

# FrameNet at 25

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## Abstract

The launch of the FrameNet project in 1997 was both a crystallisation point of decades worth of theoretical investigations into lexical meaning by Charles J. Fillmore and colleagues, as well as the seed of an ongoing line of corpus-based and computational research that seeks to implement Fillmore's theory of Frame Semantics in a way that both provides an interesting model relevant for further theorising and also is applicable practically for semantic analysis, lexicology, and lexicography.

At the occasion of FrameNet's 25th birthday, we want to introduce the project to a new generation of researchers but also take stock of, and report on, what has been achieved. We revisit the origins of the FrameNet project, assess its development and various changes in the years since it was first reported on in a special issue in the pages of this journal twenty years ago.

**Keywords:** Frame Semantics; FrameNet; Corpus Linguistics; Computational Lexicography

## 1. Introduction

Since 1997, the FrameNet project has been working on creating a lexicographic database of English based on the principles of Frame Semantics (Fillmore 1982).<sup>1</sup> The FrameNet database is the result of a corpus-based workflow in which different teams of lexicographers have been collaborating on identifying and describing semantic frames together with the words that evoke them. FrameNet consists, among other things, of several thousand semantic frames organised in a frame hierarchy and more than 10,000 frame-evoking lexical entries which provide detailed information about the semantic frames they evoke, together with valence information about how the semantics of frames are realised syntactically. The lexical entries are the result of manually annotated corpus sentences displaying semantic Frame Elements and their syntactic realisations.

This paper is structured as follows. Section 2 first provides a historical overview of the intellectual roots of FrameNet (henceforth: FN) by looking at the early work on Case Grammar by Charles Fillmore (1968). It then discusses the reasons for the eventual abandonment of Case Grammar and the gradual move towards Frame Semantics by Fillmore during the late 1970s and early 1980s. Next, it shows how a series of seminal papers providing the blueprint for FN, such as Fillmore & Atkins (1992) and Fillmore & Atkins (1994), directly evolved out of Fillmore's (1982) Frame Semantics and subsequent research during the 1980s. Section 3 gives an overview of the workflow underlying FN and the different types of data contained in FN together with an overview of how they can be accessed

by humans and computers. It also discusses how semantic frames can be used for full text annotation and how the FN database was modified to also house entries of grammatical constructions. Section 4 addresses some methodological issues underlying the design and workflow of FN. Finally, Section 5 summarises the paper and provides some thoughts about the future of FN-inspired research.

## 2. FrameNet: Historical Overview

### 2.1 From Case Frames to Frame Semantics

The intellectual roots of FN can be traced back to the pioneering research by Charles J. Fillmore in the 1960s, when he proposed a novel way of looking at the relationship between form and meaning. In his (1968) paper *The Case for Case*, Fillmore looked at lexical meaning and the syntactic structure of sentences containing words with those meanings.<sup>2</sup> More specifically, he proposed that valence patterns are best characterised in terms of constellations of semantic role types and their syntactic correlates.

To achieve this goal, Fillmore suggested a limited set of so-called universal deep cases such as Agentive, Instrumental, and Objective that specify a verb's semantic valency. For example, in the sentence *The janitor will open the door with this key, the janitor* is the Agentive, *the door* is the Objective, and *with the key* is the Instrumental. The deep cases were defined independently of verb meanings and were supposed to determine the syntactic distribution of a verb's arguments. One crucial aspect of Fillmore's deep cases was that each syntactic argument should only bear one semantic role; another aspect was that deep cases were unanalysable.

Fillmore (1968) inspired a significant amount of research on deep cases in the late 1960s and early 1970s (see Somers 1987, Klotz 2000), but during the 1970s it became apparent that the limited number of deep cases posed problems. First, it was not clear how to systematically determine the granularity of deep cases (or semantic cases or semantic roles as they became known). Second, the lack of systematic tests for determining the status of deep cases and how to differentiate them from other deep cases was seen as problematic. Third, several researchers pointed to data showing that the one-to-one correspondence between deep cases and semantic arguments did not work (for details, see Chapin 1972, Jackendoff 1972, Fillmore 1982, Jackendoff 1983, Cruse 1986, Dowty 1991, Dowty 2003, Levin & Rappaport Hovav 2005, Andor 2010, Boas & Dux 2017).

The problems surrounding the concept of deep cases led Fillmore eventually to abandon his earlier proposals and to reconceptualize the relationship between meaning and form, eliminating the idea of a limited set of semantic roles for representing meanings of words. The following quote illustrates Fillmore's thoughts about the ever-increasing list of additions and exceptions to his original list of semantic roles (a.k.a. deep cases) he proposed in his 1968 paper.

In recent years I have not had much to say about my proposals on case grammar or about the many extensions, improvements, and corrections of it that have been proposed. (...) My own silence on the subject may have been taken, I fear, as an embarrassed withdrawal. (...) Actually, the reason that I have pulled back is the same as the reason I get dissatisfied with a filing system for my notes when I suddenly become aware that the box labelled "MISCELLANEOUS" contains more than all the rest. There were just too many things I could not account for. (Fillmore 1977a: 60)

Instead of proposing a limited set of universal semantic roles (a.k.a. deep cases in Fillmore (1968)), Fillmore (1977a: 59) proposed that "meaning is relativized to scenes," and that the meaning should be captured in terms of situation-specific semantic roles (Fontenelle 2000: 234). In a series of papers in the late 1970s, Fillmore (1977a, 1977b, 1978, 1979) discusses

several different types of data showing how cultural and world knowledge motivates and is embedded in linguistic expressions.

For example, Fillmore's analysis of the meaning and use of the word *alimony* demonstrates that there are different types of knowledge needed to correctly interpret such a word, such as legal acts, the marriage relationship, and money. According to Fillmore, when "we interpret a text, we bring to the task more than our knowledge of the language - knowledge about the world, beliefs about human nature, assumptions about typical instances of objects, repertoires of stereotypic instances of behaviour, and so on." (Fillmore 1977a, Lect. 3, end of sect. 7) Insights such as these about the various complexities involved in interpreting and using words in particular contexts contributed to Fillmore's departure from abstract semantic role sets as in Case Grammar that analysed meaning in a top-down fashion. Instead, Fillmore started to focus more on a bottom-up method of linguistic analysis that analysed each semantic frame by itself, describing and analysing meaning frame by frame.

This novel way of thinking resulted, among other things, in Fillmore's (1982) paper on Frame Semantics, in which he, for the first time, discusses the various aspects of a theory of meaning that would some 15 years later become the basis for the FrameNet project. As foreshadowed in his writings of the late 1970s, the issue of understanding a word's meaning is at the centre of Fillmore's research program. More specifically, he suggests that ...

words represent categorizations of experience, and each of these categories is underlain by a motivating situation occurring against a background of knowledge and experience. With respect to word meanings, frame semantic research can be thought of as the effort to understand what reason a speech community might have found for creating the category represented by the word, and to explain the word's meaning by presenting and clarifying that reason. (Fillmore 1982: 112)

The most central concept of Frame Semantics is that of a frame, which can be thought of as "any system of concepts related in such a way that to understand any one concept it is necessary to understand the entire system; introducing any one concept results in all of them becoming available." (Petrucci 1996: 1)<sup>3</sup> One of the core ideas of Frame Semantics is that word meanings are defined in terms of frames and prototypes, as in the commercial transaction frame which consists of the elements Buyer, Seller, Money, and Goods, which can be thought of as situation-specific semantic roles.

The commercial transaction frame is said to be evoked by a set of semantically related words such as the verbs *to buy*, *to sell*, *to pay*, and *to cost*, nouns such as *payment* and *money*, and adjectives such as *expensive* or *cheap*. Each of the words evoke different aspects of the frame. For example, *to buy* gives the perspective of the Buyer and the Goods while backgrounding the Money and the Seller (e.g. *Kim bought the book*).<sup>4</sup> In contrast, *to sell* presents the perspective of the Seller and the Goods, backgrounding the Buyer and the Money (e.g. *Sascha sold the books*), while *expensive* highlights the Goods and the (high amount of) Money (e.g. *This book was expensive*). Descriptions of the words evoking a semantic frame do not only capture semantic aspects, but they also capture grammatical properties together with the different syntactic patterns in which they occur, according to Fillmore. For example, *to buy* (in active form uses) requires the obligatory syntactic realisation of the Buyer and the Goods, while allowing the Money and the Seller to be omitted. In contrast, *to sell* requires the obligatory syntactic realisation of the Seller and the Goods, while allowing the Money and the Buyer to be omitted.

Over the past four decades, Frame Semantics has been primarily used for the analysis of lexical semantics by analysing how words evoke semantic frames and how the meanings of frames are realised syntactically. Insights from Frame Semantics have also been used to study text semantics and the semantics of grammar (see Petrucci 1996), specifically in the context of Construction Grammar (Fillmore et al. 1988, Fillmore & Kay 1993, Fillmore

2013; for an overview, see [Hoffmann and Trousdale 2013](#)), which is regarded as the “sister theory” of Frame Semantics. One of the most prominent applications of Frame Semantics, FrameNet, evolved out of lexicographic and lexicological studies analysing the frame-based organisation of the lexicon. The following subsection summarises the insights of some of the most prominent frame-semantic publications of the early 1990s, which can be regarded as the blueprint for the FN project.

## 2.2 From Frame Semantics to FrameNet

By the early 1990’s both scholarly research on lexical semantics ([Fillmore 1994](#)) and practical work on lexicography began to depend on newly available systems for computer-assisted lexicography ([Atkins 1992](#)). Charles Fillmore and Sue Atkins worked together on DELIS (from 1993 to 1995), a computational lexicography project that produced a lexicon of perception and communication verbs in five languages on frame semantic principles ([Emele & Heid 1994](#), [Heid 1994](#), [Heid 1996](#)). This collaboration between Fillmore and Atkins also resulted in a number of papers on Frame Semantics, some of which can be seen as the theoretical blueprint for the Berkeley FN project that eventually received funding for three years in 1997 from the National Science Foundation (see [Fillmore & Atkins 1992, 1994, 1998, 2000](#), among others).

The most prominent of these papers, *Toward a frame-based lexicon* ([Fillmore & Atkins 1992](#)), provides a frame-semantic analysis of “the single word RISK, the family of words that are the object of the larger research effort” that are “all of those English words whose semantic description share some reference to *the possibility of an unwelcome outcome.*” ([Fillmore & Atkins 1992: 79](#)) In this paper, Fillmore & Atkins provide a detailed description and analysis of the various types of words such as *risk*, *danger*, *peril*, and *venture* that are “understandable only to someone who is capable of realising that the future is uncertain, and that among the alternative possible futures that one faces are some that one might not want.” (1992: 79) They point out that the *Risk* frame involves two notions (that can be represented in terms of sub-frames), namely Chance, which involves risk-running (*being in danger* or *at risk*), and Harm, which involves risk-taking, where someone is making a choice (*take a risk*).

Based on a 25 million word corpus, [Fillmore & Atkins \(1992\)](#) discuss a broad variety of different uses of words in the *Risk* frame, they identify differences and similarities between nominal RISK and verbal RISK, and they identify several categories (which in FN would be called Frame Elements) that make up the *Risk* frame, including Chance (the uncertainty about the future), Harm (a potential unwelcome development), Victim (the individual who stands to suffer if the Harm occurs), Valued Object (a valued possessions of the Victim, seen as potentially endangered), Deed (the act that brings about a risky situation), and (Risky) Situation (the state of affairs within which someone might be said to be at risk) ([Fillmore & Atkins 1992: 81-83](#)).

One of the key aspects of [Fillmore & Atkins \(1992\)](#) is the explicit focus on the question of which so-called “patterns” occur with the words of the *Risk* frame. By patterns, Fillmore & Atkins mean specific grammatical categories such as direct objects, nominal objects, and gerundial objects. A key aspect of this way of looking at grammatical information involves the relation of patterns to the so-called “categories” (a.k.a. Frame Elements), i.e. the combination of form with meaning. For example, the authors point out the following:

There are three main RISK-schema categories represented grammatically as objects: Valued Object, Harm, and Deed. Because the Valued Object is always a “thing,” it is represented only by nominal objects; because Harm is an “event” and Deed is an “act,” these can be represented verbally (most commonly in gerundial form) or nominally (e.g., as a nominalization of a verbal notion or as a metonym of an event or an act). ([Fillmore & Atkins 1992: 89](#))

Fillmore & Atkins identify different syntactic patterns with the verb *risk*, each pattern realising the semantics of the frame in a different way. For example, they discuss how the Situation can be introduced in a prepositional phrase with *in* or *on*, as in *He was being asked to risk his good name* (Valued Object) *on the battlefield of politics* (Situation) or *Others had risked all* (Valued Object) *in the war* (Situation). The authors identify a total of 21 different patterns occurring with *to risk*, such as the following in Figure 1 in which the Valued Object is realised as a direct object and the Situation is realised as a prepositional phrase.

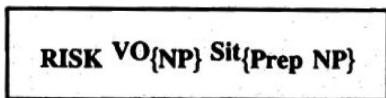


Figure 1: Valued Object as direct object, Situation as prepositional phrase (Fillmore & Atkins 1992: 88)

The architecture of the patterns identified by Fillmore & Atkins (1992) can be seen as a direct precursor of the frame element configurations in the valence tables found in FrameNet, see Section 3.1 below. Whereas the semantic and syntactic information are intimately intertwined in Fillmore & Atkins (1992), the valence tables in FrameNet split the different categories up into three different layers: Frame Elements, Phrase Type, and Grammatical Function as can be seen in Figure 2, in which there are two options for syntactically realising the Frame Elements Action, Asset, and Protagonist, as, for example in *He was risking his life by throwing it into the street* and *A concierge is not going to risk his reputation on recommending a poor restaurant*.

Number Annotated	Patterns				
5 TOTAL	Action	Asset	Protagonist		
(1)	PP[by] Dep	NP Obj	NP Ext		
(1)	PP[on] Dep	NP Obj	NP Ext		

Figure 2: Excerpt from the valence table of *to risk* in the Run\_Risk frame in FrameNet.<sup>5</sup>

In our view, Fillmore & Atkins (1992) formed the basis for the conception of a frame-based lexicon, which in 1997 was eventually established by Fillmore as the FrameNet project at the International Computer Science Institute in Berkeley, California (Baker et al. 1998; Fillmore & Baker 2010; Ruppenhofer et al. 2016, Ruppenhofer et al. 2017). The initial funding for FN came from two major grants from the National Science Foundation from March 1997-February 2000 and from September 2000-August 2003. The following section discusses the architecture, workflow, and structure of FN in more detail.

### 3. What is FrameNet?

FrameNet (FN) is an ongoing effort to produce a lexical database of English that is both human- and machine-readable, based on the theory of Frame Semantics (Fillmore 1982) and supported by annotating corpus examples of the lexical items. The work of FrameNet can be thought of as the implementation of a theory (Frame Semantics) that was already well-developed; however, the process of annotating actual sentences from corpora has also propelled the development of the theory (see Fillmore & Atkins 2000; Fillmore 2007; Boas 2008a; Fillmore et al. 2012; Fillmore 2014; Dux 2020; Boas & Ziem 2022). The units of

development are semantic frames; each frame requires an intensional definition, in text, an extensional definition (the list of lexical units which evoke the frame) and a list of frame elements (participants and props involved in events, other aspects for non-event frames), each of which also has its own textual definition.<sup>6</sup>

As discussed in Section 2, FN began as a project to enhance lexicography by incorporating data from corpus linguistics based on the principles of Frame Semantics. Thus, the major product of the FN project can be viewed as a lexico-semantic database, organised around semantic frames. A semantic frame in the sense used here is a conceptual gestalt which can represent an event, a state, an attribute, a relation, or an entity (cf. column Frame name in Table 1). For each frame, the database specifies a set of English lexical units (each of which can be a single word or a multi-word expression) which evoke the meaning of the frame in the mind of the hearer. For each frame, the database also specifies a particular set of frame elements associated with the frame; the type of association depends on the nature of the frame. Each frame, frame element (FE), and lexical unit (LU) is given a definition.<sup>7</sup> The examples in Table 1 illustrate these concepts<sup>8</sup>:

**Table 1:** Examples of different types of semantic frames in FrameNet<sup>9</sup>

Frame name	Lexical units	FE names
Commerce_buy (event)	<i>buy.v, purchase.v</i>	Buyer, Goods, (Money, Seller)
Awareness (state)	<i>aware.a, awareness.n, cognizant.a, hunch.n, know.v, presume.v</i>	Cognizer, Content, Topic
Legality (attribute)	<i>criminal.a, illegal.a, legal.a, prohibited.a, wrongly.adv, etc.</i>	Action, Object, (Code, Explanation)
Leadership (relation)	<i>leader.n, king.n, boss.n, vice-chairman.n, govern.v, rule.v</i>	Leader, Governed, Role, Activity (Manner, Duration, Place, Time, etc.)
Money (entity)	<i>cash.n, dough.n, funds.n, etc.</i>	Money, (Creator, Origin, Possessor, Use, etc.)
Replace (event)	<i>replace.v, substitute.v, swap out.v, replacement.n, substitution.n, etc.</i>	Agent, Old, New (Time, Place)

### 3.1 Workflow of FrameNet

The creation of lexical entries in FN follows a specific workflow. First, a group of researchers uses their intuitive understanding about the state of affairs represented by prototypical senses of a group of words that are considered to evoke a common semantic frame. In an interactive process, researchers create a definition of a semantic frame and its associated FEs and, based on the extraction and examination of dozens (sometimes hundreds) of examples of the LUs from the British National Corpus and the American National Corpus (Ide & Suderman 2004), they identify LUs that all evoke the same semantic frame.<sup>10</sup> The purpose is twofold: to make sure that (1) the definitions of the frame, FEs and the set of LUs are clear, and (2) sufficient corpus examples of semantic-syntactic patterns are found and annotated to provide evidence of every pattern in which the LUs can occur.<sup>11</sup>

The meaning shared by all the LUs of a frame is given by the frame definition; each LU also has its own definition (which in many cases comes from a dictionary), giving a more specific meaning. For example, one of the senses of the verb *to replace* evokes the RePlacing frame, which has the core FEs Agent, Old, and New as well as the peripheral FEs Time and Manner.<sup>12</sup> FN researchers define each FE and compile a definition of the frame that is based on a characterization of the relations between the different FEs of the frame, together with one or more prototypical example sentences illustrating the context in which a frame-evoking LU occurs. Figure 3 below shows the definition of the RePlacing frame, where names of FEs are colour-coded, the result of a manual annotation process described in the next paragraph.

# Replacing

## Definition:

An **Agent** changes the filler of a **Role** by placing a **New** filler in the position after the **Old** filler ceases to occupy the position. Often this entails the **Agent** removing the **Old** filler. In most cases the **Role** is implicit.

If you **REPLACE** me with a robot, who's gonna make excuses to your wife for you?

Following Keating's resignation from the Cabinet Hawke immediately **REPLACED** him as Deputy Prime Minister with Brian Howe, Minister for Community Services and Health.

This frame is used both for physically moving a **New** thing to a particular location formerly occupied by the **Old** thing, and for cases in which the change is accomplished by some non-motion means, e.g. Appointing.

Figure 3. Definition of the Replacing frame.<sup>13</sup>

A second group of researchers then annotates corpus example sentences exemplifying the set of semantic-syntactic patterns in which each LU can occur. These are called valence patterns and are subsequently extracted automatically from the annotations. Most LUs in FN are also exemplified by one or more annotated sentences, showing which words in the sentence fill which FEs, the phrase types of the FEs, and syntactic relations between the frame elements and the frame-evoking LU (see Fillmore/Petruck et al. 2003 for details on the annotation process and Ruppenhofer et al. 2016 for the inventory of phrase types and syntactic relations that FN uses). Finally, the manually annotated example sentences form the basis for lexical entries of each LU, resulting in sometimes quite extensive valence tables documenting the various ways in which different combinations of a frame's FEs are realised syntactically in terms of phrase type and grammatical function. Table 2 shows how the sentence *Biden replaced Stephen Breyer with Ketanji Brown Jackson* would be annotated in the Replacing frame.

Table 2. Three-tiered FN annotation.

Text	Biden	REPLACED	Breyer	(with ) Jackson
Frame elements	Agent		Old	New
Grammatical functions	External		Object	Dependent
Phrase types	NP		NP	PP[with]

Figure 4 below displays just the FE layer of three of the actual annotated sentences for *replace*, demonstrating that the FE Agent (shown in red highlighting) can be omitted in passive constructions (in FN terminology **constructional null instantiation**) or can be expressed as an **external noun phrase** (i.e. a subject).

**[X]** UV tubes need **REPLACING** **[CNI]**NI

**[X]** If the strength is **REPLACED** with a box section framework, then all is well **[CNI]**

**[X]** **He** **REPLACED** the defectors with four technocrats.

Figure 4. Three out of 95 annotated example sentences showing two distinct syntactic realisations of the FE Agent for the verb *replace* in the Replacing frame

These constructional null instantiations are instances of more general patterns of **null instantiation** (cf. Fillmore 1986), cases in which conceptually salient FEs are not realised by lexical or phrasal material in the sentence chosen for annotation. FN annotators

nevertheless record their absence, thus providing lexicographically relevant information regarding conditions on omissibility. FN distinguishes definite and indefinite null instantiation (DNI, INI) that are licensed by specific lexical items. FN also recognizes constructionally licensed null instantiation (CNI) which can apply to a wide range of LUs.<sup>14</sup>

The patterns of annotation are then summarised in LU reports that first list the frame evoked by an LU, followed by a LU-specific definition and then two tables showing how FEs are realised syntactically. Figure 5 presents a partial entry of *replace* in the Replacing frame, with an LU-specific definition followed by the first table. Figure 5 shows, among other things, that the FN entry for *replace* has a total of 95 annotated instances for the FE Agent, of which 58 are realised as subjects (i.e. external NPs), 34 are CNIs, and 3 are INIs. The right column of Figure 5 gives, for each pattern, information about the syntactic realisation of Frame Elements (FEs) on two different levels: phrase type (PT) and grammatical function (GF). The phrase types are based on fairly standard types such as noun phrase (NP), verb phrase (VP), etc. but include finer divisions such as VPing (a gerundive verb phrase, headed by the *-ing* form of the verb) and PP[*from*] (a prepositional phrase introduced by *from*). The grammatical functions are a small set, which collapse indirect object and adjunct together into “dependent” (DEP) and combines the subjects of verbal phrases and the “subjects” of deverbal nouns (e.g. *the Nazi occupation of Belgium*) into “external” (EXT).<sup>15</sup>

## Lexical Entry

### replace.v

#### Frame: Replacing

##### Definition:

FN: to put something new in the place of something

#### Frame Elements and Their Syntactic Realizations

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

Frame Element	Number Annotated	Realization(s)
Agent	(95)	CNI.-- (34) INI.-- (3) NP.Ext (58)
Explanation	(3)	AVP.Dep (2) 2nd.-- (1)
Manner	(6)	AVP.Dep (4) PP[as].Dep (1) PP[in].Dep (1)
Means	(1)	PP[by].Dep (1)
New	(95)	INI.-- (24) PP[with].Dep (67) NP.Ext (2) PP[by].Dep (2)

Figure 5. Partial LU entry of *replace* in the Replacing frame<sup>16</sup>



The second table in the LU entry of *replace*, shown in Figure 6, provides the valence information broken down by the observed sets of FEs and their order in the sentence. Each combination of FEs in Figure 6 is a unique frame element configuration providing a specific perspective of the meaning of the semantic frame. For example, at the top in Figure 6 we see the configuration <Agent, Explanation, New, Old>, which can be realised syntactically in three different ways, each of which is supported by annotated corpus sentences. Altogether, the FN valence table for *replace* in the Replacing frame lists 12 different frame element configurations with a total of 37 different syntactic realisations of the semantics of the Replacing frame. Each of the different syntactic realisations is based on at least one manually annotated example sentence. This level of detail regarding how the semantics of a frame may be idiosyncratically realised syntactically per and across LU is, in our view, unmatched by any other lexicographic resource available for English.<sup>17</sup>

### Valence Patterns:

These frame elements occur in the following syntactic patterns:

Number Annotated	Patterns				
<u>3</u> TOTAL	Agent	Explanation	New	Old	
(1)	CNI --	AVP Dep	INI --	NP Obj	
(1)	CNI --	AVP Dep	PP[with] Dep	NP Ext	
(1)	NP Ext	2nd --	INI --	NP Obj	
<u>4</u> TOTAL	Agent	Manner	New	Old	
(1)	CNI --	AVP Dep	PP[with] Dep	NP Ext	
(2)	NP Ext	AVP Dep	PP[with] Dep	NP Obj	
(1)	NP Ext	PP[as] Dep	INI --	NP Obj	
<u>2</u> TOTAL	Agent	Manner	New	Old	Time
(1)	NP Ext	AVP Dep	PP[with] Dep	NP Obj	PP[in] Dep
(1)	NP Ext	PP[in] Dep	PP[with] Dep	NP Obj	AVP Dep
<u>1</u> TOTAL	Agent	Means	New	Old	
(1)	NP Ext	PP[by] Dep	INI --	NP Obj	
<u>60</u> TOTAL	Agent	New	Old		
(1)	CNI --	INI --	NP Ext		

Figure 6. Partial valence table of *replace* in the Replacing frame

### 3.2 Structure of the frame inventory

Obviously, the 1,224 frames in the current version of FN are not all of equal importance or scope. The FN researchers have defined a set of hierarchical frame-to-frame relations, such that child frames are more specific and derive some of their definition from their parent frames. However, FN does not claim to be a formal ontology, nor to exhaustively carve up the world. Instead, the hierarchy has been built largely from the bottom up, defining frames for related words in a domain, and then searching for a more general frame for several such groups. The highest frames in the resulting hierarchy are usually fairly abstract, such as the Event frame, the Intentionally\_act frame, etc. Because the process generally works from low-level frames up, there is no guarantee that all frames fit into a single tree. Also, since multiple parents are allowed for a single child frame, the resulting structures are technically lattices, rather than trees; these range from a few large connected networks to several dozen frames unconnected with larger structures.

The project began with one notion of frame relations, inheritance, but gradually evolved to include nine types of frame relations (Baker et al. 2003, Fillmore et al. 2004, Ruppenhofer et al. 2016). Three are more clearly hierarchical: Inheritance, Perspective\_on, and Using; two are basically generalisations of lexical relations (Causative\_of and Inchoative\_of), and one is a temporal relation (Precedes). The Subframe relation is used to represent either subevents of a complex event or subparts of an entity. The Metaphor relation was introduced to allow a more satisfactory representation of metaphorical relations between frames. Finally, the See\_also relation provides the kind of information conveyed by the words “see also” in a conventional dictionary; the reader is advised that for a full understanding of the current frame, it may be helpful to look at another frame, and note the differences between the two. Table 3 provides examples of these relations.

**Table 3.** Nine types of frame relations in FrameNet.

Name	Frames	Lexical units
Inheritance	Judgement_communication → Judgement_direct_address	<i>praise, denounce</i> → <i>compliment, scold</i>
Perspective_on	Hostile_encounter → Attack	<i>brawl.n/v, skirmish.n/v</i> → <i>assault.n/v, lay (into).v</i>
Uses	Bear_arms → Weapon	<i>armed.a, bear arms.v</i> → <i>crossbow.n, shotgun.n</i>
Causative_of	Cause_to_be_wet → Being_wet	<i>drench.v, wet.v</i> → <i>damp.a, wet.a</i>
Inchoative_of	Death → Dead_or_alive	<i>expire.v, kick the bucket.v</i> → <i>alive.a, deceased.a</i>
Precedes	Committing_crime → Criminal_investigation	<i>commit.v, perpetrate.v</i> → <i>investigate.v, probe.n/v</i>
Subframe	Buildings → Building_subparts; Trial → Court_examination	<i>igloo, skyscraper</i> → <i>room.n, elevator; trial.n</i> → <i>cross-examine.v</i>
Metaphor	Cause_motion → Manipulate_into_doing	<i>press.v, drive.v</i> → <i>fool.v, blackmail.v</i>
See_also	Holding_off_on → Waiting	<i>hold off.v, wait.v</i> → <i>wait.v, bide its time.v</i>

Figure 7 shows frame relations in the domain of employment. The top frame is Employment\_scenario, whose definition begins “An Employee and Employer enter into an employment relation, wherein the Employee remains employed for some Duration of time, and finally the relationship ends either by the Employee leaving the job or the Employer letting go (or firing) the Employee.” This frame introduces the core frame elements (FEs) in this domain: Employee, Employer, and Task.

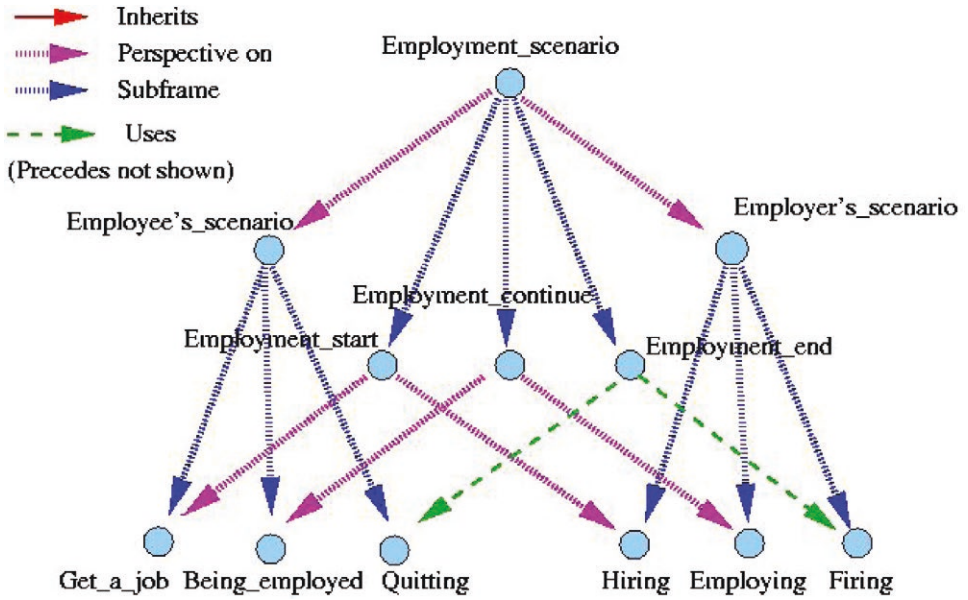


Figure 7. Relations among frames related to employment

The employment process, like all processes, can be broken down into three subprocesses, the start of the process, the period where the process takes place, and the end; in this case, they are represented by three subframes of the *Employment\_scenario*, *Employment\_start*, *Employment\_continue*, and *Employment\_end*. However, the Employee and the Employer will inherently have different points of view of the employment process, with different lexical units to express them. Thus, FrameNet defines separate frames for them, the *Employee's\_scenario* and the *Employer's\_scenario*; the *Perspective\_on* relation links them to the *Employment\_scenario*. There are further details of employment, such as the agreement between the two sides and their joint action to begin the employment that are not represented in these frames.

However, the two sides use different vocabulary to describe this event; the Employee can say *I signed on with Amazon last week as a content specialist*, whereas the person who hired them can say *Amazon hired 200 new content specialists last week*. Thus, we have the frame *Get\_a\_job*, the Employee's *Perspective\_on* *Employment\_start*, and the frame *Hiring*, the Employer's *Perspective\_on* *Employment\_start*. The continuation of the employment also requires continuing actions by both sides, leading to the frames *Being\_employed* (with examples like *have a job (at)* and *work for*) and *Employing* (evoked by expressions such as *Gambling ... is a major source of employment*, and *The employees deserve the recognition*). These two frames are linked by *Perspective\_on* relations to the *Employment\_continue* frame.

When it comes to the ending of employment, however, the situation is quite different; either party can end the employment without the consent of the other. The Employee can quit (*Quitting* frame) or the Employer can fire the Employee (*Firing* frame). These are clearly related to the frame *Employment\_end*, but they are different types of events, not merely different perspectives on the same event. FN expresses this somewhat looser connection with the *Uses* relation, which indicates that the *Employment\_end* frame provides necessary background for understanding the two ways that employment can end.<sup>18</sup>

Every frame relation is associated with one or more relations between the FEs of the parent frame and those of the child frame. In the case of Inheritance, all the core FEs of the parent have counterparts in the child. (For purposes of this discussion, we define core frame elements as those which are crucial semantically for the definition of the frame and which generally occupy central syntactic positions, such as subject and direct object. See Endnote 7 in Section 3.1) In order for semantic relations to be passed down the hierarchy, it has been found necessary to create some frames without any lexical units; there are currently 1,075 frames with lexical units, and 149 without.

### 3.3 Full text annotation

The process described in Section 3.1 is lexicographic analysis and annotation. Each of the examples involves annotation on a single LU in a sentence extracted from a large corpus, thereby losing the context in which it originally appeared. Since 2004, FN staff members have also annotated continuous texts from a wide variety of documents, thereby producing both entries for LUs and fully annotated texts. This expansion to full-text was motivated by the experience of NLP researchers working on parsing and semantic role labelling in the PropBank style on Penn Tree Bank data who urged for the inclusion of FN full text annotation as being more suitable for training data for role labeling systems based on FrameNet FEs.

Typically, in this “full-text” annotation, between two and ten LUs are annotated per sentence, in as many different frames; in theory, combining all of these annotations will yield a dense, rich semantic representation of the sentence. This procedure means that annotators must label whatever the text contains, regardless of syntactic complexity, ambiguity, rhetorical infelicity, etc. Full-text annotation also drives the discovery of new frames; if an annotator encounters a word without an appropriate existing frame, the annotator (as lexicographer) must create one. Thus, full-text annotation is more difficult than lexicographic annotation; it constitutes about one third of the total annotation in the FrameNet database. Nevertheless, full-text annotation has proven especially useful in the development of software for automatic semantic role annotation (see Sec. 4.1).

The screen-shot in Figure 8 from the FN public website shows full-text annotation of a sentence from WikiNews: *The construction company said that the fire broke out at about 2:10 pm local time (0310 UTC) and appeared to have been caused by a welding accident in the basement of a building.* The top part of the figure shows the text, with twelve lexical units in all caps and underlined; the name of each frame is in subscript at the right of each LU. The lower part of the figure shows the annotation of the frame elements for five of the frames. For example, the first line in the lower part shows that the FE Speaker of the verb *said* in the *Statement* frame is filled by “the construction company” and the FE Message by the rest of the sentence, “fire broke out...of a building”. The second line shows the verb

4. The CONSTRUCTION<sub>Building</sub> COMPANY<sub>Businesses</sub> SAID<sub>Statement</sub> FIRE<sub>Fire\_burning</sub> BROKE<sub>Catching\_fire</sub> OUT<sub>Catching\_fire</sub>  
 AT<sub>Temporal\_collocation</sub> about 2:10pm local time ( 0310 UTC ) and APPEARED<sub>Give\_impression</sub> to have been CAUSED<sub>Causation</sub> by a  
 welding ACCIDENT<sub>Catastrophe</sub> IN<sub>Interior\_profile\_relation</sub> the BASEMENT<sub>Building\_subparts</sub> of a BUILDING<sub>Buildings</sub> .

Clear Sentences Turn Colors On

[X] [Speaker:The construction company] SAID<sup>Target</sup> [Message:fire broke out at about 2:10pm local time ( 0310 UTC ) and appeared to have been caused by a welding accident in the basement of a building] .

[X] The construction company said [Fire:fire] BROKE<sup>Target</sup> OUT<sup>Target</sup> [Time:at about 2:10pm local time ( 0310 UTC )] and appeared to have been caused by a welding accident in the basement of a building .

[X] The construction company said [Inference:fire] broke out at about 2:10pm local time ( 0310 UTC ) and APPEARED<sup>Target</sup> [Inference:to have been caused by a welding accident in the basement of a building] .

[X] The construction company said [Effect:fire] broke out at about 2:10pm local time ( 0310 UTC ) and appeared to have been CAUSED<sup>Target</sup> [Cause:by a welding accident in the basement of a building] .

[X] The construction company said fire broke out at about 2:10pm local time ( 0310 UTC ) and appeared to have been caused by a [Cause:welding] [Undesirable\_event:ACCIDENT<sup>Target</sup>] [place:in the basement of a building] .

Figure 8. Full text annotation on a single sentence with multiple frame-evoking LUs.

*broke out* in the *Catching\_fire* frame with FEs *Fire* (filled by the word *fire* itself) and *Time* (filled by “at about 2:10 pm local time (0310 UTC)”)<sup>19</sup>

Since 1997, the FrameNet team at ICSI has developed more than 1,200 such semantic frames, containing more than 10,000 frame-specific frame elements, covering more than 13,000 lexical units. They have manually annotated more than 200,000 instances of frames in naturally occurring sentences. All of this data is freely available in the FN lexical database, which has been downloaded more than 5,000 times from the FN website.

### 3.4 The “Constructicon”

Providing full-text annotation at the lexical level as outlined in the previous section led the FrameNet team to realise that there is a great deal of syntactico-semantic information relevant for the understanding of texts that goes beyond purely lexicographic work. To this end, [Fillmore \(2008\)](#) proposes an outline of a so-called constructicon for English, a database of English grammatical constructions whose construction entries are based on manually annotated corpus examples (similar to annotations at the lexical level) that indicate which parts of them are licensed by which specific constructions. The constructicon is a natural extension of FN’s work on the lexicon, because in Construction Grammar ([Fillmore et al. 1988](#), [Fillmore & Kay 1993](#), [Goldberg 1995](#), [Fillmore 2013](#)), the sister theory of Frame Semantics, there is no strict separation between lexicon and syntax and language is seen as a large structured inventory of constructions, i.e. pairings of forms and meanings that vary in size and complexity ([Goldberg 2006](#), [Boas 2008b](#), [Fillmore 2008](#), [Boas & Dux 2017](#), [Boas 2021](#)). Construction Grammar presupposes a network of semantic frames that represent the shared meaning of groups of LUs - the meaning poles of their lexical constructions. For the most part, however, those working on FrameNet had originally been content to leave the building of construction entries to others.

However, Fillmore was eager to define a “starter set” of constructions with supporting annotations, using an extension of the FN database. In 2007, he was awarded \$100k to do that, under the title “Beyond the Core: A Pilot Project on Cataloguing Grammatical Constructions and Multiword Expressions in English.” The FN database was modified to include constructions (defined analogously to frames) and labels for Construction Evoking Expressions and Construction Elements, and the annotation software modified to handle either mode of annotation. Fillmore and two graduate students from the FN project created a corpus of example sentences and annotated them with Constructions they defined. In all, 75 constructions were defined and annotated; many were derived from constructions that had been generally defined previously in the work of Fillmore and his colleagues, such as the Subject-Predicate construction, the Head-Modifier Construction, and the Head-Complement construction ([Fillmore 2008](#)). The creation of construction entries follows the same workflow as the creation of lexical entries in FN, i.e. a group of researchers first proposes a construction entry, then a second group of researchers annotates example sentences from an electronic corpus with information about construction-evoking elements and construction elements.

The prototype of the English FN constructicon consists of entries for grammatical constructions of different types, including frame-bearing constructions, valence-augmenting constructions, constructions without meanings, pumping constructions, exocentric and headless constructions, and clause-defining constructions (for details, see [Fillmore 2008](#), [Fillmore et al. 2012](#), [Boas 2017a](#), [Lee-Goldman & Petruck 2018](#), [Boas et al. 2019](#)). The Berkeley FN constructicon for English served as the basis for similar constructicon projects for other languages, including German ([Boas & Ziem 2018](#)), Japanese ([Ohara 2018](#)), Brazilian Portuguese ([Torrent et al. 2018b](#)), and Swedish ([Lyngfelt et al. 2018](#)), which in turn has led to the emergence of a new paradigm known as constructicography (see [Lyngfelt et al. 2018](#)).

#### 4. Methodological issues

While the work on FN over the past 25 years has led to a number of novel insights about the structure of the English lexicon, there have also been some issues raised about the workflow, structure, and theoretical underpinnings of FN. One major issue concerns the workflow of FN, which proceeds frame by frame. In the view of Hanks & Pustejovsky (2005: 65), FN's workflow is problematic, because it "relies on the intuitions of its researchers to populate each frame with words." According to Hanks & Pustejovsky, this "runs the risk of accidental omissions, and it means that (in principle) no word can be regarded as completely analysed until all frames are complete."

While we agree with Hanks & Pustejovsky's (2005) observation that the workflow of FN is rather unusual in the realm of lexicography projects, we do not see this particular workflow issue as problematic for the following reasons. First, FrameNet aims to cover all the lemmas and their senses in the British National Corpus. By operating frame by frame and not word by word from A to Z, the FN workflow only follows a different path, but not necessarily one that does not cover all of a word's senses. Second, by documenting word senses frame by frame, FN eventually arrives at the same end goal as traditional lexicography projects that operate word by word. In the view of FN it is advantageous to cover word senses frame by frame because it allows simultaneous coverage of different types of words related in meaning, showing which aspects of a semantic frame they realise and which ones they do not. The difference between FrameNet and traditional lexicography lies in how word senses are organised in the database. While traditional lexicography projects organise word senses by alphabetical order of the headwords, FN organises word senses based on the semantic frames that they evoke.

Another major issue raised by Hanks & Pustejovsky (2005) concerns the coverage of FN.<sup>20</sup> They discuss FN's analysis of the verb *to spoil* as an example. They show that it "is currently a member of two frames in FrameNet: Rotting and Desiring. Rotting is the 'rotting meat' sense, which may be cognitively salient but is actually quite rare. The Desiring frame is exemplified in the phrase 'spoiling for a fight'. Together, these two senses account for less than 3% of all uses of this verb in BNC. The main uses ('spoil an event' and 'spoil a child') are not yet covered," according to Hanks & Pustejovsky (2005).

While Hanks & Pustejovsky are certainly right in that the FN coverage of *to spoil* at the time of their writing was incomplete, this, too, is a direct result of the workflow of FN (see above). Criticising FN for a lack of coverage because it has not completed its mission is, in our view, similar to criticising traditional lexicography projects for coverage issues because in their work they only got as far as words beginning with "m" and have not yet made it to "z." Because FN builds its lexicon frame by frame, rather than letter by letter, it is harder to gauge progress.

The third issue discussed by Hanks & Pustejovsky is related to the prior two issues and concerns the question of the unknown time frame as well as the unknown number of frames that a complete FN may have in the future. They point out that "[a]t the time of writing, there has been no indication of when that will be, nor of the total number of frames that there will be." Hanks (2012) makes a similar claim: "[T]here does not seem to be any very good reason to believe that the number of possible frames is finite."<sup>21</sup> We disagree with their claims for the following reasons.

First, criticising a lexicography project because of its unknown time frame is problematic as the history of the making of the OED shows (Gilliver 2016). The original time frame estimated for completion of the OED was significantly shorter than the actual time it took to complete the first edition.<sup>22</sup> In contrast to the OED, which had and still has considerable financial and institutional support, FN has had much reduced funding in the years after the first two major grants from the National Science Foundation. Another issue is the brain drain of qualified lexicographers working on FN who have left for financially more lucrative jobs in the tech industry starting around 2006. In other words, FN faces many of the

same problems as other lexicography projects when it comes to estimating a time frame during which it could be completed in the future.

Second, we do not see the lack of knowledge about the future total number of frames as a problem. In contrast, we regard the question of the total number of frames in a FN that covers all of the BNC as an empirical open question that can only be answered once all of the word senses found in the BNC are covered. Making any a priori decisions about the number of frames does not cohere with our view of language, which we regard as an empirical object of study. Finally, the number of frames might very well be much larger than the number of frames derived on the basis of all word senses found in the BNC. Because language is constantly changing, new word senses emerge, some of which require new frames. Similarly, specialised vocabulary for specific domains such as sports (Schmidt 2008, 2009), biomedicine (Dolbey et al. 2006), or linguistics (Ziem & Neumann-Schneider 2022) require additional frames.<sup>23</sup>

## 5. Conclusions and Outlook

In this paper, we first provided a historical overview of the intellectual roots of FrameNet, which can be traced back to Fillmore's (1968) early research on Case Grammar and his subsequent proposal of Frame Semantics during the 1980s (Fillmore 1982, 1985). We then showed how FrameNet grew directly out of a series of papers co-authored by Fillmore and Atkins during the 1990s and we provided an overview of the workflow of FN and the different types of data contained in FN and how the FN workflow was extended to conduct full text analysis and to also compile entries for grammatical constructions that go beyond the lexical level. Finally, we reviewed a number of past, current, and future challenges for FN as a long-running project, mainly in terms of workflow, funding, and organisation.

While we were able to go into some detail about the history of Frame Semantics and the inner workings of FrameNet, much more could and should be said about the project's wide-ranging impact on various practical and theoretical areas of study. We plan to do so in a follow-up article (Boas, Ruppenhofer, Baker in prep.) that discusses the impact of FN on, and interactions with, lexicography, linguistic theory, computational and applied linguistics (with a special emphasis on translation studies, linguistic typology, and foreign language teaching). In the follow-up, we will also show how the concepts and ideas of English FN were eventually extended to allow for the creation of FrameNets for other languages and to support the modelling of domain-specific terminology in areas ranging from biomedicine to soccer. But even considering only what we were able to present so far, we would like to argue that the history of FN and the data it produced from 1997 to 2023 are unique for a number of reasons:

First, FN has its intellectual roots in Fillmore's research from the late 1960s to the mid-1990s, when his frame-semantic ideas about the organisation of lexical knowledge were eventually applied to the creation of FN. We do not know of any other theory of lexical meaning that was developed over such an extensive period before being applied to the creation of a lexicographical database of English. And in fact, most of the research on Frame Semantics conducted over the past 25 years has been closely related to the ongoing development of the Berkeley FrameNet project for English or the development of new FrameNet resources for other languages.

Second, the data produced by FN since 1997 is unique because it is almost entirely the result of original, manual definitions of semantic frames and manual annotation of corpus data. The other widely-used lexical databases for English are organised very differently. WordNet (Fellbaum 1998) is primarily a lexicon, relying on long-established principles of lexical organisation such as synonymy, antonymy, hypernymy, and hyponymy, with no explicit information on semantic roles or argument structure. PropBank (Palmer et al 2005), based on a pre-existing parsed corpus (Marcus et al. 1993), has a small set of semantic roles,

which are then given specific definitions for each lexical unit. There is nothing in either resource that is equivalent to FrameNet frames. VerbNet (Kipper-Schuler 2005, Kipper et al. 2008) is a hierarchical broad-coverage verb lexicon whose classes extend and refine Levin's (1993) diathesis-based classes. (For discussion on the differences between Levin's classes and FrameNet's frames, see Baker & Ruppenhofer 2002.) Mappings exist to other lexical resources, among them WordNet and FrameNet. Given the differences and complementary strengths between the various databases, a significant amount of research has been done to combine WordNet, FrameNet and VerbNet either for extending one of the resources or for applied NLP purposes (Giuglea & Moschitti 2006; Bauer & Rambow 2011; Mújdricza-Maydt et al. 2016; Palmer et al. 2014; Stowe et al. 2021, Brown et al. 2022).

Third, the ideas and concepts developed over more than 25 years by the Berkeley FN project for English have been reused and applied to the creation of FrameNets for other languages (see, e.g., Boas 2005/2009, Burchardt et al. 2009, Ohara 2009, Petruck 2009, Subirats 2009, Borin et al. 2010, Salomão et al. 2013, Candito et al. 2014, Lyashevskaya & Kashkin 2015, Gilardi & Baker 2018, Torrent et al. 2018). While the activities of the Berkeley FN project appear to be pausing after 25 years (hopefully only temporarily), the FN concepts and ideas live on in FN projects for many other languages and are being continuously developed further by these projects. An example is the global FrameNet group that for the past several years has been working on shared cross-linguistic annotation tasks and regularly exchanging ideas for improving frame-based lexical resources. This means that even though the original Berkeley FN for English may be paused at the moment, its ideas and influence live on in many FN-style projects around the world. In our view, the inspiration which Fillmore's original FrameNet project provides for other FN projects around the world will be its continuing legacy and perhaps the best measure of its success.

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## Notes

- 1 We are thankful for the helpful comments by two anonymous reviewers as well as the editor of IJL. We are grateful for the funding for FrameNet from the National Science Foundation. Finally, we will be forever indebted to Prof. Charles J. Fillmore, one of the major developers of the theory of Frame Semantics and the founder of the FrameNet project.
- 2 For a related proposal, see Gruber (1965).
- 3 Note that the term "frame" has been used by other linguistic theories for similar and different purposes. For more information, see Petruck (1996), Ziem (2008) and Busse (2012).
- 4 Following notation conventions used in the 2003 special issue of the International Journal of Lexicography on FrameNet, names of semantic frames appear in Courier New font and names of frame elements (FEs) appear in small caps.
- 5 See <https://framenet2.icsi.berkeley.edu/fnReports/data/lu/lu13383.xml?mode=lexentry>
- 6 For a concise overview of the terminology associated with FrameNet, we refer the reader to Fillmore & Petruck's (2003) glossary. For a more general overview of FrameNet, see Ruppenhofer et al. (2017).
- 7 Lexical units are typically words, but roughly 1,000 are multi-word expressions like *make out* (several senses), *ramp up*, *on the run*, *lose (one's) head*, *seal (one's) lips*, etc. Each lexical unit is mapped to one frame; polysemy is represented by mapping the same word form(s) to multiple frames, constituting multiple lexical units.
- 8 The parentheses in the FE names column contain so-called non-core FEs, for which see section 3.1.
- 9 The frames can be found from the Frame Index at <https://framenet.icsi.berkeley.edu/frameIndex>, the lexical units index is at <https://framenet.icsi.berkeley.edu/luIndex>.
- 10 For more information on the workflow of FrameNet, see Atkins/Fillmore/Johnson (2003), Atkins/Rundell/Sato (2003), Fillmore/Johnson/Petruck (2003), and Fillmore/Petruck (2003).



- 11 Patterns which are regularly derivable from other, annotated patterns are not always annotated. For example, passive verb phrases are usually not annotated if corresponding active verb phrases have been annotated. In addition to instances matching pre-identified valence patterns that LUs are expected to occur in, annotators also always inspect a random sample of instances for a LU in order to allow patterns that were initially overlooked to be picked up by a second pair of eyes.
- 12 As discussed in Ruppenhofer et al. 2016, FrameNet distinguishes between core roles and peripheral as well as extra-thematic roles. The core roles are those that instantiate conceptually necessary components of a frame, while making the frame unique and different from other frames. The three core roles of the Replacing frame are defined as follows. The Agent is “[t]he conscious entity, generally a person, that performs actions resulting in the New entity occupying the position”. The New entity is defined as “the person or thing that the Agent sets to fill a Role”, whereas the Old entity is defined as “the entity that formerly occupied the position”. Frame elements that do not introduce additional, independent or distinct events from the main reported event are characterised as peripheral. They do not uniquely characterise a frame, and can be instantiated in any semantically appropriate frame. Common Peripheral FEs mark notions such as Time, Place and Manner, which are indeed also found in the Replacing frame. Extra-thematic frame elements situate an event against a backdrop of another state of affairs, as illustrated by the Explanation FE of the Replacing frame.
- 13 See <https://framenet2.icsi.berkeley.edu/fnReports/data/frameIndex.xml?frame=Replacing>
- 14 For details of the differences among these, see Boas 2017b and Atkins et al. 2003 Sec. 2.4.2.
- 15 For a full discussion of PTs and GFs see Ruppenhofer et al. (2016), Sections 4 and 5)
- 16 See <https://framenet2.icsi.berkeley.edu/fnReports/data/lu/lu10560.xml?mode=lexentry>
- 17 For a discussion of frame element configurations and how their semantics are realised syntactically, see Boas (2008c). For related detailed research on verbal valence patterns in the framework of Lexicon Grammar, see Salkoff (1983), Gross (1994a,b), and Leclère (2005).
- 18 FN does not currently model the full complexity of layoffs, termination agreements, furloughs, re-hiring, subcontracting, non-compete clauses, etc.
- 19 See Ziem et al. (2018) for a full-text analysis of a German newspaper text.
- 20 Palmer & Sporleder (2010) also discuss the issue of coverage “gaps” in FN.
- 21 Hanks (2012) also has a more conciliatory side note on FN: “Despite these somewhat negative comments, it must be emphasised that FrameNet is full of profound lexical and semantic insights that will repay careful study by anyone interested in meaning in language.”
- 22 Other large-scale dictionary projects that took a very long time to complete are the Deutsches Wörterbuch (‘The German Dictionary’), which was begun by the Brothers Grimm in 1838 and was completed in 1961. Most recently, in late October 2023, the Svenska Akademiens Wordbok (‘Dictionary of Swedish’) was completed, 140 years after it got started.
- 23 Osswald and Van Valin (2014) offer a review of FN that focuses on the application of insights from FN to a theory of the syntax-semantics interface. They point out a number of different problems based on various types of frame definitions that make it complicated to come up with consistent regularities regarding the linking of semantic information to syntactic positions. While we acknowledge their insights regarding the various issues encountered by linguistic theory when using FN to arrive at high-level generalisations about the syntax-semantics interface, we do not see this as a primary problem regarding the overall architecture and workflow of FN, especially because FN has so far not yet covered all of the core vocabulary of English. In our view, it would be prudent to conduct a consistency check of the different types of FN frames and their organisation in the FN hierarchy once all of the core vocabulary of English has been covered.

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