vindictive.a*. Some example sentences with the lexical unit *avenge* are given here.

> [His brothers AVENGER] **avenged** [him INJURED_PARTY].
>
> With this, [El Cid AGENT] at once **avenged** [the death of his son INJURY].
>
> [Hook AVENGER] tries to **avenge** [himself INJURED_PARTY] [on Peter Pan OFFENDER] [by becoming a second and better father PUNISHMENT].

The general principles that guide our annotation are as follows.

- FrameNet annotation is always done relative to one particular linguistic unit, the target, which is most often a single word but can also be a multiword expression such as a phrasal verb (e.g., *give in*) or an idiom (e.g., *take into account*).

- We annotate whole constituents rather than just the head words of the target's syntactic dependents. For instance, in the third of the introductory examples above, the preposition *on* is included in the constituent expressing the OFFENDER frame element.

- Each dependent is annotated for Frame Element identity, Phrase Type, and Grammatical Function relative to the target LU.

- We annotate single sentences rather than running text.

- Sentences are preselected because they contain a predetermined target LU.

- The sentences used in describing a single LU are annotated only in respect to that LU.

- We intend the set of sentences annotated for a given LU to represent the full range of combinatorial possibilities for that LU.

- The FrameNet database does not offer information about frequency of occurrence.

Against the backdrop of these general principles, we produce annotation of two different types, reflecting the two different kinds of target words we have:

- annotation relative to a **frame bearing** syntactic governor, either a predicate, modifier, or a referring expression and

- annotation relative to a **slot filler**, that is, relative to a referring expression that is a frame element of a frame determined not by itself but by a governor

Both kinds of annotation will be discussed. Since the annotation relative to syntactic governors is our main task, we will discuss it first.

## 2.2 Annotation with verbs as targets

Frames can be evoked by words in any of the major lexical categories: noun, verb, adjective or preposition. We will begin our discussion with verbs.

### 2.2.1 Easy cases

Annotation is easiest when all and only the **core** frame elements (the conceptually necessary participants of the frame that a syntactic governor evokes) find syntactic expression in the sentence as separate immediate syntactic dependents of the governor. Under such circumstances, we simply annotate the syntactic dependents for the three kinds of information: Frame Element role, Grammatical Function, and Phrase Type.

The different kinds of information are recorded on separate annotation **layers**. The separation of layers makes it possible to represent many complex situations, such as when the constituent that realizes one frame element is contained within the constituent that realizes another, or when the semantic and syntactic constituency don't match. Usually, however, they do agree, so that most tagged constituents consists of triples, with coterminous tags on three layers, and they are displayed as such in the FrameNet Desktop. Figure 1 is a screen shot of the annotation software in which an example sentence has been annotated. Abbreviations for the names of the layers appear in the left-most column of the bottom frame: FE (Frame Element); **GF** (Grammatical Function); and **PT** (Phrase Type).

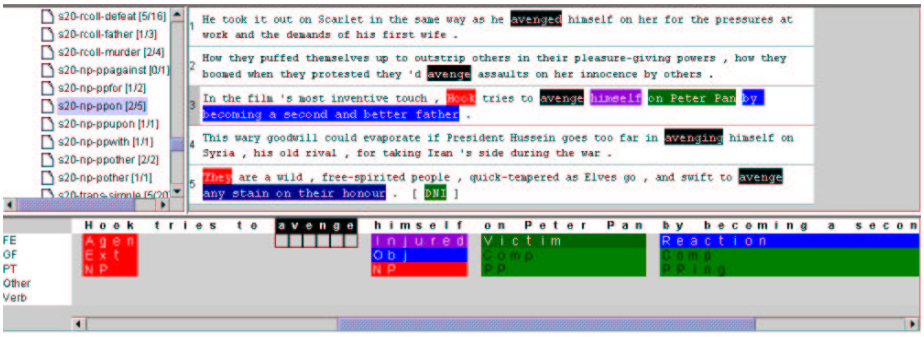


Figure 1 - Annotation: Sentence with target LU *avenge*.v

The annotators actually only need to apply a Frame Element label; Grammatical Function and Phrase Type are derived algorithmically based on patterns of part-of-speech labels but may require manual correction.

In addition to core frame elements, we also provide annotation for some **non-core** frame elements expressed in the sentences that we select for annotation. Non-core frame elements are conceptually not necessary in the sense that they do not uniquely characterize the frame. Thus, for most frames standing for events or processes, TIME and PLACE frame elements are not core, and therefore may not always be annotated. (For a more complete discussion of core vs. non-core, see Section 7.1.1). Similarly, actions often have a PURPOSE that the AGENT intends to accomplish by performing the action indicated by the target word.

However, having a purpose doesn't usually distinguish types of actions and so PURPOSE is often a non-core frame element, as in the following example:

> They **wake** you up [to give you a sleeping pill PURPOSE].

Grammatically, we notice that non-core elements cannot be nuclear arguments (subject or object) of target verbs, and that they frequently are adverbs or prepositional phrases.

Unfortunately, not all sentences that we encounter are as straightforward to annotate as the ones we have seen so far. We will now discuss how we deal with various challenging cases.

### 2.2.2 Missing frame elements

Sometimes FEs that are conceptually salient do not show up as lexical or phrasal material in the sentence chosen for annotation. Nevertheless, we indicate their absence since it provides lexicographically relevant information regarding **omissibility conditions**. The FE that has been tagged indicates which semantic role the missing element would fill, if it were present.

Not all cases of frame element omission are alike. We recognize three different cases, one that is not lexically specific and two that are. We will now discuss the three types of omission.

**Constructional Null Instantiation (CNI):** Constructionally omitted constituents (also called *structurally* omitted) have their omission licensed by a grammatical construction in which the target word appears and are therefore more or less independent of the LU. Cases of CNI include: the omitted subject of imperative sentences, the omitted agent of passive sentences, the omitted subjects of independent gerunds and infinitives (PRO), and so on. In each of the following two examples, the FE AVENGER is tagged with the symbol CNI.

> Family feuds last for generations, and [slurs on honor INJURY] are **avenged** [by murder PUNISHMENT] . [CNI AVENGER]
>
> **Get even** [with her OFFENDER] [for this INJURY] [CNI AVENGER]

In addition, we use CNI for missing objects in instructional imperatives such as exemplified below, even though in this case the omission is not dependent on a particular construction, but rather on a genre.

> **Cook** on low heat until done. [CNI FOOD]
>
> **Tie** together loosely. [CNI ITEMS]

**Definite Null Instantiation (DNI):** We now come to the first lexically specific type of null instantiation. Cases of definite null (also called *anaphoric*) instantiation are those in which the missing element must be something that is already understood in the linguistic or discourse context. In the following

example, the OFFENDER is not expressed overtly in the syntax, but its referent has to be known in the context.

> [The monkey AVENGER] **avenged** [himself INJURED_PARTY] [by growing to the size of a giant and setting fire to the city PUNISHMENT]. [OFFENDER DNI]

**Indefinite Null Instantiation (INI):** The indefinite cases (sometimes also referred to as *existential*) are illustrated by the missing objects of verbs like *eat*, *sew*, *bake*, *drink*, etc., that is, cases in which these ordinarily transitive verbs can be spoken of as used intransitively. (e.g. *Molly rarely eats alone*; *Granny begins baking about a month before Christmas*; *Jo even drinks heavily on weeknights.*) As is well known, there are often special interpretations of the existentially understood missing objects: for example, with *eat* the missing entity is likely to be a meal, with *bake* it is likely to be flour-based foods, with *drink* it is likely to be alcoholic beverages, etc. However, the essential difference between indefinite/existential and definite/anaphoric omissions is that with existential cases the nature (or at least the semantic type) of the missing element can be understood given conventions of interpretation, but there is no need to retrieve or construct a specific discourse referent.

For example, in the Revenge frame, all lexical units happen to allow the frame element PUNISHMENT to be omitted under indefinite null instantiation.

> He took it out on Scarlet in the same way as [he AVENGER] **avenged** [himself INJURED_PARTY] [on her OFFENDER] [for the pressures at work and the demands of his first wife INJURY]] . [INI PUNISHMENT]

Note that usually verbs in a frame differ in this respect. For instance, while *eat* allows its object to be omitted, *devour* does not, even though they are both in the Ingestion frame.

Figure 2 shows the FrameNet Desktop opened for the annotation of a case of definite null instantiation. Notice the tab to the right of the frame element OFFENDER in the picture, which shows that the FE was omitted under definite null instantiation. In addition, an appropriately colored DNI tag appears at the end of the sentence in the corpus viewing section of the FNDesktop.

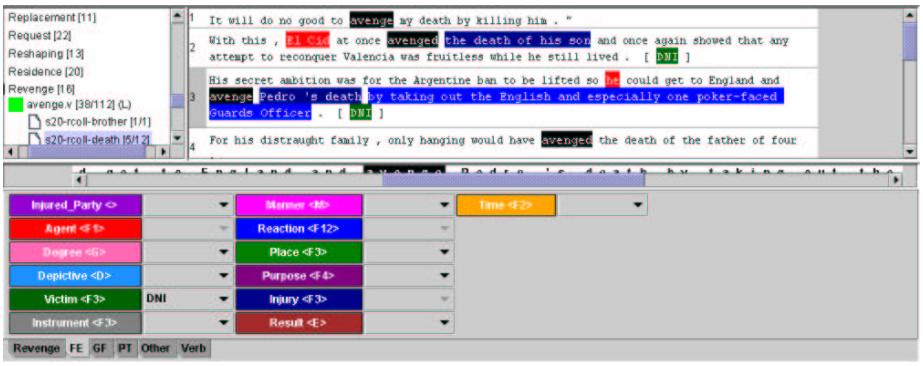


Figure 2 - Annotating a Null Instantiated Frame Element

### 2.2.3 Expletives

Some syntactic constructions require the presence of non-referential material in an argument position even though the non-referential material has no semantic relationship to the predicate. In a subset of cases this happens while a semantic argument is dislocated to a non-canonical position. The non-referential items appearing in such constructions are called expletives. *It* and *there* are the two kinds of non-referential NPs in English. They are never frame elements and so are not not given GF and PT tags. We do, however, record their presence with the **Null** tag on the Other Layer. Some typical examples of expletives are given in the following examples.

**Subject extraposition**

[It NULL] is **clear** that we won't finish on time.

**Object extraposition**

I **hate** [it NULL] when you do that.

**Existential construction**

[There NULL] are more cookies in the jar.

**Subject requirement of zero-place predicates**

[It NULL]'s **raining**.

### 2.2.4 Frame element conflation

In some cases, information about two frame elements is expressed in a single constituent, a situation we call **conflation**. For instance, the concept of ousting somebody from office requires an understanding of the incumbent of the office

and the identity of the office, and these both can be represented separately in a sentence like *We ousted Jones as mayor*. But in a sentence like *We ousted the mayor*, the direct object stands for both the office and the incumbent.

We also find examples of frame element conflation in the Revenge frame. In particular, the INJURED_PARTY may be contained as a possessive in the phrase that realizes the INJURY frame element as seen in the following example:

> [He AVENGER] **avenged** [Pedro 's death INJURY] [by taking out the poker-faced Guards Officer PUNISHMENT].

In this example, the possessive *Pedro's* realizes the frame element INJURED_PARTY, the person who suffered the INJURY. In such cases, the annotation tool allows for the creation of an additional FE layer, enabling the secondary annotation of (parts of) constituents in the same frame, as shown in Figure 3.


Figure 3 - Secondary FE Annotation

Note that there is never a phrase type or grammatical function indicated for the frame elements on the secondary FE layer.

Even with conflation, it is still possible for the FE annotated on the secondary layer to be instantiated as a constituent of its own in the syntax. In the following example, information about the person who was hit is encoded in the direct object *me*, as well as in the possessive of the NP complement of the preposition *on*.

> He **hit** me on my hand.

### 2.2.5 Syntactic locality

As mentioned in the introduction to this chapter, FrameNet annotation is directed toward the dependents of a target word. We do not annotate constituents that we understand only through context as referring to the filler of a particular frame element role. Consider the following example.

> Smith was surprised when Lowry **retaliated** for the attack.

Here, the target *retaliate* evokes the Revenge frame, but the surface syntax does not contain constituents representing the OFFENDER and the INJURED_PARTY. One plausible understanding of the sentence as a whole is that Smith was the one against whom Lowry retaliated . One might thus want to tag *Smith* as the OFFENDER. However, there is an alternative interpretation: Smith

could just be an observer of a conflict involving Lowry and a third party. In such cases, where there is no syntactic construction present that guarantees the interpretation we have in mind, we do not allow ourselves to annotate the non-local phrases in question. In our particular example, we would mark the OFFENDER as omitted under definite null instantiation (DNI).

In general, we try to select sentences for annotation where, with the exception of subjects, we find all frame elements realized by constituents that are part of the maximal phrase headed by the target word. In addition, there are several clear cases where, unlike the above example, grammatical structure guarantees a particular interpretation of phrases that are not dominated by the maximal phrase headed by the target. In such cases, we choose to annotate the non-local constituents realizing frame elements. Some of the most common of the relevant constructions are illustrated below.

**Raising**

**Subject to object**
We expect [John AVENGER] to **retaliate** [against us OFFENDER] [INI PUNISHMENT] [DNI INJURY].

**Subject to subject**
[John AVENGER] seems to have **avenged** [the death of his brother INJURY] [by luring Smithers into a trap PUNISHMENT].

**Control**

**Subject control**
[They AVENGER] are hoping to **get even** [with Smithers OFFENDER] [for the insult INJURY].

**Object control**
The commander ordered [the troops AVENGER] not to **retaliate** [against the rebels OFFENDER]

**Tough-movement**

[The defeat INJURY] was difficult to **avenge**. [CNI AVENGER]

### 2.2.6 Aspect

When verb targets co-occur with particles that are used productively to indicate aspectual information, we tag the particle with the label **aspect** on the Verb-Layer. Some examples follow.

They were **chattering** [away ASPECT] in the kitchen, when the door bell rang.

Mo **talked** [on and on ASPECT].

However, particles that seem aspectual but form entrenched lexical units with the verb are not treated in this way. For instance, in examples such as the following, *pull through* would be treated as one lexical unit, rather than as an instance of the verb *pull* accompanied by aspectual *through*.

> It's amazing what they can do these days and luckily the sick dog **pulled through**.

## 2.3 Annotation with nouns as targets

FrameNet also annotates relative to noun targets. In the course of our work, we have been paying attention to several types of nouns: nouns that denote events such as *withdrawal* and *replacement*; relational nouns such as *brother* or *girlfriend*; artifact nouns such as *house* and *vest*; and some others. Of these, event nouns and relational nouns are most clearly frame-bearing. Consider some examples from the Revenge frame.

> The Americans must have felt as if he was taking **revenge** on them for what had happened.
>
> King Menephta took awful **revenge** on a Libyan army he defeated around 1300 BC

In both of these examples, it is clear that what is reported is an act of revenge rather than an act of taking, the frame evoked by the noun *revenge* clearly being more dominant. Thus, nouns like *revenge* are legitimate objects for annotation as frame-bearing targets. Many of the issues discussed earlier for verbs, e.g. conflated frame elements, apply to nouns in the same way as to verbs. However, the annotation of nouns also brings some new challenges to the annotation enterprise.

### 2.3.1 Support expressions

As we noted, in the last two examples, the noun *revenge* provides the dominant frame, not the verb *take*. However, we would also like to give verbs like *take* a special treatment as **support verbs**. The intuition behind this is basically that support verbs do not introduce any semantics of their own. Constructions of nouns with their support verbs denote the same state of affairs that would be denoted by the noun occurring by itself. Thus, we define support verbs as those verbs that combine with a state noun or an event noun to create a verbal predicate, allowing arguments of the verb to serve as frame elements of the frame evoked by the noun. In the examples above, the subject of *take* realizes the AVENGER frame element, and *take* itself contributes no semantics: all that is talked about is an act of revenge. In contrast, in the following example, *encouraged* significantly changes what the sentence is about.

> The Prime Minister encouraged **revenge** against Absurdistan.

Encouraging somebody to do something is different from doing it and the encourager may not even be a participant at all in the encouraged act. Thus, we would not consider *encourage* a support verb. Similarly, if the verb in the preceding example had been *called for*, we would not consider it a support verb.

Recognizing support verbs not only allows us to annotate their subjects as frame elements. It is also lexicographically necessary to record them, given that in many cases it is the support verbs that are selected by the noun rather than the other way around. Support verbs also have other interesting properties that we want to be able to study. Some vary with the sense of the noun, that is, a noun may take different support verbs depending on the frame it belongs to. For instance, in the first of the following examples, the noun *argument* takes the support verb *have*, and has a meaning related to conversation; in the second example, the noun takes the support verb *make*, and has a meaning related to reasoning.

> John and I [had SUPP] a terrible **argument** last night.
>
> John [made SUPP] a convincing **argument** that the project should be funded.

Some support verbs have associations with certain registers. In the Revenge frame, for instance, *wreak* and *exact* clearly belong to a higher, more formal register than *take* and *have*.

> A short while later Joseph [had SUPP] his **revenge** on Watney's.
>
> The Australians magnificently [took SUPP] **revenge** for their defeat.
>
> He [wreaked SUPP] a terrible **revenge** on them for their betrayal.
>
> When de Raimes had [exacted SUPP] his **revenge** he would hand her over to his knight, who would complete her destruction.

In addition to support verbs we recognize a second type of support expression, namely combinations of nouns with **support prepositions**. Support prepositions combine with certain target nouns to yield a phrase that is more or less equivalent to a predicative adjective.[1] As in the case of support verbs, the frame of the noun is dominant and it is the noun that selects the particular support preposition rather than the other way around. Notice that in the case of target noun with support preposition, we also tag the copular verb that combines with the preposition and noun to form a verb phrase as a support expression.

> The painting [is SUPP] [on SUPP] **loan** from Mr Smithers
>
> About 650 oil wells [are SUPP] [on SUPP] **fire**.
>
> This old book [is SUPP] now [in SUPP] my **possession**.
>
> The documents [came SUPP] [into SUPP] my **possession** by inheritance.

[1] We might want to recognize another possibility: a preposition may turn a noun into an adverb, e.g. *at X's risk/peril*

Notice also that there need not be a copular verb for a target noun occurring with a support preposition. When the combination of support preposition and noun is used as a depictive or resultative secondary predicate, there will be no copular verb. Illustrative examples from the Facial_expression frame are given here.

His face was twisted [in SUPP] a **grimace**.

He wrinkled his brow [into SUPP] a **frown**.

Such sentences are usually roughly parallel to sentences with a support verb. For the two preceding examples, *make* would be a good candidate.

His face was twisted [making SUPP] a **grimace**.

He wrinkled his brow [making SUPP] a **frown**.

Finally, notice that in accordance with their status as syntactic arguments for target nouns, support expressions are not frame elements. They are tagged on their Noun Layer and have no grammatical function or phrase type assigned to them.


Figure 4 - Annotation of Support Verb for Target *revenge*.n

### 2.3.2 Noun Compounds

Our treatment of **noun compounds** recognizes but does not easily cover the full range of problems with this phenomenon that any theory of the grammar of English must address. In practice we distinguish compounds that are treated as single LUs, for which FrameNet gives no account of their substructure (e.g. *firing squad*, *sugar daddy*, *wine bottle*), from compounds based on frame-evoking nouns whose modifiers happen to be nouns or a relational adjective. Almost all noun compounds are **motivated** in that their components have clearly defined semantic relations to each other, whether or not the pattern they exemplify are "productive". In addition, the separation between conventionalized two-part words and examples of productive processes is not always clear, though there are clear cases. Compounds like *fire risk* and *health risk* would be treated with the noun *risk* and the modifiers would be given FE labels that follow a description of the head noun's frame. Similar treatment is given for the compounds *language pedagogy*, *animal sacrifice*, and *water flow*, where the modifier is a noun, as well

as *presidential privilege*, *economic problem*, *educational crisis*, etc., where the modifier is a relational adjective.

Figure 5 shows our treatment of the compound noun *firing squad* as a single lexical unit. Notice that the whole compound is the target (indicated with capital letters), and is annotated with the FE EXECUTIONER.

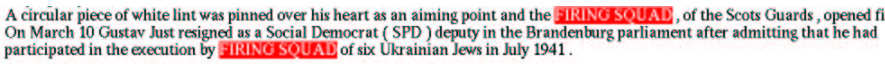


Figure 5 - Annotation: Compound Noun as LU - *firing squad*.n

Figure 6 shows our treatment of the compound noun *fertility rite* as a head noun modified by a noun. Notice that in the first sentence the target word *rite* is modified by a noun that is annotated with the FE DESIRED_STATE.

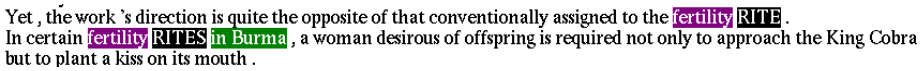


Figure 6 - Annotation: Compound Noun as Head Noun+Modifier - *fertility rite*.n

### 2.3.3 Copula and Copular sentences

Our use of the term **copula** is highly idiosyncratic and runs counter to grammatical tradition, so careful explanation is in order. Usually, the term *copula* or *linking verb* is used for the verb *be* (and a few others) when they occur in constructions of the form: $NP_1$ *V* $NP_2$. [2]

Examples include:

John **is** a sailor.

Smithers **is** the vice-president of the armchair division.

However, the two sentences above exemplify different uses of the verb. The first use is predicative: the property of being a sailor is predicated of John. The second use is specifying or equational: the identity of the referents of *Smithers* and *the vice-president of the armchair division* is asserted. In specifying sentences, $NP_1$ and $NP_2$ can be switched, with the resulting sentence still meaningful and even having the same truth conditions. The same is not true of predicational sentences, as shown below.

[2] There are some cases of structural ambiguity where *be* is a copular verb under one reading, and an auxiliary under the other, as in: *His pastime is annoying the girls.*

The vice-president of the armchair division **is** Smithers.

*A sailor is John.

This has two important consequences for our annotation. Certain event nouns occur in equational sentences where what's to the right of *be* expresses a frame element of the frame evoked by the target noun.

His **decision** is to leave the company.

To leave the company is his **decision**.

In these equational sentences, we want to tag the non-target NP as a frame element, but we also want to distinguish the two possible orderings of target NP and frame element. Therefore, we made the decision to call *be* a copula only in cases where it follows the target. When *be* precedes the target we call it a support verb in analogy to regular support verbs like *take*, which in active sentences normally precede their target, as in the following examples.

His **decision** [is COPULA] to leave the company.

To leave the company [is SUPP] his **decision**.

We also use copula in some cases where the target names an artifact, rather than an event, and where a descriptive predicative adjective fills a frame element role.

Sue's **feet** [are COPULA] narrow.

Finally, note that the COPULA tag, unlike the SUPP tag, is applied on the Other-Layer.

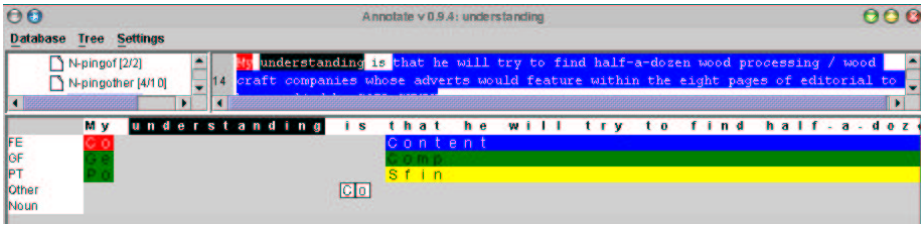


Figure 7 - Annotation of Copula for Target *understanding*.n

### 2.3.4 Existential sentences

A subset of nouns can be used to report the occurrence of an event in a *there*-construction. We record these cases by applying the label **Existential** to the copular verb on the Other-Layer. Usually the verb is *be*, but others, such as *come*, *occur*, and *ensue* are found as well.

> There [was EXISTENTIAL] an **argument** between the players.
>
> There [ensued EXISTENTIAL] a **discussion** about the current program.

In existential sentences such as these, the word *there* is marked with the Null tag on the Other-Layer (see section 2.2.3 for more information on the Null tag).

### 2.3.5 Null instantiation with Noun Targets

In the case of noun targets, null instantiation is very common, and it is much more difficult to decide what licenses the absence of the noun's conceptually necessary arguments. Quantification and generic use make the notion of DNI inapplicable since, by definition, they do not allow for the individuation of events or states and their participants. Consider the following pair of examples.

> Every time Max did something like that, I knew how to **get even**.
>
> **Revenge** is sweet.

However, even without quantification, there are no reliable clues from definiteness marking about whether frame elements are contextually known. Consider the following sentence uttered in a courtroom context.

> Smithers was **convicted** after two hours of deliberation.

It is clear that in the Verdict frame, to which the noun *conviction* belongs, the CHARGES are a core frame element. The preceding example is felicitous only if the CHARGES is contextually recoverable.

Now, consider an example with the noun *conviction*.

> His role in that **conviction** is now under investigation.

We note that that sentence could be preceded by either one of the following discourses:

> We have reason to believe that this agent has tampered with evidence before to get a conviction. Just two months ago the murder **conviction** of Howie Cheatham was overturned. Agent Smith also was a witness there.
>
> We know that this agent has tampered with evidence before to get a **conviction**. There is for instance the case of a man in Missouri that had to be released after it was found that agent Smith had manipulated fingerprints.

In the first example, the CHARGES (*murder*) are explicitly mentioned, while in the second they are not identified at all, just existentially bound to the event of the earlier trial and conviction. Thus, definite reference to an event does not require that all aspects of an event be known to speaker and hearer. We must decide whether the absent frame elements should be assigned to the INI or the CNI class. Since the omission does not seem lexically specific we could call it a case of CNI. However, because the expression of FEs for noun targets is always optional, we decided not to annotate null instantiated FEs.

There are a few cases where we record DNI for frame elements of nouns. In the following example, a SOURCE location seems to have to be understood in the context.

> [His THEME] **departure** had been delayed by two hours [DNI SOURCE].

But even in this case, one could construct an admittedly less plausible context that allows for mere existential binding of the SOURCE frame element, as given below.

> Sam lost his wallet in an airport cafeteria last year. It took him an hour to retrieve it and he thought he had missed his flight. But luckily, ...

In sum, we do not yet have a good account of omitted arguments with target nouns. Use our annotation of null instantiated arguments of nouns with care.

## 2.4 Annotation with adjectives as targets

Adjectives can also evoke frames, that is, be frame-bearing. Certain semantic areas such as emotion or evaluation-related frames actually have a considerable share of adjectival lexical units. FrameNet annotates adjectives both when they are used attributively and when they are used predicatively. For the most part, adjectives take the same kinds of phrases as complements that verbs or nouns do: finite clauses (*Jo is happy that he passed*); infinitival clauses (*Jo is eager to finish*); gerundive forms (*Jo is busy writing*); prepositional phrases (*Jo is curious about the new student*); adverbial phrases (*Jo is not in the least disappointed*); etc. However, predicative adjectives are different from verbs in that they do not take direct objects, with the possible exception of *worth* (as in *It's not worth the trouble*). And attributive adjectives, of course, modify nominals rather than complete noun phrases.

### 2.4.1 Support & Copula

When adjectives are used predicatively, the annotation of verbs like *be* is the same as with predicate nominals: we tag them SUPP. Notice that in the case of adjectives, unlike with nouns, there is no possibility of a specifying use since adjectives are not referential. Thus, the copular verbs occurring with adjectives are tagged as SUPP in all cases.

Smithers [is SUPP] very **clever** but he's no Einstein.

**Clever** though he may [be SUPP], Smithers is no Einstein.

### 2.4.2 Relational modification

There is a distinct subclass of adjectives like *medical, military, judicial* that can never be used predicatively as is shown in the following examples.

The White House announced a new **economic** policy.

*The policy that the White House announced is **economic** .

We call these adjectives **relational** modifiers. Other names used for them include **pertainyms** or **domain adjectives**. Relational adjectives are comparable to the modifying noun in noun-noun compounds (e.g. *medicine* in *medicine man*). They do not modify the referent or the extension of a head noun but rather its sense or intension, hence the name. Dictionaries typically define them with phrases like *having to do, relating to, characteristic of* [some abstract or concrete entity]. These adjectives are not frame-bearing, at least not in a way that is concrete enough to allow for a clear definition of a scenario and of frame elements. Although they are placed in the frames that they are broadly associated with—the adjective *retributory*, for instance, lives in the Revenge frame—we do not provide full annotation for them.

## 2.5 Annotation relative to slot fillers

Some nouns—for example, natural kind and artifact nouns like *tomato, hammer*, or *pants*—do not evoke frames by themselves, or do so only marginally. These nouns mostly just occur as slot fillers in frames evoked by verbs, adjectives, or other nouns. Nevertheless, we tag a governing verb or preposition on their Noun-Layer as a governor for some of these slot filler nouns.

The motivation for doing this is as follows: For certain entities, we would like to know in which frames they appear as slot fillers. Conversely, we also want to know, for a particular FE, what its typical slot fillers are. For example, consider the Building frame. We might wonder what kinds of things are usually built or constructed. Conversely, thinking about various kinds of buildings, we might want to know in what kinds of events they participate. We may intuit that they are often mentioned as objects of *build*, but are there other kinds of building, for instance, that apply to buildings or their sub-parts?

We could attempt to automatically derive this kind of information from our annotation relative to governors like *build, construct, assemble*, etc. However, for that to be useful we would have to annotate many more sentences for each of the governors than we currently do.[3] For lexicographic purposes, it is not necessary to document that in addition to houses, towers, and many other things,

[3]We aim for around 3 -5 examples per subcorpus, resulting in an average of around 20-25 sentences per lexical unit.

castles can be constructed or put up, and so we have not done it. Thus, currently the easiest way to address questions like the ones above is to look for sentences with nouns such as *castle*, *tower* etc. and treat them as targets. We can then record what syntactic governors (**Gov**) take phrases containing the artifact noun targets as arguments and what kind of syntactic constituents contain the target. (For lack of a better term, we call the constituent containing the target slot filler noun **X**.)

He [built GOV] [two tall **towers** X].

Design and [construct GOV] [the **castle** X].

Notice that we tag both the verb and the particle as GOV when a phrasal verb is the Governor of a target noun, whether or not the verb and particle are contiguous.

Leslie [put GOV] [up GOV] [the **towers** X].

Leslie [put GOV [the **towers** X] [up GOV].

In several of our frames of artifact nouns, we also have defined some frame elements reflecting a kind of qualia structure of the artifacts(Pustejovsky 1995). For instance, we may record modifiers that denote the material from which an artifact is made (constitutive quale) or the purpose for which it is used (telic quale). Here are some examples from the Clothing frame, which contains nouns denoting items of clothing.

Dot always [slept GOV] [in [her WEARER] [**vest** GARMENT] and knickers X]

I [put on GOV] [[my WEARER] [smart DESCRIPTOR] **suit** X] for the last of the interviews

In addition to Gov-X annotation and qualia-type annotation, we can also attach a semantic type to some or all the lexical units in a frame. For instance, we could assign the semantic type 'Dress' to all items of clothing. Similarly we could give nouns like *wood, concrete, ivory* in a Materials frame a semantic type 'Material'. This kind of information would then give users of our database information about classes of words that meet certain selectional restrictions.

One special kind of noun that received Gov-X annotation are what we call **transparent** nouns. Nouns like *top, pound, bunch* can appear as the first noun in $N_1$-of-$N_2$ constructions in contexts where the governing verb actually selects $N_2$ semantically rather than $N_1$, the syntactic head. In these contexts, we call $N_1$ transparent.

Sue drank a **cup** of hot coffee.

He pinned a **square** of fabric on the back.

Semantically, the nouns that can be transparent fall into the following classes:

- Aggregates (*bunch, group, collection*)
- Quantities (*flood, number, scores*)
- Types (*breed, class, ilk, kind*)
- Portions and Parts (*half, segment, top, bottom*)
- Unitizers (*glass, bottle, box*)
- Evaluations (*gem, idiot*)

While these words were annotated in appropriate frames such as Aggregate in the case of *group, bunch*, annotators added Gov-X annotation for those sentences where the target noun appears as a transparent $N_1$:

> Leslie [ate GOV] [a [**sliver** PIECE] [of lemon SUBSTANCE]X].
>
> Robin [drank GOV] [[a COUNT] [**pint** UNIT] [of beer STUFF] X].

## 2.6 Text annotation

As stated in the introduction to this chapter, we annotate individual sentences that we selected for containing a target word of interest to us. Annotation of running text is not a part of the main project but it is technically possible thanks to the annotation layering technique: one could one by one declare each word in a sentence a target, select a frame relative to which the new target ought to be annotated, get a new set of annotation layers (frame element, grammatical function, phrase type) and appropriate frame elements tags, and begin to annotate.

# Chapter 3

# Identifying Phrase Types

The syntactic metalanguage used in the FrameNet project is intended as a framework for **lexical description**–i.e. to describe the syntactic valence properties of individual lexical items. It is not intended as a framework for the complete syntactic description of sentences. In choosing the phrase types and grammatical functions to use, the major criterion was whether or not a particular label might figure into a description of the grammatical requirements of one of the **target words** of the project. The emphasis on what is relevant to lexical descriptions means that we limit ourselves, for the most part, to those phrase type labels which might appear in subcategorization frames. We do not include a complete list of all phrase types as would appear in more theoretically oriented syntactic descriptions.

FrameNet syntax also differs from traditional treatments of subcategorization, in its inclusion of certain modifiers. For example, the FrameNet description of a noun like *clinic* makes reference to the types of nouns which can modify this noun in compounds like *allergy clinic*. In theoretical treatments, modifiers of this sort are typically assumed to be outside the realm of subcategorization. We include them because they frequently express the same semantic roles (or frame elements) with respect to the modified heads as complements express with respect to their governors. For example, the frame associated with the verb *treat* includes a role for the Disease which is treated, and this role is typically expressed as the object of *treat*. Thus, you can *treat an allergy*, *treat the flu*, and so forth. Modifiers occurring with the noun *treatment* often express the same role; thus, there are *allergy treatments*, *flu treatments*, etc. We consider such observations to be of lexicographic relevance, and our syntactic descriptions reflect this perspective.

Target words are not assigned a PT tag.

## 3.1 List of phrase types

What follows is a list of phrase types used in FrameNet. Phrase types are assigned automatically during the classifying process, but may require manual correction.

### 3.1.1 Noun Phrase Types

**Non-referential Noun Phrase**

**There** (Expletive *there*)
**It** (Expletive *it*)

**Possessive Noun Phrase (Poss)**

**Non-maximal Nominal (N)**

**Standard Noun Phrase (NP)**

### 3.1.2 Prepositional Phrase Types

(**Prepositional Phrases (PP)**
Two types of Prepositional Phrases are assigned the phrase type **PP**.

Standard Prepositional Phrase (with NP object)
Particle (with no object)

**PPing** (Preposition with gerund object)

### 3.1.3 Verb Phrase types

**Finite Verb Phrase (VPfin)**

**Nonfinite Verb Phrase**

**VPbrst** (Bare Stem Verb Phrase)
**VPto** (*To*-Marked Infinitive Verb Phrase)
**VPing** (Gerundive Verb Phrase)

### 3.1.4 Complement Clause Types

**Finite Clause**

**Sfin** (Finite Clause (with or without *that*))
**Swh-** (*Wh*-Clause)
**Swhether** (*Whether/if*-Clause)

**Nonfinite Clause**

**Sing** (Gerundive Clause)

**Sto** (*To*-marked Clause)

**Sforto** (*For-to*-marked Clause)

**Sbrst** (Bare Stem Clause)

### 3.1.5 Subordinate Clause (Ssub)

### 3.1.6 Adjective Phrase Types

**Non-maximal Adjective (A)**

**Standard Adjective Phrase (AJP)**

### 3.1.7 Adverb Phrase (AVP)

### 3.1.8 Quantifier Phrases (QUANT)

### 3.1.9 Quote (QUO)

## 3.2 Phrase Type Labels for Noun Phrases

### 3.2.1 Non-referential NPs

The first distinction to worry about with NP types is that between **referential** and **non-referential** NPs. Expletive *it* and *there* are the two kinds of non-referential NPs. These are **not** given PT tags, although we record their presence on the Other Layer.

Some examples are given below.

[It] is clear that we won't finish on time.

[It] is odd that George is winning.

[There] are more cookies in the jar.

[There] is a fly in my soup.

### 3.2.2 Possessive Noun Phrase (Poss)

Referential NPs are either possessive NPs (marked **Poss**) or standard (non-possessive) NPs (marked **NP**). Possessive NPs, which may either be possessive pronouns or noun phrases marked with *'s*, often express frame elements of predicating nouns. For example, in the Communication frame, possessive nouns express The Speaker role when they are the determiners of target nouns such as *claim*, *remark*, *reply*, etc.:

I question [your] **claim** that the car was already damaged.

[The President's] **remarks** surprised the reporters.

[Leslie's] **reply** was well-timed.

**Note:** The label 'possessive' is not restricted to NPs denoting actual possessors. It is a morphosyntactic type rather than a semantic type.

### 3.2.3 Non-maximal Nominal (N)

In some situations it is necessary to tag nominal expressions which are not complete (i.e. maximal) noun phrases. For example, consider nominal modifiers of target nouns, as in the first two examples below, or the modified nouns in sentences showing target adjectives used attributively, as in the second two examples.

The judge dismissed the [forgery] **allegations**.

[Cancer] **treatments** are advancing rapidly.

**Allergic** [patients] benefit from this medicine.

The senator gave a **polemical** [speech].

These non-maximal nominal expressions are given the phrase type **N** (for 'nominal').

In contrast, head nouns that are frame elements of post-nominal modifiers are treated as if the post-nominal modifier was used with a copula, i.e. they are treated as full NPs with respect to Phrase Type, and as External arguments with respect to Grammatical function. They are not treated as non-maximal nominals.

The problem seems to affect [people NP/External] **sensitive** to primulas.

### 3.2.4 Standard Noun Phrase (NP)

With the exception of possessive [3.2.2] and of non-referential noun phrases [3.2.1], all noun phrases are marked with the phrase type **NP**. The sections below discuss special circumstances which arise with the tagging of NPs.

I **heard** [an interesting story] today.

I **dropped** [the lid] on my foot.

Standard NPs do not have to be headed by nouns. We treat free relative clauses (also called headless relative clauses) as NPs also. Likewise, we consider bare numerals as complete NPs.

Harry will **eat** [what Sally is eating NP].

I **want** [two NP].

**Nouns with complements**

Some nouns take prepositional or clausal complements. These are included in the PT tag for the relevant NP. In the examples below, noun complements appear in italics.

I **heard** [a story *about a man named Jed*].

I **dropped** [the lid *of my vitamin jar*].

[The fact *that moles are blind*] is totally **irrelevant**.

**Nominals with relative clauses**

**Relative clauses containing the target word** If the target word is inside the relative clause, we include the relative pronoun or relativizer with the head nominal, as in the following examples:

[the doctor who] **cured** my insomnia

[the joke that] got **repeated** over and over

**Relative clauses with the target word outside** If the target word is not inside the relative clause, we tag the whole relative clause modifier along with the nominal head, as in the following examples. (Relative clauses are in italics.)

[The acupuncturist *(whom) I saw last month*] **cured** my insomnia.

Recall that free relatives are treated as NPs in their own right.

**Other post-nominal modifiers**

We also tag other post-nominal modifiers inside NPs. These include reduced relative clauses headed by prepositions and participial forms of verbs. (Note, however, that, in general, if possible we choose sentences for annotation without reduced relative clause.)

[The cat *in the corner*] likes celery.

I have [a cat *with orange stripes*].

[The cat *running down the hall*] is my favorite.

I'm talking about [the cat *bitten by a mouse*].

If there is more than one post-nominal modifier, they are all tagged with the phrase type NP, as illustrated below.

Stop [that cat *with orange stripes running down the hall*].

### 3.2.5 Coordinate Noun Phrase (Coord)

While a Noun Phrase can consist of coordinated NPs (e.g. *John and Sue*, it cannot consist of an NP and a following PP headed by *with along with*, or *together with*.

Compare the following two sentences, where only the first one is a coordinate noun phrase and tagged **Coord**.

The police **arrested** [Jim and me COORD].

The police **arrested** [me SUSPECT] along with Jim.

## 3.3 Phrase Type Labels for Prepositional Phrases

**PP** is assigned to ordinary prepositional phrases with nominal objects and to particles, the latter under the assumption that particles can be regarded as prepositional phrases which lack objects. **PPing** is assigned to prepositional phrases with gerundial objects rather than nominal ones. Here are some examples:

The passengers **looked** [at the monitors]. PP

The players began to **spread** [out]. PP

The fog **prevented** us [from seeing anything]. PPing

In addition we assign the phrase type PP to the second piece of certain discontinuous degree phrases, as exemplified below.

Jo is so **wicked** [as to be beyond redemption PP].

Stealing paper clips from work is less **immoral** [than to take them from a store PP].

These are closely related to the *than*- and *as*-phrases in the following sentences, which we tag also tag as PP.

Jo is as **wicked** [as John PP].

Jo is less **moral** [than Dave PP].

### 3.3.1 Particles

Particles like those in the following examples are treated as prepositions without objects and are assigned the Phrase Type **PP**.

Did you **figure** the problem [out]?

**Look** the number [up] in the phone book.

He **took** his hat [off] and put it on the table.

Note that particles of this kind may occur before NPs and therefore give the appearance of being the heads of regular PPs with NP objects.

Did you **figure** [out] the problem?

**Look** [up] the number in the phone book.

He **took** [off] his hat and put it on the table.

However, given the fact they are separable, as shown in the earlier examples, they cannot plausibly be treated as the heads of PPs in these contexts. Therefore, they are assigned a separate label **PP**. Generally, lexicographers are informed in advance of the particles that can appear with particular target words. Note also, that if *figure out*, *look up*, and *take off* were to be treated as multiword expressions (multilexeme lemmas), the annotator does not assign any FE-GF-PT triple for the particle, since it is treated as part of the target in that case.

**Test:** If you are uncertain about whether or not to treat a word W as a particle, perform this test:

1. Think of a simple VP of the form V W NP.
2. Transpose the W and the NP: V NP W.
3. If the transposed version is an acceptable paraphrase of the original VP, then the word W is a particle.

While some particles, like the ones above, are equivalent in form to prepositions and may therefore misleadingly appear to head PPs in certain contexts, other particles do not resemble prepositions and are therefore less likely to be mis-analyzed that way:

**Throw** [away] those old things!

The librarian told me to **put** [back] the books.

There is no syntactic reason to distinguish these particles from the ones which resemble prepositions, and they are therefore given the same label (PP).

### 3.3.2 Prepositional Verbs

Some verb-preposition combinations are clearly conventional, as shown here.

The passengers *looked at* the information monitors.

Let me know if you *come across* that reference I asked you about.

We analyze the prepositions in such expressions as heading PPs.

The passengers **looked** [at the information monitors].

Let me know if you **come** [across that reference].

Though these verb-preposition combinations are units in the lexicon, we do not capture their unitary status in terms of *constituent structure*. That is, we do not analyze *look at* and *come across* as syntactic constituents.

In accordance with the Construction Grammar analysis of these expressions, their unitary status is captured in the valence representations of lexical entries. For example, there will be a lexical entry for *look at* which states that the verbal head *look* requires a PP headed by the preposition *at*.

### 3.3.3 Complex Prepositions

Some prepositions function as individual lexical units but consist, orthographically, of more than one word (complex prepositions shown in italics):

Put the birthday cake *next to* the other desserts.

We had tofu *instead of* veal.

Expressions of this kind are treated as single complex prepositions which head normal PPs. The PPs in the above sentences should be tagged in the following way:

Your birthday cake is [next to the other desserts].

We had tofu [instead of veal].

### 3.3.4 Preposition Stranding

A preposition and its complement may be separated from each other, with the preposition appearing in a canonical post-verbal position and its complement noun phrase appearing in a pre-verbal position higher in the clause.

[John] we **laughed** [at].

[The man] you **screamed** [at] is my father.

Since allowing for preposition stranding is not lexically relevant information, annotators are discouraged from marking such sentences. If, however, sentences with preposition stranding have been annotated, then the two parts are assigned their normal phrase type values, NP and PP.

### 3.3.5 Preposition Phrases with Relative Clauses

If the target word is inside the relative clause and one of its frame elements is a prepositional phrase containing the relative pronoun, then we include the phrase containing the relative pronoun or relativizer inside the tagged constituents with the head nominal, as in the following examples:

[the house out of which] I was **evicted**

[the operator to whom] he had **spoken**

Notice that the bracketed constituent is treated as a PP.

If preposition stranding occurs within the relative clause, we mark the antecedent and relativizer as well as the stranded preposition.

[the house that] I was **evicted** [out of]

[the operator that] he had **spoken** [to]

## 3.4 Phrase Type Labels for Verb Phrases

Every verb phrase has at least a head verb, which may be a main verb or an auxiliary. VPs headed by main verbs may also contain one or more auxiliaries. A verb phrase may also have a negative marker, an infinitive marker, a preverbal adverb phrase, one or more complements of the verb, and one or more post-verbal adjuncts. A VP may be headed by the main verb in a sentence or it may be embedded as a complement under another verb. The following examples show a variety of VPs.

I *have*. (In response to "Have you taken out the trash?")

This book *really stinks*.

I didn't expect you *to eat your sandwich so quickly*.

### 3.4.1 Finite Verb Phrases (VPfin)

Any VP containing a verb (including auxiliaries) which (1) expresses information about tense and (2) is not in a separate embedded clause is tagged as a finite VP. Finite VPs are not generally subcategorized for, but it is nonetheless necessary to tag them in certain contexts, as illustrated here.

Who do you **think** [ate the sandwich]?

What did you **say** [fell on your hat]?

This pattern seems to be limited to a fairly small number of verbs of belief and assertion which subcategorize for clausal complements: *think*, *believe*, *say*, *claim*, *assert*, etc.

### 3.4.2 Non-finite Verb Phrases

Among non-finite VPs it is necessary to recognize bare stem infinitives (**VPbrst**), *to*-marked infinitives (**VPto**), and gerunds (**VPing**).

#### Bare stem infinitives (VPbrst)

Bare stem infinitives are non-tensed verb phrases headed by verbs in the bare stem form without the infinitive marker *to*. Examples of bare stem infinitives (VPbrst) are given below.

We **made** the children [take naps].

Management **let** the employees [set their own hours].

Note that *the children take naps* and *the employees set their own hours* are not treated as clauses in the FrameNet project, though that is how they are sometimes analyzed.

#### *To*-marked Infinitives (VPto)

To-marked infinitives are VPs that begin with the infinitive marker *to*. Otherwise they are identical to bare-stem infinitives. Examples of *to*-marked infinitives appear below.

The cat **wants** [to go outside].

The mayors **persuaded** the President [to support the cities].

It is **hard** for infants [to tie their own shoes].

#### Gerundive Verb Phrases (VPing)

Gerundive VPs are VPs headed by verbs in the *-ing* form. They often occur in syntactic contexts in which nominal expressions also occur. Examples of Gerundive VPs are provided here.

My friend **likes** [running barefoot].

[Inhaling pepper] **makes** most people sneeze.

We **watched** the dogs [playing].

Gerunds present a challenge because they are sometimes verb-like and sometimes noun-like. Annotators are advised to consider both syntactic and semantic criteria to determine if the automatic classification of gerundive verb phrases is correct.

## 3.5 Phrase Type Labels for Clauses

Expression types that are treated as clauses in some syntactic theories are treated in the FrameNet syntax as combinations of smaller constituents. For example, the sequence *Pat leave* in a sentence like *They made Pat leave* is sometimes analyzed as a 'small clause,' but in the FrameNet metalanguage it is treated simply as an NP followed by a bare stem infinitive VP. This strategy has been adopted for two reasons. First, it simplifies the lexicographers' task of annotation, making it unnecessary to decide in certain cases which combinations of constituents should be treated as clausal and which should not. Second, it makes the lexical descriptions produced by the FrameNet project relatively theory-neutral. While the question of which verbal complements are clausal and which are not is answered differently in different syntactic theories, the analysis of clauses into their major constituents is in most cases uncontroversial.

### 3.5.1 Finite complement clauses

#### Declarative Finite Complement clauses (Sfin)

Declarative finite complement clauses are full sentences that may begin with the complement marker *that*. In this PT, the entire clause, including the complement marker, is tagged.

Pat **knew** [Kim would never agree].

Pat **knew** [that Kim would never agree].

#### *Wh*-interrogative Clauses (Swh)

Structurally, a *wh*-interrogative clause may be a sentence or a verb phrase. Although not full clauses, these phrases only occur in constructions which allow a full Swh and therefore a single PT is used for both. Note that we treat *how* as a *wh*-expression. *Wh*-expressions are included in the tag for the clause.

I **heard** [what you said].

I **forgot** [what to say].

I **know** [how you feel]. I don't **know** [how to react].

I **asked** [who came]. She **told** me [who to invite].

#### *Whether-if* Interrogative Clauses (Swhether)

Structurally, a *Whether-if* interrogative clause may be a sentence or, in the case of *whether*, a verb phrase. Although not full clauses, these phrases only occur in constructions which allow a full *Whether-if* clause and therefore a single PT is used for both.

I **wonder** [whether the Indian restaurant delivers].

He **wondered** [whether to turn back].

Kim didn't **know** [if Pat liked the show].

### 3.5.2 Non-finite Clauses

#### Gerundive Clauses (Sing)

Sequences of object-form noun phrase and gerundive verb phrase are treated as single clauses by FrameNet. The reason for the analysis as a clause is that the noun phrase cannot be separated from the gerundive verb phrase, for instance, in passivization.

I don't like [him being here all the time].

[*He] wasn't liked [being there all the time]

Notice that similar-looking gerundive forms with a possessive subject are treated as noun phrases:

I don't **like** his being here all the time.

***To*-marked clauses (Sto)**

I'd **like** [you to meet my mother]. Certainly, but I should **hate** [you to forget that he has scored more runs in Test cricket than any other Englishman].

In sentences like the above example, *you* cannot be the subject of a passive and therefore is treated as part of the non-finite clause.

*[You] would be liked [to meet my mother]

***For-to*-marked clauses (Sforto)**

I'd **like** [for you to meet my mother].

I would **prefer** [for John to stay in the 250 class].

**Bare stem clauses (Sbrst)**

The manager **demanded** [that employees be on time].

### 3.5.3 Subordinate Clauses

Certain clauses introduced by subordinators can be frame elements and consequently need to be tagged. Such clauses receive the PT value Ssub (Subordinate Clause) rather than Sfin (finite complement clause). In the following sentence, the *because*-clause expresses the Reason frame element of the target word *admire*, which belongs to the Cognition_Judgment frame.

I **admire** her [because she is an actress who can also sing].

Certain adjective targets welcome discontinuous Degree phrases, as in the following example, where we assign the phrase type **Ssub** to the *than*-phrase.

That wine is more **delectable** [than I could imagine SSUB].

## 3.6 Phrase Type Labels for Adjective Phrases

Adjective Phrases typically occur as pre-nominal modifiers, as non-Subject complements of copular *be* and a small number of related verbs (*seem*, *become*, etc.), and as predicate complements of verbs like *find*, *consider*, etc.:

They were eating [very large] sandwiches.

The house is [empty].

You seem [sad] today.

The company considers these documents [extremely valuable].

### 3.6.1 Standard Adjective Phrase (AJP)

An Adjective Phrase may consist of just a single adjective, an adjective with some modifying expression (such as an adverb or an intensifier), or a conjunction of adjective phrases:

We **found** the play [dull].

We **found** the play [extremely dull].

We **found** the play [extremely dull and too long].

### 3.6.2 Non-maximal Adjectival (A)

Some adjectival expressions to be tagged are not treated as complete (i.e. maximal) adjective phrases. This is typically the case with relational modification, as shown below.

[marital] **bliss**

*very marital bliss

These expressions are given the phrase type A.

### 3.6.3 Adjectives with Complements

Some adjectives take complements other than the nouns they modify and these should be included as part of the Adjective Phrase. For example, consider the comparative adjective illustrated below:

Leslie is [taller than Kim].

An adjective and its complement may form a discontinuous constituent:

We need to find a [taller] player [than Kim].

In such cases, both the adjective and its complement are enclosed in brackets and assigned the label AJP.

## 3.7 Phrase Type Labels for Adverb Phrases (AVP)

Sometimes an adverb expresses a frame element of a target verb, as illustrated here.

The President **answered** the question [affirmatively].

In this sentence, the adverb *affirmatively* expresses the frame element Message, because it tells us that the President said *Yes*, or something equivalent in meaning, to the reporter's question. It is therefore tagged and assigned the phrase type AVP, the grammatical function Mod(ifier) and the frame element Message.

## 3.8 Phrase Type Labels for Quantifiers (QUANT)

When annotating target nouns, the preceding number or quantifier is given the phrase type QUANT. For example,

Bob poured [two QUANT] **cups** of coffee.

Bob poured [thirty seven QUANT] **cups** of coffee at the brunch.

Bob drank [a QUANT] **glass** of wine.

Note that we treat cardinal numbers and *a* (= 1) in the same way.

## 3.9 Phrase Type Labels for Quotes (QUO)

Some verbs of communication take quoted material as a complement and are assigned the PT QUO. For example:

["Get out of here!"] she **cried**.

["But, I, er, uh..."] he **stammered**.

Quoted material can be of any syntactic form, or syntactically ill-formed, for that matter. Because the distribution or 'external syntax' of quoted material does not depend on its internal syntactic structure, we use a separate phrase type to tag it. Only direct quotes are given the phrase type QUO. Indirect quotes always take the form of some other kind of specific phrase type, e.g.

They **asked** us [what we were doing there].(*Wh*-clause)

The President **said** [that he would support the inner city].(*That*-clause)

Quoted material is easy to identify because it almost always appears in quotation marks, which should be included inside the brackets marking the Quote constituent.

Sometimes quoted material forms a discontinuous constituent:

[“Cities,”] he **said**, [“are a very high priority.”]

In such cases, both portions of the quote should be enclosed in square brackets and assigned the PT QUO. The tagging and annotation software will automatically coindex the parts and treat them together as a single unit.

# Chapter 4

# Assigning Grammatical Functions

In FrameNet, we annotate example sentences from the point of view of one particular **target word** in a given sentence. Each constituent tagged with a frame element in respect to a **target word** is also assigned a grammatical function tag in respect to that target. Only constituents tagged with frame elements are assigned grammatical functions. While target words are occasionally tagged with frame elements, they are never assigned a grammatical function.

The grammatical functions (**GFs**) that are assigned describe the ways in which the constituents satisfy abstract grammatical requirements of the target word. FrameNet grammatical function labels do not describe surface-syntactic positions of the constituents to which we assign them.

For example, suppose the following sentence is selected to exemplify grammatical properties of the target word *treat*:

Circumstances forced the doctor to **treat** her enemies.

Although the word *circumstances* is the subject of the sentence as a whole, this fact is not of interest to us and is not marked in any way in the example sentence. Instead, the NP *the doctor* is tagged as the external argument (Ext) of *treat*, even though it is not the surface subject of the sentence, because it satisfies a valence requirement of the verb *treat* outside the phrase headed by *treat* (thus 'external'). That is, it satisfies a semantic role, associated with *treat*, which would be realized in a simple declarative main clause by the subject of the clause.

The doctor also **treated** her enemies.

The combinations of grammatical function labels that occur with particular lexical items provide both a way of encoding the syntactic constructions a lexical item occurs in, and also a way of retrieving certain narrower distinctions between grammatical functions than those covered by the set of GF labels used.

For example, the verb *like* can occur in sentences with 'extraposed objects':

I **like** it [that you speak French].

FrameNet annotation of example sentences demonstrate that as one of its valence options, the verb *like* may take a null object *it* followed by a complement clause.

Eventually, it will be possible to retrieve examples of extraposed objects from the database by searching for combinations of null object and complement clause.

## 4.1 List of Grammatical Functions

What follows is a list of all of the grammatical functions used in FrameNet. It is followed by sections providing detailed criteria for the assignment of each GF. As with phrase types, GFs are assigned automatically during the classifying process, but may require manual correction.

### 4.1.1 Grammatical Functions assigned by Target Verbs

External Argument (Ext)

Object (Obj)

Complement (Comp)

Modifier (Mod)

### 4.1.2 Grammatical Functions assigned by Target Adjectives

External Argument (Ext)

Head noun modified by attributive adjective (Head)

Complement (Comp)

Modifier (Mod)

### 4.1.3 Grammatical Functions assigned by Target Prepositions

External Argument (Ext)

Object (Obj)

### 4.1.4 Grammatical Functions assigned by Target Nouns

External Argument (Ext)

Complement (Comp)

Genitive determiner (Gen)

Modifier (Mod)

Appositive (Appos)

## 4.2 Assigning GFs for Verbs

### 4.2.1 External Argument (Ext)

**External** covers situations in which phrases outside of the maximal phrase headed by the target word are functionally linked to the target word. This includes anything that satisfies an FE requirement of a target word in any of the following syntactic contexts:

- as a subject of a finite target verb, as in

  [The physician] **performed** the surgery;

- as a subject or object of a controlling governor of the target, as in

  [The physician] **decided** to **perform** the surgery;

- as the possessive modifier of a governing noun, as in

  [The physician's] **decision** to **perform** the surgery....

Notice that the phrase *the physician's* is in the Genitive GF relation to the noun *decision*, but bears the Ext relation to the verb *perform*.

In addition, any constituent which controls the subject of a target verb is assigned the GF External. This constituent might be a subject, an object, or a prepositional object in its local syntactic context, as shown below.

[The doctor] tried to **cure** me.

They persuaded [the doctor] to **treat** me.

They gestured to [us] to **leave**.

In the last example, note that it is just the NP *us*, and not the PP *to us*, which is tagged as the External Argument. This is because here we are interested in the valence properties of *leave* and not in the valence properties of *gesture*. Only the latter are responsible for the prepositional marking of the prepositional phrase *to us*.

A sub-case of a controlling verb is that of a verb that can be seen as specifically dedicated to providing external representation for an element of the conceptual structure associated with the meaning of a nominal or adjectival target,

which we refer to as **support verbs**. Subjects and objects of support verbs can be taken as Ext for the dependent word; other complements of the support verb, where relevant, can be treated as complements of the dependent noun or adjective.

This last provision allows us to finesse the problem of disputed constituency decisions in the case of support-verb constructions. Thus, in the following sentence it is contestable whether the phrase *to the press* is a complement of the noun *statement* or the verb *wrote*.

He wrote a **statement** to the press about the bribery case.

Regardless of the analysis, FrameNet tags the phrase with the FE Addressee as a complement of the target word *statement*. By allowing this phrase under either of the disputed analyses, we avoid the constituency decision completely.

It would have been theoretically justifiable to omit selecting phrases outside of the standard **subcategorization frame** of a target word, or we could have limited such excursions to the subjects of finite verbs. However, since one of our goals is to provide a database that includes samples of phrases capable of satisfying particular FE requirements of the words we analyzed, our decision increased the size of such a sample.

In the process of noting the function of such words, we have also taken on the obligation of recording the actual support verbs we encountered. Thus, the database is also a resource for identifying the support verbs that our annotators have often found accompany particular nouns and adjectives. In doing this, we have taken a relaxed rather than a strict view of identifying support verbs, including not only the traditional "light" verbs, such as *make* (as in *make an attack*), but also such semantically richer verbs as *launch* (as in *launch an attack*), etc. An extension of FrameNet could be defined which sought to include the full range of **Lexical Functions** in the sense of I. Mel'cuk(Mel'cuk 1996).

### 4.2.2 Object (Obj)

Any normal object, any *wh*-extracted object, or any post-target-verb NP which controls the subject of a complement of the target verb is assigned the grammatical function Obj, as shown here.

Voters **approved** [the stadium measure].

[What] did you **cook** for dinner?

They **expect** [us] to finish soon.

They **made** [us] eat our vegetables.

In some syntactic theories, the NP *us* in the last two examples would be treated as the subjects of small clause complements, and not as Objects of the target words. We have decided to treat all post-verbal NPs of this type as Objects in order to simplify the task of tagging.

The GF Object is also assigned to any subject of a *tough*-predicate which satisfies the Object role of a verb or preposition in the complement of the *tough*-predicate.

[Artichokes] are hard to **eat**.

### 4.2.3 Complement (Comp)

Complement is the general grammatical function assigned to PPs, VPs, Clauses (and a small number of NPs) which occur after their governing verbs, adjectives or nouns in normal declarative sentences. This grammatical function includes both what are usually referred to as *complements* and what are usually referred to as *obliques*. One reason we do not recognize Oblique as a distinct grammatical function is that it seems merely to be reserved for PPs that are complements. In other words, it redundantly encodes phrase type. For those who wish to maintain the distinction between complement and oblique, keep in mind that any PP which is assigned the GF Complement can be considered an oblique.

#### PP Complements

The GF Complement is assigned to any particle or any PP, optional or obligatory, which expresses a semantic role belonging to the frame associated with the target word. This does not include setting adjuncts of PLACE or TIME, purpose clauses, or other such expressions which can occur with very large classes of predicators. Here are some examples of of the Complement GF.

**Give** the gun [to the officer].

Pat **spoke** [to me].

Pat **lives** [in Cleveland].

**Note:** A Locative expression may be a Complement if it expresses a role belonging to the frame of the target predicator. In the third example above, the PP *in Cleveland* is a Complement because the frame of the verb *live* (='reside') includes a role for the place in which a person lives.

**Some NPs are marked as Complements rather than as Objects.** These NPs are not passivizable, and they often express Place, Time, and other meanings normally associated with adjuncts and PP complements (e.g. Measurement). Such NPs are often Complements in the same contexts in which comparable PPs might be used instead.

I **run** [ten miles] every day.

**Come** [this way]!

I **expect** your papers [the moment you walk into class].

In keeping with conventions of Construction Grammar, the second object of ditransitives is treated as a Comp. FrameNet does not have a category for

second object and does not assign the grammatical function Object a second time in ditransitive sentences.

They **gave** the children [candy].

The children were **given** [candy].

**A note on particles:** Even if a preposition seems to 'go with' a verb to form a phrasal verb, if it can plausibly be considered the head of a post-verbal PP it is analyzed that way, and the PP is assigned the GF Comp. Separable verb particles, like *up* in *pick up the package* (and *pick the package up*), cannot plausibly be treated as the heads of PPs. They are therefore marked with the GF Comp by themselves, and the NPs with which they occur are treated as GF Obj. Of course, as noted above, when they are treated as part of a multiword expression, these questions do not arise.

In passive sentences, these NPs are treated as GF Subj.

Pat **picked** [up Comp] [the package Obj].

Pat **picked** [the package Obj] [up Comp].

[The package Subj] was **picked** [up Comp] by Pat.

For more information on particles, see the appropriate section in the chapter on Phrase Types.

Locative adverbs such as *here* and *there*, when used as true complements, are also assigned the GF Comp.

Chuck **went** [there Comp].

#### Verbal and Clausal Complements

Any verbal or sentential complement, regardless of whether or not it is passivizable is assigned the GF Complement, as shown here.

They **want** [to stay home].

They **expect** us [to stay home].

I **believe** [that you are the winner].

They **think** [you are the president].

You **persuaded** me [to finish early].

I **wonder** [who will finish first].

### 4.2.4 Modifier (Mod)

Modificational adverbs such as those indicating manner or ending in *-ly*, as well as related modificational adverbs denoting speed, are assigned the GF Mod.

The board [quickly] **resolved** the problem.

## 4.3 Assigning GFs for Adjectives

### 4.3.1 External Arguments of adjectives

When an adjective appears in a clausal predication, one of its arguments is expressed as the subject of a support verb (indicated with underlining) and of the clause as a whole, as in the following examples.

[The chair] is **red**.

[My sister] seems more **interesting** than yours.

This constituent is assigned the GF External Argument (Ext). Also, the noun in object-control constructions with adjectives is assigned the GF External Argument, illustrated below.

We consider [Pat] very **intelligent**.

Note that copulas and support verbs are not assigned GFs.

### 4.3.2 Modified head nouns with pre-nominal adjectives

In pre-nominal uses of adjectives, the modified head nouns are assigned the GF Head (Head).

the **small** [children Head]

Only some types of sentences in which a target adjective appears in pre-nominal position will actually be annotated and included in the database of corpus examples. These are the sentences in which the adjective has a *qualitative* as opposed to a *relational* use.

In a qualitative use, the modified noun expresses an element of the frame associated with the adjective, and this is the same frame element which is typically expressed by the subject of the verb BE or other clausal predication (in which the adjective occurs in predicate position):

The children are **small**.

Note that in these cases, the annotators tag the verb with the label Supp on the POS-Layer.

In a relational use of an adjective, it is much more difficult to identify a specific frame element which is expressed by the modified noun. In fact, the semantic relation between the adjective and noun may be more strongly determined by the modified noun than by the adjective. In any event, the relation between modifier and head is much less tightly constrained than in cases of qualitative modification, resembling the relation between nouns in a noun compound. Very often relational uses of adjectives do not have corresponding predicative uses:

Pat had an immune response to the virus.

*Pat's response to the virus was immune.

We do not annotate relational uses of target adjectives because doing so is unlikely to reveal much that is interesting about the frames associated with the adjectives. Instead, they should be captured as fillers of roles in frames evoked by the nouns they modify.

Many cases of relational modification (like many noun compounds) are highly conventionalized. Such cases will be treated as idioms when they are relevant to a particular domain, and will be identified with respect to their head nouns rather than their adjectives. For example, *immune response* will be treated in the health care domain as a lexical unit headed by *response*, rather than as a particular use of *immune*.

### 4.3.3 Post-nominal adjectives

In post-nominal uses of adjectives, their arguments are treated as if the adjective were used with a copula. In particular, modified head nouns are assigned the GF External (Ext) and the PT Noun Phrase (NP) rather than the GF Modifier (Mod) and the PT Noun (N). Thus, in the following example, *people* has the grammatical function Ext and the phrase type NP.

The problem seems to affect [people] **sensitive** to primulas.

### 4.3.4 Adverbial Modifiers of Adjectives

Adverbial modifiers of adjectives are assigned the GF Mod.

The [very MOD] **beautiful** woman left the office.

Certain degree adverbs may also modify adjectives, and are therefore assigned the GF Mod with adjective targets, as shown below.

That was [so Mod] **silly** of you.

[How Mod] **offensive** that movie was!

It was a [quite Mod] **remarkable** feat.

### 4.3.5 PP Complements of Adjective

Some adjectives welcome PP Complements, to which we assign the GF Comp.

Jo is not **aware** [of his bad behavior Comp].

Lee is **certain** [of his innocence Comp].

## 4.4 Assigning GFs for Prepositions

For most frames prepositions are not among the target words. However, they are targets in frames that cover the vocabulary of space, time, and motion. In these frames, we need to be concerned with assigning GFs for the relevant constituents.

### 4.4.1 Objects of prepositions

Any constituent which occurs immediately after a preposition and which expresses an element of the frame associated with the preposition is tagged as an Object (**Obj**). Typically this constituent is an NP, but it can also be a gerund or a clause:

We had a glass of wine **before** [the meal].

Wash your hands **before** [returning to work].

He left **before** [I had a chance to say anything].

### 4.4.2 External Arguments of prepositions

A constituent which expresses an element of the frame associated with a preposition, but which is outside the PP, is tagged as an External Argument (**Ext**). The most easily identified prepositional External Arguments are those which occur with so-called reduced relative clauses (i.e. post-nominal modifiers) and with copular predications:

[the day] **before** yesterday

[the trail] **to** our campsite

[the ball] **under** the table

[The ball] is **under** the table.

## 4.5 Assigning GFs for Nouns

### 4.5.1 Assigning GFs for Nouns (Comp)

The GF Comp is assigned to any post-nominal complement of a target noun, example sof which are shown here.

the **fact** [that cats have fur]

a **letter** [to the President]

a **story** [about a young entrepreneur]

your **attempt** [to scare me]

our **arrival** [at the station]

Sometimes complements of nouns are realized as the predicates of copular sentences, e.g.

The **fact** is [that cats have fur].

The **letter** was [to the President].

The **attempt** was [to scare you].

In order to assist the computer in this process it is necessary to tag the copula which follows the target and introduces the 'predicate complement' in these expressions. For this purpose annotators use the simple tag Copula (Cop) on the Other-Layer.

### 4.5.2 Assigning GFs for Nouns (Ext)

There are a few cases in which frame-evoking nouns have an External argument of their own. One is with support verbs, as in

[He EXT] made a **statement** to the press.

Another is when the frame-bearing noun is governed by a control noun:

[My EXT] attempt at an **agreement** with Pat failed.

### 4.5.3 Genitive determiner of noun (Gen)

The GF Gen is assigned to any possessive NP functioning as determiner of a target noun, as indicated here.

[your GEN] **book**

[your work's GEN] **influence** on the field

Note that we use the term Possessive (Poss) to refer to the phrase type of Genitive NPs.

### 4.5.4 Modifier of noun (Mod)

The GF MOD is assigned to any pre-nominal modifier (whether a noun, adjective, gerund, or participle), as shown below.

[allergy] **treatment**

[monthly] **stipend**

[sleeping] **cat**

[broken] **lamp**

### 4.5.5 Quantification Modifiers (Quant)

The GF Quant is assigned to a pre-nominal modifier of a target noun, including the indefinite determiner when it functions as a number, illustrated below.

[two] **cups** of coffee

[a] **glass** of wine

### 4.5.6 Appositives

(Appos)
The GF Appositive is assigned to post-target appositional Ns or NPs.

> Libel **lawyer** [Jonathan Crystal APPOSITIVE] represented the plaintiff.

# Chapter 5

# Lexical Entry Structure

## 5.1 Lexical Entries

FrameNet lexical entries are sets of lexical sub-entries, each of these being a record of what FrameNet has recorded for the lemma in one of its senses. (Since our work has proceeded one frame at a time, rather than one lemma at a time, there are not many instances of multiple sub-entries in the database.

An individual lexical entry, then, covers a lemma in a particular part of speech, e.g., as verb or as noun. A lexical sub-entry is intended to represent a single lexical unit, i.e., a lemma in a given part of speech in a single sense.

A lexical sub-entry comprises the following components:

1. Headword: the lexeme to be defined
2. Frame: a path to the individual background frame, e.g. Attaching, Judgment_communication, or Weather
3. A definition, taken from the Concise Oxford Dictionary, 10th Edition, or written by a FrameNet lexicographer
4. Table of Frame Element Realizations: a full list of the syntactic ways, in terms of grammatical function and phrase type, in which Frame Elements have been expressed in the annotated sentences
5. Table of Valence Patterns: a list of the groupings of Frame Elements and their syntactic realizations as found in the annotated sentences
6. Annotated sentences (where each sentence is annotated in respect to a single target word and the semantic roles which neighboring phrases bear to that word)

The Frame Element Realization table and the Valence Pattern table are derived automatically from the sentence annotations. Each item in each of these tables is linked to the annotations that exemplify it.

In short, a FrameNet entry provides information, for each sense, about frame membership and the syntactic means by which each Frame Element is realized in the word's surroundings, and summarizes, as Valence Patterns, the full range of combinatorial possibilities as attested in the Corpus.

## 5.2 Incorporated Frame Elements

There are many verb frames which involve a particular kind of entity, in general, and some of these words incorporate information about a particular entity type in their meaning. Consider verbs of body movement, where a typical case is a verb which is expected to co-occur with the name of a body part, even when the identity of the body part is clear from the meaning of the verb. A dog *wags its tail*, people *arch their brows*, *bat their eyes*, *purse their lips*, etc. However, in the case of *smile*, *grimace*, *frown*, *pout*, and *scowl*, the affected body-part is not separately presented. We say that it is **incorporated**. Notice that with some verbs in this frame the affected body part can either be present or not: we can say either (*She blinked* or (*She blinked (her eyes)*. For such cases, the information about incorporated FEs is given in the lexical entry of the word.

We will provide complete lexical entries for each lexical unit in the FrameNet database in the final release of the data.

# Chapter 6

# Semantic Relations

There are several different kinds of semantic relations in the FrameNet database. These consist primarily of frame-to-frame relations which indicate semantic relationships between collections of concepts. In addition, **semantic types** are employed for a variety of purposes, marking features on frames, frame elements, and lexical units. Recording all of these relations in the database remains a high priority.

## 6.1 Frame-to-frame Relations

The FrameNet database records information about **Subframe**, **Inheritance**, **SeeAlso**, **Use**, **Inchoative_of** and **Causative-of** relationships between frames. Marking of these relationships is a work in progress, especially in the case of the Inchoative_of and Causative_of relations, both of which were only recently added to our repertoire.

### 6.1.1 SubFrames

Some frames are complex in that they designate sequences of states of affairs and transitions between them, each of which can itself be separately described as a frame. The separate frames are related to the complex frames via the SubFrame relation. In such cases, frame elements of the complex frame may be identified (mapped) to the frame elements of the subparts, although not all frame elements of one need have any relation to the other. (In this respect, it contrasts with inheritance; see below.) Also, the ordering and other temporal relationships of the subframes can be specified using binary precedence relations. To illustrate, consider the complex Criminal_process frame, defined as follows: A Suspect is arrested by an AUTHORITY on certain CHARGES, then is arraigned as a DEFENDANT. If at any time the DEFENDANT pleads guilty, then the DEFENDANT is sentenced, otherwise the DEFENDANT first goes to trial. If the VERDICT after the trial is guilty, then the DEFENDANT is sen-

tenced. In the end, the DEFENDANT is either released or is given a SENTENCE by a JUDGE at the sentencing. For each step in the process, there is a separate frame in the database, including Arrest, Arraignment, Trial, Sentencing, and so on. Each of these frames is related to the Criminal_process frame via the SubFrame relation in the frame editor. Moreover, subframes (of the same complex frame) are related to each other through their ordering.(Fillmore & Baker 2001; Narayanan *et al.* 2002)

Notice that a given subframe may itself be a complex frame. For example, the Trial frame is a subframe of the Criminal_process frame, and has its own rich structure, some of which can be decomposed into simpler frames that are related to each other. A Trial is made up of court appearances, and involves opening arguments, presentation of evidence and testimony, and closing arguments. The system of subframe links is also quite complex. At present, the SubFrame relation is not indicated across the entire database.

### 6.1.2 Frame Inheritance

Frame inheritance is a relationship in which a child frame is a more specific elaboration of the parent frame. In such cases, all of the frame elements, subframes, and semantic types of the parent have equally or more specific correspondents in the child frame. For example, the Perception_active frame, evoked by concepts such as *listen* and *watch*, inherits from the more general Perception frame, and thus all the frame elements of Perception have correspondents in the Perception_active frame as follows:

| Perception_active | Perception |
|---|---|
| Ground | Ground |
| Perceiver_agentive | Perceiver |
| Phenomenon | Phenomenon |

This means that Perception_active is a more specific kind of Perception, and that the PERCEIVER_AGENTIVE role is a more specific instance of the PERCEIVER role, in which additional restrictions involving the PERCEIVER's active participation are imposed. As an example of how subframes correspond in an inheritance relationship, the Cause-to-move frame has Motion as a subframe, and thus its descendant, Carrying, must also have Motion (or a more specific kind of Motion) as a subframe.

In some cases a single word may evoke multiple frames simultaneously. In such cases, we say that the lexical unit belongs to a frame which inherits from both. This is called **multiple inheritance** (formerly referred to as *frame blending*).

An example of such a case is Judgment_communication, which inherits from Communication and Judgment. The two judgment frames share the following canonical structure

```
A __ed B for C-ing
```

representing the JUDGE (A), the EVALUEE (B) and the REASON for the judgment (for C-ing). As part of the inheritance relationship between these two frames, the Judgment_communication frame elements JUDGE, EVALUEE, and REASON are identified or **mapped** to the corresponding frame elements in the Judgment frame. In contrast, Judgment_communication and Communication, share the roles of SPEAKER, ADDRESSEE, and TOPIC. In the Judgment_communication frame the SPEAKER role is identified with the JUDGE and for some lexical units, such as *scold*, *berate*, *flatter*, and *compliment*, the ADDRESSEE role is, identified with the EVALUEE.

The inheritance relations are included in the Frame Information web report.

### 6.1.3 SeeAlso

In cases where there are groups of frames which are similar and should be carefully differentiated, compared, and contrasted, each of the frames in question will have a SeeAlso relation with a representative member of the group. In the frame definition of the representative member, there will be a comparison which will contrast the frames to make clear the intended boundaries between them. For example, since the Scrutiny and Seeking frames are similar, there is a SeeAlso relation from Scrutiny to Seeking, and text in the Seeking frame that explains the difference.

This relationship does not denote any particular relationship between the Frame Elements or Subframes of the frames involved.

### 6.1.4 Use

Often a particular frame makes reference to the structure of a more abstract, schematic frame. Typically, this occurs in cases where the Specific frame provides a specific perspective of the Schematic frame. For these, we say the that the Specific frame has a Use relationship with the Schematic frame, and bindings between the Frame Elements and Subframes may be specified. For example, the Commercial_transaction frame specifies a complex schema involving an exchange of multiple Themes (the MONEY and GOODS) between the BUYER and SELLER. The BUYING frame has a Use relationship with the Commercial_transaction frame in which the MONEY, GOODS, BUYER, and SELLER are identified.

This type of relation can capture the FrameNet I concept of domains. In FrameNet I, frames were organized by domains - very general categories of human experience and knowledge - to cover various areas of the English vocabulary and to provide useful groupings of semantic frames. Domains also had a degree of theoretical significance: they were broad-level generalizations over the frame network that we are constructing.

Many frames will have Use relationships simultaneously with inheritance relationships. In such a case, the Use relation will specify something like the basic domain of relevance, such as Cognition, Communication, Society, Body, Crime and Justice, Life and Death, Education, etc. (The frames that serve as a

basis for Use relationships have alternatively been called *background frames* or *big frames*.) The frame or frames from which a frame inherits would be more akin to image-schemas, including Giving and Receiving, Containing, Emitting, Motion, etc. This combination of relationships will facilitate incorporating the notion of perspective into the database.

### 6.1.5 Causative_of and Inchoative_of

We recognize the especially close and fairly systematic non-inheritance relationships between certain kinds of frames, in particular, the relationship of stative frames and the inchoative and causative frames built from them, with the frame-to-frame relations **Causative_of** and **Inchoative_of**.

To illustrate, consider the following frames: Attaching, Inchoative_attaching, and Be_attached.

The Attaching frame is related to the Inchoative_attaching frame via the Causative_of relationship, and the Inchoative_attaching frame is related to the Being_attached frame via the Inchoative_of relationship.

The following sentences illustrate the kind distinction captured in these frames.

> The magician **attached** Paul to a chair with a rope. Attaching
>
> The remoras **attached** to the whale with their jaws. Inchoative_attaching
>
> The tarp remains **attached** to the frame with a rope. Being_attached

## 6.2 Semantic Type

We employ the mechanism of Semantic Type in order to capture semantic facts about frames, FEs, or LUs that don't necessarily fit into our developing hierarchy of frames. One of the major uses of semantic types is recording important semantic differences between lexical units that cut across frames, such as "Positive evaluation" and "Negative evaluation".

For example, lexical units across a range of frames may incorporate positive versus negative evaluation. Consider (again) the Judgment verbs *praise* and *criticize*, the Experiencer_subject verbs *like* and *hate*, and the Frugality adjectives *generous* and *stingy*. We can indicate the semantic type "Positive evaluation" on the first word of each pair, and "Negative evaluation" on the second, thus recording the information in the database.

Other uses of semantic types include:

- Basic typing of fillers of frame elements, e.g. "Sentient" for the Cognizer FE
- Useful, functional marking on frames, such as the type "Non-lexical" on frames which are present purely to participate in inheritance, subframe, or use relations with other frames

- Useful, functional marking on lexical units, especially the case where a lexical unit (e.g. *Wednesday* in the Calendric_unit frame) is not to be annotated because it is essentially identical to other lexical units which have been annotated.

# Chapter 7

# Recent Innovations and Future Plans

## 7.1 Recent Innovations and Future Plans

### 7.1.1 Coreness

While we have been working with the idea of core (vs. non-core) frame elements since the earliest phase of FrameNet, only recently have we implemented a more carefully articulated definition of the concept. To be specific, we classify frame elements in terms of how central they are to a particular frame, distinguishing three levels: **core**, **peripheral**, and **extrathematic**. A fourth possible value for this attribute, called **core-unexpressed** is also discussed below.

A core frame element is one that instantiates a conceptually necessary participant or prop of a frame, while making the frame unique and different from other frames. For example, in the Revenge frame, AVENGER, (PUNISHMENT, OFFENDER, INJURY, and INJURED_PARTY are all core frame elements, because an avenging event necessarily includes these participants. Frame elements that do not introduce additional, independent or distinct events from the main reported event are characterized as peripheral. Peripheral FEs mark such notions as TIME, PLACE, MANNER, MEANS, DEGREE, and the like. They do not uniquely characterize a frame, and can be instantiated in any event frame. In respect to the Revenge frame, any report of an event of revenge may also include explicit information about the time, place, manner, etc. of the revenge.

> The bereaved family **retaliated** [immediately TIME].

Extrathematic frame elements situate an event against a backdrop of another event, either of an actual event of the same type, as illustrated with ITERATION or by evoking a larger frame within which the reported event fills a role, as shown for PURPOSE.

Lee called the office [again ITERATION].

Abby went to Philadelphia [to study law PURPOSE].

The value "Core-Unxpressed" means that the FE is Core. It is also notational shorthand for recognizing that the FE is core in the frame, and therefore should appear in all descendant frames, though in practice it can only be used for annotation in the current frame. As such, it will not be listed among the FEs in descendant frames. This is not a violation of our definition of full inheritance, but rather syntactic sugar intended to keep frames which are low in the lattice from becoming cluttered with inherited FEs which will never be used in annotation in those frames.

Coreness marking makes the most sense for event and state frames, and in these frames we use all three statuses. Coreness marking is done at the level of the frame and is intended to be consistent for all lexical units in a frame. In frames whose LUs are artifacts or natural kinds, we only use a two-way distinction (core and peripheral), noting that the values do not have exactly the same meaning as with events. In such cases, typically there is just one core frame element which is marked on the target word. For instance, in the Clothing frame the FE CLOTHING is core, and all other FEs are peripheral.

### Coreness Sets

We have found that some groups of FEs seem to act like sets, in that the presence of any member of the set is sufficient to satisfy a semantic valence of the predicator. We refer to such a group of FEs as a **coreness set**, or **CoreSet**. For instance, SOURCE, PATH, and GOAL are core FEs in the various motion frames in the database. However, although possible, it is not necessary for all of the FEs to occur, as shown below.

Fred **went** [from Berkeley SOURCE] [across North America and the Atlantic Ocean PATH] [to Paris GOAL].

Fred **went** [from Berkeley SOURCE] [to Paris GOAL].

Fred **went** [to Paris GOAL].

Thus, if only one of them occurs in a sentence annotated in a motion frame, we consider it to be sufficient to fulfill the valence requirement of the target word.

### Requires

In some cases, the occurrence of one FE in a coreness set requires that another occur as well. To illustrate, in the Attaching frame ITEM, GOAL, and ITEMS constitute a coreness set. If ITEM occurs, then GOAL is required, as shown below, where the sentence without a GOAL is unacceptable. In this situation, we mark a "requires" relation between the two frame elements.

The robbers **tied** [Paul ITEM] [to his chair GOAL].

* The robbers **tied** [Paul ITEM].

**Excludes**

In some cases, if one of the FEs in a CoreSet shows up, no other FE in that set can. Again, in the Attaching frame, if ITEMS occurs, then ITEM and GOAL are excluded. In this situation, we say that ITEMS excludes ITEM and GOAL.

The robbers **tied** [his ankles ITEMS] together.

A clear instance of the excludes relation between frame elements can be shown in the Communication frame, where usually either the TOPIC or a more detailed MESSAGE is expressed, but not both, as shown below. Here, the occurrence of both FEs produces an ungrammatical sentence.

She talked [about actors TOPIC].

She said [that Richard Gere is her favorite MESSAGE].

* She said/talked [about actors TOPIC] [that Richard Gere is her favorite MESSAGE].

### 7.1.2 Reframing

Having decided to change (generally, refine) the granularity of our analysis, we have reanalyzed many frames; we call this process **reframing**. For the most part, we reassign annotation from the LUs of a source frame to the LUs of a destination frame, or (in the simplest cases) we reassign entire LUs from the source to the destination. In most cases, the new analysis is more nuanced than the old, and that requires first defining new destination frames, with distinct sets of FEs and LUs.

One important reason for reanalyzing a frame (or group of related frames) is to capture semantic distinctions such as causative vs. inchoative vs. stative, that we now use systematically as the basis for distinguishing frames. For example, in an early version of the Expansion frame, we annotated causative sentences as well inchoative sentences, such as those shown here.

Milly **stretched** the taffy until it broke. [Causative]

The taffy **stretched** until it broke. [Inchoative]

With reframing, we end up with two separate frames: Cause_expansion for the causative and agentive sentences; and Expansion for the inchoative examples.

Some Lexical Units like *blow up*, occur only in the causative frame; some, such as *grow* and *swell* occur only in the inchoative frame; others, like *inflate*, *stretch*, and *expand* occur in both of the frames. For those LUs that occur in both frames, the annotation of the original LU is split so that everything

that makes reference to the FEs CAUSE, AGENT, or PURPOSE occurs in the Cause_expansion frame, and everything that makes reference only to the ITEM and its SIZE_CHANGE will go in the simple Expansion frame.

We recognize the close and fairly systematic relationships between the stative and the inchoative and causative frames with the (new) frame-to-frame relations Causative_of and Inchoative_of, discussed earlier. 6.1.5

### 7.1.3 Future Plans

#### FrameNet API

A number of users of the FrameNet data have suggested that we need to defined an API and build a library to allow other programs to easily access FrameNet information. For example, given a verb, it should be possible to find out what frame(s) it occurs in, and what other verbs occur in that frame or those frames. A prototype has been built, with a command line interface, but it is not ready for distribution.

#### FrameNet and the Semantic Web

In addition to the current data release, we plan to release FrameNet data in RDF/OWL suitable for use as part of the semantic web initiative (Narayanan *et al.* 2002; Narayanan *et al.* 2003). A program to convert the proprietary XML format for the FrameNet I data to RDF has been written by Srini Narayanan, and a conversion of the FrameNet II data is planned for the winter of 2003-2004.

#### Open FrameNet

In line with the open source software initiative, we are exploring the possibility of an "open source" FrameNet, or "Open FrameNet". To this end, we must find a balance between allowing experts in various technical domains to contribute frames and frame element definitions to the FrameNet database and maintaining the integrity of the database. One possible model that has been suggested to us is the Parallel Grammar Project (http://www2.parc.com/istl/groups/nltt/pargram/), which is developing LFG grammars for various languages under the aegis of a consortium of research centers who meet periodically to agree on common principles and grammatical features.

We are taking some tentative steps in this direction with collaborators in Spain, Germany and Japan. In Barcelona, the Spanish FrameNet project is using the frames and FEs from the FrameNet database and the FrameNet annotation and report-generation software to create LUs for Spanish and annotate corpus examples, exactly as we do in Berkeley. In Saarbrücken, members of the SALSA project are annotating running text from a newspaper corpus with their own software, but using FrameNet frames and FEs wherever possible. In Tokyo, researchers at Keio and Tokyo universities are collecting corpus examples of words grouped according to frames, although they do not have annotation software yet.

A number of users of FrameNet data have expressed interest in developing frames and doing annotation in particular semantic domains, such as medical records, patent applications, recopies, etc. We are actively seeking means whereby work in such specialized domains could be integrated into the general FrameNet database and thus shared with other users.

# Appendix A

# Publications related to FrameNet

## Frame Semantics Background


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in Semantics and Lexical Organization. Hillsdale: Lawrence Erlbaum Associates, 75-102.

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## Recent Papers by FrameNet Staff

Many of these papers are available for down-load as .pdf or word files at the FrameNet web-site: http://framenet/icsi.berkeley.edu/~framenet.

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# Index