From the past into the present:
From case frames to semantic frames

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Abstract: This paper first shows how Frame Semantics (Fillmore 1982) grew out of earlier work by Charles Fillmore (1968) on Case Grammar. Then, it discusses some of the basic principles of Frame Semantics and shows how these have been implemented in FrameNet, an online corpus-based lexicographic database (http://framenet.icsi.berkeley.edu). Using semantic frames to structure the lexicon of English, FrameNet provides a wealth of information showing how frame elements (situation-specific semantic roles) are realized syntactically (valence patterns). Finally, the paper provides an overview of how frame-semantic principles have been applied to cover non-lexical phenomena using compatible annotation and data formats. This so-called "constructicon" offers entries of grammatical constructions that are also based on corpus data and that are parallel to lexical entries in FrameNet.

1. Introduction

A great number of publications dealing with the research of Charles Fillmore (1929-2014) focus on his seminal paper *The Case for Case* (1968) and its impact on linguistic theory during the late 1960s and into the 1970s. In this paper, Fillmore proposes a set of so-called case frames, which specify a verb's semantic valency, and he lays out a research program proposing how such case frames are mapped to syntax. While Fillmore's seminal paper was groundbreaking at the time, most of its core ideas were challenged during the 1970s and eventually abandoned. Interestingly, in the present day (the year is 2017) Fillmore is mainly remembered by many linguists for his 1968 paper as well as a few subsequent publications, but not really for most of his later research in Frame Semantics building on his original proposals. In other words, except for Fillmore's former students, colleagues, and associates or researchers closely affiliated with this branch of Cognitive Linguistics, there is very little recognition in the mainstream linguistics literature of Fillmore's own eventual abandonment of his original ideas.

More importantly, Fillmore's subsequent development of Frame Semantics during the 1980s and 1990s as a novel approach to structuring the lexicon (and exploring how lexical-semantic information is realized syntactically) has received little to no recognition in the mainstream linguistics literature. For example, in their book on argument structure, Levin and Rappaport Hovav (2005) devote an entire chapter to reviewing Fillmore's (1968) proposals and its advantages and disadvantages, but they do not mention Fillmore's (1982, 1985) theory of Frame Semantics, which offers a very different view of many concepts presented in his 1968 paper while still preserving some of its key ideas. Even within the growing body of literature on Construction Grammar, the sister theory of Frame Semantics, there is proportionally little discussion of Frame Semantics. For example, Goldberg's (1995) seminal book mentions

semantic frames a few times, but it neither defines frames nor discusses how they are structured and organized. Similarly, the *Oxford Handbook of Construction Grammar* (Hoffmann and Trousdale 2013) does not include a chapter on Frame Semantics, and the journal *Constructions and Frames* published only very few papers devoted specifically to Frame Semantics (Boas 2014b).

This paper seeks to close this gap and to demonstrate how Fillmore's (1982, 1985) Frame Semantics grew out of his original ideas of the late 1960s and subsequently developed during the 1980s and 1990s, while at the same time interconnecting with a corresponding theory of grammar that eventually became known as Construction Grammar. The paper is structured as follows. Section 2 first provides a brief overview of some of Fillmore's (1968) key proposals and discusses why they were largely abandoned throughout the 1970s. It then introduces Fillmore's theory of Frame Semantics and moves on to a discussion of the FrameNet project, which, since 1997, has been applying the principles of Frame Semantics to a corpus-based lexicography project seeking to construct an online lexical database of English. Section 3 first discusses how insights from English FrameNet have been applied to the description and analysis of other languages. Then, it provides a brief overview of the FrameNet Constructicon, an inventory of entries of grammatical constructions similar to the types of lexical entries in FrameNet. Finally, Section 4 summarizes our paper.[1]

2. Frame Semantics and FrameNet

2.1 The Case for Case

Fillmore (1968) proposed a limited set of semantic roles (also known as deep cases) such as Agentive, Instrumental, Dative, Locative, and Objective that are organized in a specific hierarchy for realizing grammatical functions. For example, Agentive was at the top of the hierarchy, followed by Instrumental, Objective, and others. This hierarchy was used to ensure proper linking of a particular semantic role to syntax depending on the total number of roles present. For example, in sentences such as *Kim opened the door*, the Agentive would be realized in subject position because the Agentive role is the highest in the hierarchy. In contrast, in sentences such as *The key opened the door*, the Instrumental would be realized in subject position because there was no Agentive to link to subject position and the Instrumental was the next role down in the hierarchy.

Fillmore's proposals were different from previous approaches, because they explicitly called for the identification of a restricted set of semantic roles that would be applicable to any argument of any verb. In addition, semantic roles were defined independently of verb meaning,

[1] Parts of this paper are based on Boas (2013b, 2017).

they were regarded as unanalyzable, and each semantic role was supposed to be realized by only one argument. At the same time, each syntactic argument should bear only one semantic role.[2]

During the 1970s, much research was devoted to applying Fillmore's (1968) proposals to a range of different phenomena and languages (see Busse 2012 for an overview), and it soon became apparent that Fillmore's original ideas were problematic. One of the key issues is that there are no systematic tests for determining semantic roles. For example, in sentences such as *Kim ate dinner with a friend* and *Kim ate dinner with a fork*, the objects of the *with*-phrases are distinct semantic roles and as such grammatical markers do not seem to be precise when it comes to identifying specific semantic roles. Another problem is the grain size of semantic roles, which makes it difficult to distinguish between different types of semantic roles. For example, Nilsen (1972) identifies four sub-classes of Instruments based on distributional data illustrating that they exhibit different types of acceptability when realized in subject position (compare *The cook opened the jar with a new gadget* / *The new gadget opened the jar* vs. *Shelley ate the sliced banana with a fork* / **The fork ate the sliced banana*) (Levin and Rappaport Hovav 2005: 39). Another problem is a lack of one-to-one correspondence between syntactic arguments and semantic roles. Sentences such as *Pat rolled down the hill* and *Sascha resembles Lee* illustrate that one syntactic argument can be interpreted as two semantic roles (Pat causes the action (Agent) and changes location (Theme)) and two syntactic arguments can bear a single role (both Sascha and Lee are compared to each other). Issues such as these led many researchers to abandon Fillmore's original proposals as well as modifications of them in the early 1970s (see Fillmore 1977 for a discussion).

2.2 Frame Semantics and FrameNet

The development of Case Grammar into Frame Semantics was motivated by Fillmore's increasing awareness of the shortcomings of "case roles" and growing interest in cognitive and ethnographic semantics. Fillmore (1977) addresses several critiques of his initial formulations of Case Grammar and marks a major step away from the assumption of primitive abstract case roles. He recognizes that many scholars had interpreted his 1968 work as a full-fledged grammar, whereas his original intention was to develop only a method for identifying case distinctions and characterizing the case structure organization of sentences. The problems mentioned above with the enumeration and identification of case roles led Fillmore to claim that case roles are not primitive and universal, but that they are determined by events and more generally that "meaning is relativized to scenes" (1977: 59). Specifically, rather than defining verb meanings (or "situations") by the semantic roles of their arguments, one must define situation types in their own right and identify what participants (semantic roles) define the situations.

Concurrently, Fillmore (1975, 1982, 1985) sought to identify the nature of these "events/scenes" that determine case roles. His 1977 article showed how recent developments in

[2] For a related proposal, see Gruber (1965); for more details, see Petruck (1996), Ziem (2008/2014b), and Busse (2012).

cognitive science, notably scenes (Fillmore 1987) and prototypes (Berlin and Kay 1969, Rosch 1973), could be applied to the study of word meaning. Subsequently, Fillmore (1982, 1985) offers rich and detailed examples of how cultural and world knowledge motivates and is embedded in linguistic expressions, emphasizing that solely truth-conditional semantic approaches cannot account for these aspects of word meaning and demonstrating the need for a "semantics of understanding" (see also Fillmore 1975). The core ideas underlying research in Frame Semantics are summarized in the following quote:

> A word's meaning can be understood only with reference to a structured background of experience, beliefs, or practices, constituting a kind of conceptual prerequisite for understanding the meaning. Speakers can be said to know the meaning of the word only by first understanding the background frames that motivate the concept that the word encodes. (Fillmore and Atkins 1992: 76-77)

During the 1990s, research in Frame Semantics focused on lexicographic and grammatical questions surrounding the syntactic realization of participants. Fillmore and Atkins (1992) provide a detailed investigation of how the concept of 'risk' is realized linguistically by (a) identifying all participants in the risk scenario, (b) documenting how participants are formally realized in concrete linguistic expressions, and finally (c) summarizing the various ways in which the concept can be realized syntactically. They show, for instance, that 'risk' can be construed in (at least) two ways and therefore evokes two different frames, with expressions such as *take a risk* perspectivizing the risky activity carried out by the risk-taker and *put at risk* perspectivizing the entity endangered by the risky activity.

Fillmore and Atkins' (1992) seminal study not only demonstrated the rich results of characterizing word meanings and grammar in terms of semantic frames, but also laid the groundwork for the development of FrameNet (http://framenet.icsi.berkeley.edu), which started at the International Computer Science Institute in Berkeley, California, in 1997. FrameNet is an online lexical database documenting a wide variety of frame-semantic and syntactic information for the English lexicon.[3] The most important notions around which FrameNet is structured are semantic frames, Frame Elements, and lexical units. Frame Elements (FEs) are the participants/roles by which semantic frames are defined. For instance, the FEs of the `Taking` frame are AGENT, THEME, and SOURCE, because a taking event minimally requires that some entity (AGENT) takes something (THEME) from somewhere (SOURCE).[4] A distinction is made between these core FEs that are crucial for the understanding of the frame and non-core FEs that do not define the frame but provide additional information such as time, place, and manner. Lexical units (LUs) are linguistic expressions (including all parts of speech and multi-word units) that evoke a given frame. LUs of the `Taking` frame, for instance, include specific senses of the verbs *take* and *grab* and the noun *seizure*. FrameNet accounts for polysemy by positing

[3] For details, see Fillmore and Baker (2010), Ruppenhofer et al. (2010), Ruppenhofer et al. (2013), Ruppenhofer et al. (in press), and Boas (2017).
[4] Following FrameNet practice, frame labels are in Courier New font and FE labels are in small capital font.

LUs in different frames for polysemous expressions. For instance, *take* is also listed as a LU of the `Taking_time` and `Ride_vehicle` frames, among several others. Another major organizing principle of FrameNet are frame-to-frame relations, which capture relations across frames. A key frame-to-frame relation is Inheritance, whereby a daughter frame inherits and further specifies information (including Frame Elements) of a mother frame.[5] The `Taking` frame, for instance, inherits from a more general `Getting` frame, because taking is a more specific instance of getting (i.e. volitionally/intentionally getting). In the other direction, the `Taking` frame is an inheritance mother to the `Theft` frame, which further specifies the illegal or unallowed nature of the more general taking event.

The information contained in the FrameNet database is the result of a workflow that begins with selecting a target word (including multi-word expressions) and identifying the frame it evokes by "characterizing schematically the kind of entity or situation represented by the frame" (Fillmore et al. 2003b: 297). More specifically, FrameNet researchers use intuition and corpus data to determine what features are necessary for the understanding of the word and assign mnemonic labels to each of the Frame Elements defining the frame. Next, a thorough corpus search is conducted for expressions deemed semantically similar to the target word in order to determine whether they have the same frame semantics and Frame Elements, thereby arriving at a full list of lexical units for the frame. For each of these lexical units, a number of representative corpus sentences are extracted and annotated for both syntactic and (frame-)semantic information. Specifically, the grammatical function and phrase type for each Frame Element occurring in the sentence is documented, resulting in layered annotations such as that in Table 1.

(Text)	*John*	*took*	*the bottle*	*from the baby*
FE	AGENT	target word	THEME	SOURCE
PT	NP		NP	PP.from
GF	Ext		Obj	Comp

Table 1. Layered frame-semantic annotation for *John took the bottle from the baby*

Table 1 illustrates one potential configuration of Frame Elements for the verb *take*,[6] in which the AGENT is realized as a nominal subject (Ext), the THEME as a nominal object, and the SOURCE as a complement prepositional phrase headed by *from*. Similar annotations are conducted to document the full range of FE realization patterns for each lexical unit, resulting in two types of valency tables: one summarizing the potential syntactic realization of each FE and one summarizing the full set of FE constellations. FrameNet's workflow is not strictly linear, as new

[5] Other frame-to-frame relations include Causative_of, Perspective_on, Uses, and Subframe. See Baker et al. (2003) and Petruck et al. (2004) for more details on frame-to-frame relations.

[6] At least five other FE configurations are documented for *take* in FrameNet.

data may lead to the identification of finer-grained frames or the inclusion of more lexical units for a given frame (see Fillmore et al. 2003a and Petruck 2004).

These frame-semantic analyses are documented on the Frame Description and Lexical Entry pages in FrameNet. Frame Description pages provide information for semantic frames. Figure 1 shows the Frame Definition for `Taking` as well as definitions and example sentences for each of the core FEs in the frame.

Taking

Definition:

An Agent removes a Theme from a Source so that the it is in the Agent's possession.
Milton TOOK the can of beer out of the refrigerator.

FEs:

Core:

Agent [] **Semantic Type:** Sentient	The person who takes possession of the Theme. Milton TOOK the can of beer out of the refrigerator.
Source [] **Semantic Type:** Source	The location of the Theme prior to the taking. Milton TOOK the can of beer out of the refrigerator.
Theme [] **Semantic Type:** Physical_object	The Agent takes possession of the Theme. Milton TOOK the can of beer out of the refrigerator.

Figure 1. Frame and Frame Element Definitions of `Taking` frame in FrameNet

Note how the frame definition includes the FE labels, explicitly describes the relations between them, and associates each with a semantic type, specifying for instance that the AGENT of `Taking` must be sentient. In addition to these definitions, the Frame Description pages also list the non-core FEs compatible with the frame (such as PLACE and MEANS), frame-to-frame relations (e.g. that `Taking` inherits from `Getting`), and a list of all lexical units evoking the frame.

Lexical entry pages document frame-semantic and valency information for individual lexical units. Each lexical unit is given a brief definition (either written by FrameNet researchers or taken from a print dictionary). Valency information derived from corpus annotation (as in Table 1 above) is also documented both for individual FEs (showing all possible realizations of each FE) and for combinations of FEs (in Valence Pattern tables, see Fillmore 2007). Figure 2

shows a portion of the Valence Patterns table for the verb *take* in the `Taking` frame, summarizing the results of the frame-semantic annotation of corpus sentences containing the lexical unit.

1 TOTAL	Agent	Place	Source	Theme
(1)	NP Ext	PP[in] Dep	INI --	NP Obj
2 TOTAL	Agent	Source	Theme	
(1)	DNI --	DNI --	NP Obj	
(1)	NP Ext	PP[from] Dep	NP Obj	
1 TOTAL	Agent	Theme		
(1)	NP Ext	NP Obj		

Figure 2. Portion of Valence Patterns for *take* in the `Taking` frame in FrameNet.

Three combinations of Frame Elements are shown in the table, the first of which includes the core FEs AGENT, SOURCE, and THEME, and the non-core PLACE FE, as in the sentence [<Agent>The Ottomans] *took*^{tgt} [<Theme>land] [<Place>in what is now Turkey] [<Source>INI]. The grammatical function and phrase type of each FE is listed below the FE name, e.g. the THEME is a nominal object. The labels DNI and INI refer to FEs that are not overtly expressed and are interpreted under definite or indefinite null instantiation, respectively (see Section 3.1). The numbers in the left-hand column refer to the number of annotated corpus sentences bearing each FE configuration. Users can click on the number to see the corpus sentence(s) for each configuration, and all annotated corpus sentences can also be accessed on the annotation page of the Lexical Entry.

As noted above, FrameNet also organizes frames in a hierarchical structure by means of frame-to-frame relations, such as Inheritance, Uses, and Perspective_on, among others. These relations account for frames and FEs that are similar but differ in terms of specificity or perspective. These relations are documented on FrameNet's FrameGrapher tool, with which users can select a frame and see which frames are related to it in which ways (see Fillmore and Baker [2010] for details). Table 3 shows a portion of the frame hierarchy surrounding the `Taking` frame.

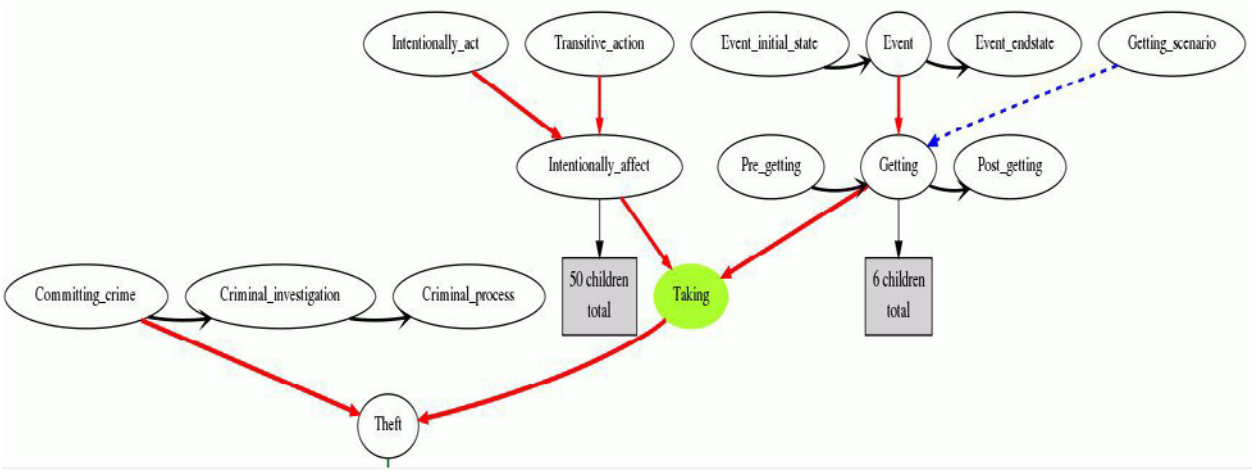


Figure 3. FrameNet's Frame Grapher representing different relations between semantic frames.

Below, we discuss how the frame hierarchy and frame-to-frame relations can be used to arrive at broader-scale linking rules which predict the syntactic realization of FEs, but we also point out the difficulty of formulating such rules without adequate empirical data.

Additional FrameNet data not included in frame description or lexical entry pages include the Frame SQL search interface, which allows detailed searches of FrameNet (e.g. for specific FE-GF-PT combinations), and some full text annotations in which entire texts are annotated for frame-semantic information (see Ziem et al. 2014).

2.3. Current research in and challenges for Frame Semantics and FrameNet

One of the issues raised by researchers not familiar with FrameNet is its coverage (see Hanks 2012). After twenty years of continuous work, members of the FrameNet project have created lexical entries for 13,635 lexical units, evoking 1,223 frames (consisting of 10,542 unique frame elements), together with 202,229 annotation sets (FrameNet accessed on June 17, 2017). Compared to other lexical resources such as WordNet (Fellbaum 1990), the coverage of FrameNet appears relatively limited in comparison. However, there are a few points to keep in mind when comparing FrameNet with other lexical resources. First, FrameNet offers a much greater wealth and depth of information, specifically when it comes to documenting how the semantics of frames evoked by words are realized syntactically (see, e.g., the rich information contained in the valence tables such as in Figure 2 above). Second, creating frame descriptions and annotating corpus examples with semantic frames are both manual activities that require a great deal of time and funding. Since its inception in 1997, the usability of FrameNet data (despite its perceived lack of coverage) has been demonstrated by research on different types of linguistic phenomena, including syntactic alternations (Baker and Ruppenhofer 2002, Boas 2002/2011b, Iwata 2008, Dux 2011), verb classification (Boas 2008c, Croft 2009, Bouveret 2012, Dux 2016), lexicography (Fillmore and Atkins 2000, Atkins 2003, Fillmore et al. 2003, Schmidt 2009, Ruppenhofer et al. 2013, Boas 2013b), full text analysis (Ziem et al. 2014),

analysis of metaphors (Gargett et al. 2014, Gemmell 2015, Ziem 2015), and contrastive analyses (Subirats and Petruck 2003, Boas 2010b, Hilpert 2010, Boas and Gonzalvez-Garcia 2014, Hasegawa et al. 2016), to name just a few. In addition, FrameNet data have been applied to solve issues in foreign language education (Atzler 2011, Friberg Heppin and Heppin 2012, Boas and Dux 2013, Boas et al. 2016, VanNoy 2016, Benjamin et al. in progress) and natural language processing, e.g. Automatic Semantic Role Labeling (Gildea and Jurafsky 2002, Das et al. 2010, Ruppenhofer et al. 2013), Semantic Parsing (Baker et al. 2007, Schneider 2015), automatic induction of frames (Hermann 2014), and Sentiment Analysis (Ruppenhofer and Rehbein 2012). The breadth of research underway demonstrates that FrameNet data, despite its perceived limitations of coverage, is not a serious issue. On the contrary, we would like to propose that the different types of current research demonstrate the quality and usability of FrameNet data and that the real issue is one of funding in order to reach a more complete coverage of the lexicon of English more quickly.[7] An alternative option is to (semi-)automatically induce new frames and to (semi-)automatically create frame annotations using computational techniques. Research in these areas is ongoing, but it is not clear yet what the exact outcomes will be (Das et al. 2014).

Another issue with the current architecture of FrameNet pointed out in the literature concerns the lack of systematicity and organization. Recall that in earlier versions of Fillmore's case theory, there was only a limited set of semantic roles, similar in spirit to the relatively small inventory of semantic primitives found in other contemporary theories of lexical meaning (e.g. Bierwisch (1970), Jackendoff (1990), Levin and Rappaport Hovav 2005, Wierzbicka (2006)). Because of the issues with such a limited set of semantic roles (see Section 2 above), during the 1980s Fillmore purposely moved to a frame-based organization of the lexicon, which finds its practical implementation in FrameNet. The critique leveled by researchers such as Osswald and Van Valin (2014) focuses on the observation that there is "a certain lack of systematicity in the definition of frames and frame relations, which may hinder the derivation of linking generalizations" (2014: 125). Based on data from verbs of cutting and separation in FrameNet, Osswald and Van Valin (2014) point out a number of inconsistencies in the organization of these frames and the definitions of their Frame Elements.

While Osswald and Van Valin (2014) certainly point out some important issues in the current organization of FrameNet, specifically with respect to its data-driven, purely bottom-up methodology, we propose that this critique is both inadequate and too early. First, as pointed out in the previous paragraph, the coverage of the English lexicon by FrameNet is not complete. This means that there is yet no complete inventory of frames and frame relations available. As such, it is difficult to arrive at broad-scale or "universal" linguistic insights about linking generalizations. In other words, we believe that without having a more complete (if not totally complete) coverage of the English lexicon by FrameNet, it is almost impossible to arrive at the types of generalizations that Osswald and Van Valin are looking for. Up to this point, FrameNet research

[7] Studies such as Baker and Fellbaum (2008) and Baker and Palmer (2009) have also compared FrameNet with the WordNet project (Miller 1995, Fellbaum 1998), which organizes the English lexicon according to semantic relations such as synonymy, hyponymy, and metonymy, showing how the two resources can be aligned and complement each other in various tasks such as text understanding.

has focused on providing a rich and empirically sound characterization of the English lexicon, which has led its researchers to appreciate the difficulty of establishing linking rules that accurately account for all data. In fact, one of the key insights made by members of the FrameNet project over the past two decades is that the exploration, definition, and description of new frames during the project's workflow regularly resulted in the necessity to reframe existing frames and frame relations (see Petruck et al. 2004 and Ruppenhofer et al. 2010). In sum, broad-scale linking rules can only be formulated with a much larger amount of (annotated corpus) data, and even given this, it is yet unclear whether a word's (frame) semantics is fully predictive of its syntactic behavior, and vice versa (see Faulhaber 2011 and Dux 2016).

At the same time, now that FrameNet has documented a substantial (though not complete) portion of the English lexicon, research has begun to identify certain smaller-scale generalizations and insights, as evidenced by the plethora of studies drawing on FrameNet data cited above. We believe that numerous empirically rich and detailed investigations of individual frames or sets of related frames may eventually result in the identification of broader-scale linking rules. Frame-to-frame relations and the frame hierarchy (see Figure 3 above) show promise as theoretical tools for identifying and defining the linking rules desired by scholars such as Osswald and Van Valin, but more data and careful small-scale investigations are required at this point.

3. Extending FrameNet[8]

3.1 Multilingual FrameNets

One of the ideas found in Fillmore's earlier work during the 1960s was that his early case frames could be used to investigate universal aspects of language such as the subject selection rule (Fillmore 1968). Later research in Frame Semantics also explored the idea of applying frame-semantic insights to study aspects of language that could possibly reveal interesting universal aspects. Early research during the 1990s by Heid (1996) and Fontenelle (1997) investigated how frame-semantic insights derived on the basis of English could be applied to the systematic analysis of the lexicons of languages other than English. Subsequent research demonstrated in greater detail how English-based semantic frames could be employed for frame-semantic analysis of other languages (Fillmore and Atkins 2000, Boas 2001/2002/2005b, Petruck and Boas 2003). The results of this research inspired the creation of FrameNets for other languages, most notably Spanish (Subirats and Petruck 2003; Subirats 2009), Japanese (Ohara et al. 2003, Ohara 2009), German (Burchardt et al. 2009), Swedish (Borin et al. 2010), and Brazilian Portuguese (Torrent et al. 2014). These projects provide vital information about how the semantics of a given frame are realized syntactically by different LUs evoking that frame in different languages, allowing researchers to systematically conduct contrastive and comparative

[8] Parts of this section are based on Boas (2017).

research on both lexical-semantic and argument realization topics such as polysemy, profiling properties, and the interface between lexicon and syntax (see Petruck 2009, Hasegawa et al. 2016, Leino 2010, Timyam and Bergen 2010, Bouveret 2012, and Willems 2012).[9]

3.2 The Constructicon

Fillmore's research in Frame Semantics repeatedly pointed to the interconnection between semantic frames and grammatical construction, and Fillmore et al.'s (1988) account of the 'let alone' construction and Fillmore's (1988) concurrent formulation of Construction Grammar established the close relation between these theories. However, it was not until 2008, when a pilot project housed at FrameNet sought to explore systematically the possibility of identifying grammatical constructions and describing them using a FrameNet-type format.[10] The goal of this effort was to identify, analyze, and annotate constructions in a very similar way as LUs in FrameNet.

Consider an example such as the construct *Kim doesn't like citrus fruit, let alone grapefruit*. A construct is a linguistic form that instantiates one or more constructions. In this example, the construct instantiates the `Let-alone` construction (Fillmore et al. 1988),[11] in which the phrase *let alone* functions as a conjunction with very specific semantic-pragmatic constraints on the pieces that it joins. Other constructions contributing to the construct include the non-lexical `Subject-predicate` and `Negation` constructions and the individual words (except *let alone*), which are lexical constructions (i.e. LUs evoking a particular semantic frame). Finding and annotating constructions follows roughly the same steps as the lexicographic workflow in FrameNet, i.e. just like lexicographers first choose a frame to analyze, construction grammarians first choose a construction and then search for corpus data that enables them to annotate the data and arrive at an adequate description (see Fillmore et al. 2012 for details).

Table 2 compares the similarities between lexical and constructional description (and analysis). Descriptions of constructions are formulated in prose (similar to lexical frame descriptions), together with a definition of construct elements (CEs). In construction annotation, annotators often look for a so-called construction-evoking element (CEE) (parallel to a frame-evoking LU), which is specific lexical material central for evoking the construction, such as the phrase *let alone*. Then, annotators identify and use the FrameNet desktop software to mark CEs such as, in the case of the `Let-alone` construction, First_conjunct (*citrus fruit*) and Second_conjunct (*grapefruit*), which are constituent parts of a construction, similar to FEs in lexical annotation. In some cases, however, there may not be any CEE, as in abstract

[9] In fall of 2016, the Berkeley FrameNet project received a grant for a three-year long project to systematically set up a multilingual FrameNet infrastructure. The first goal of this project is to have FrameNet teams working on at least eight different languages annotate the same texts in different languages in order to take a first step towards systematically describing and linking semantic frames across different languages.

[10] Constructional entries developed in this pilot project can be found at: http://sato.fm.senshu-u.ac.jp/frameSQL/cxn/CxNeng/cxn00/21colorTag/index.html.

[11] Following Fillmore et al. (2012), names of constructions are represented in italicized Courier New font.

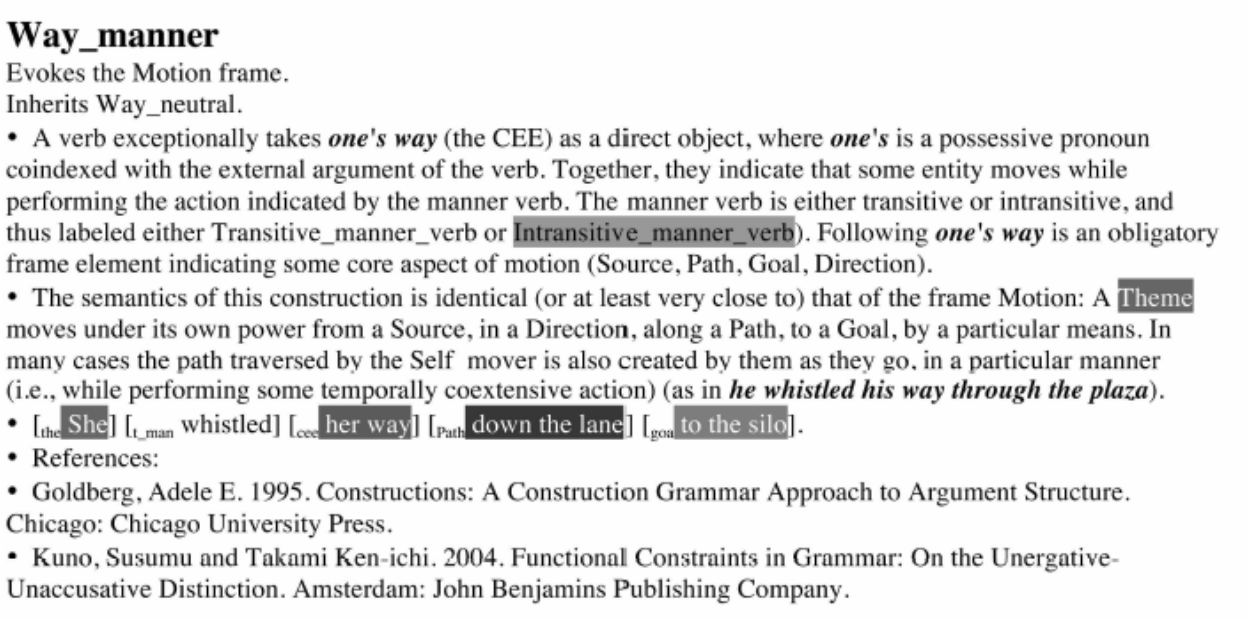
constructions such as *Subject_Predicate*, *Gapping*, and *Right_Node_Raising*, which have no overt lexical material signaling the presence of a construction. In such cases, annotators only employ the CE labels to identify the different parts of the construction. Besides the identification of CEs, annotations on different layers may also include information about grammatical functions and phrase types, parallel to FrameNet's lexical annotation. These added annotation layers are intended to capture possible variations in the realization of a construction.

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

Table 2. Lexical and constructional description and annotation compared (Fillmore 2008: 9).

After the annotation process is complete, the construction descriptions, together with their annotated example sentences, are stored in the Constructicon, an extension of the original FN database. It currently consists of roughly 75 construction entries documenting different types of constructions according to the kinds of constructs they create. These include frame-bearing constructions, valence-augmenting constructions, constructions without meanings, contextually bound constructs, pumping constructions, exocentric and headless constructions, and clause-defining constructions (see Fillmore et al. 2012 for details). To illustrate, consider Figure 4 below, which is the first part (the description) of the entry of the *Way_manner* construction in

the Constructicon. Above the construction description we see that this construction evokes the `Motion` frame, and it inherits from the *`Way_neutral`* construction. This information is followed by a general prose description, including the semantics of the construction. Beneath the description we find references to publications on the *`Way_manner`* construction.



Way_manner

Evokes the Motion frame.
Inherits Way_neutral.

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

Figure 4. First part of *`Way_manner`* construction: Construction description.

The second part of a construction entry, seen in Figure 5, contains the definitions of CEE(s) and CEs. In the case of the *`Way_manner`* construction, this is the noun phrase *one's way*, where *one's* is co-indexed to the Theme. One special feature of the *`Way_manner`* construction is the fact that its CEs are directly linked to the FEs of the `Motion` frame.

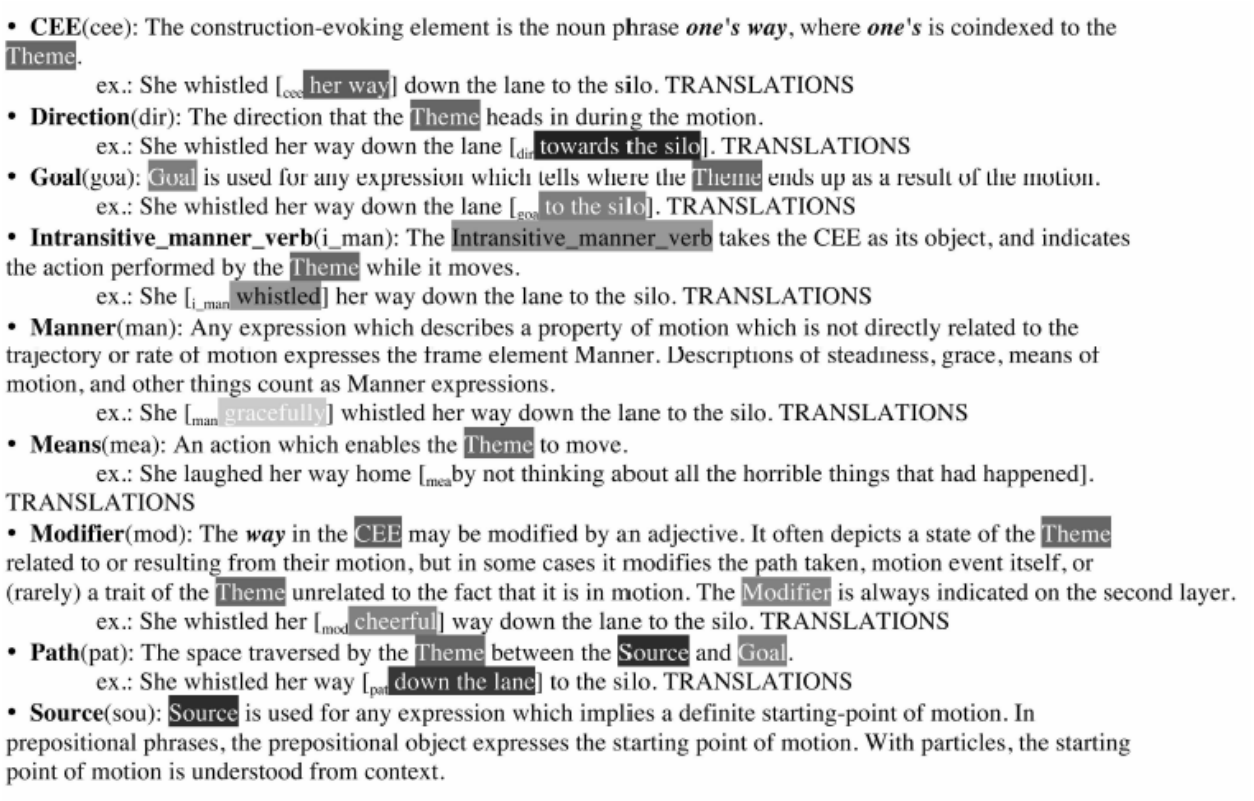
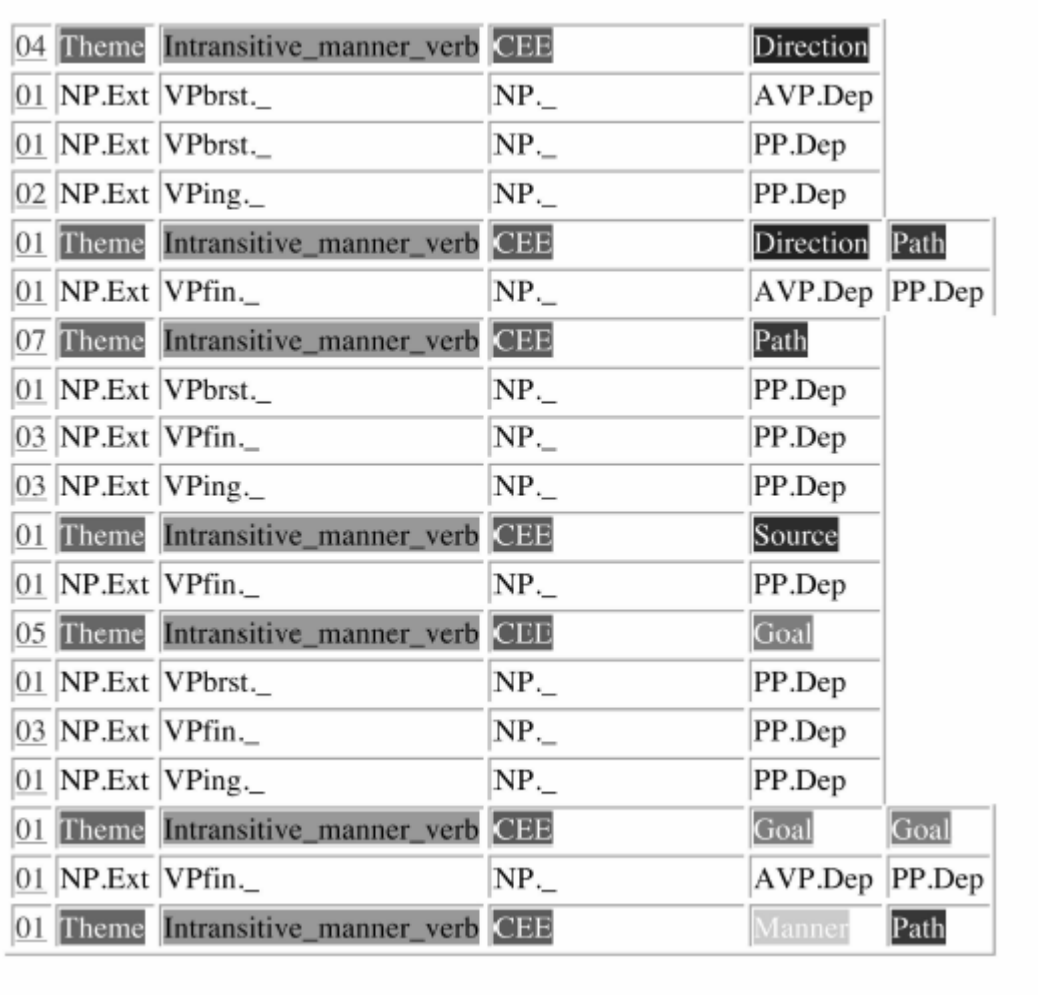


Figure 5. Second part of *Way_manner* construction entry (partial)

Finally, the summary of how the construction's CEs are realized syntactically can be found in the last part of a construction entry. In the case of the *Way_manner* construction, Figure 6 shows that the Theme is always realized as an external NP, and that the Intransitive_manner_verb appears in different forms such as finite (VPfin) and the progressive form (VPing). The CEE is always a NP, while the Direction is realized as a dependent ADVP or PP.[12]

[12] Note that while the types and granularity of information displayed differs from construction to construction, they are still parallel to the valence tables found in the FN lexical entries.



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

Figure 6. Third part of *Way_manner* construction entry: partial summary

While the Berkeley Constructicon for English currently consists of about 75 construction entries, more work is currently under way at FrameNet to enlarge the inventory of constructions. In the meantime, various multilingual FrameNet projects have begun to also assemble construction entries for Swedish, Japanese, Brazilian Portuguese, and German (Lyngfelt et al. 2012, Ohara 2013, Boas 2014, Ziem 2014a, Ziem and Boas 2017). The goal is to determine to what degree it is possible to arrive at corresponding grammatical constructions across multiple languages and to see whether such construction entries can be linked to each other (Boas 2010b). While it is too early to arrive at any definite conclusions about the correspondence of constructions across languages, first results seem to suggest that it is possible to arrive at a fair amount of corresponding constructions for English constructions, although typically with some minor differences. The closest equivalents are typically relative general grammatical constructions, whereas those containing specific lexical elements tend to differ more (Bäckstrom et al., submitted). As the inventories of corpus-based construction entries grow for each language, we expect these to be of more than descriptive value and thereby also to become more relevant for a more general theory of language.

4. Conclusions

FrameNet was originally designed as a corpus-based project that sought to apply the principles of Fillmore's Frame Semantics towards constructing a lexicographic database for English. Over the past twenty years, FrameNet has grown significantly in coverage, but much work remains to be done. This paper provided an overview of the layout and methodology underlying FrameNet, and how its principles have been applied to the construction of FrameNets for other languages. In addition, we have shown how FrameNet has been expanded to cover grammatical constructions of English, and multilingual FrameNets around the world are now also working on assembling constructicons for other languages. We hope that the interested reader will spend some time familiarizing himself with the rich content that FrameNet has to offer in order to see how it may inform the analysis of specific linguistics problems.

References

Atkins, Sue, Michael Rundell, and Hiroaki Sato. 2003. The contribution of FrameNet to practical lexicography. *International Journal of Lexicography*. 16(3). 333–357.

Atzler, Judith K. 2011. *Twist in the list: Frame Semantics as vocabulary teaching and learning tool*: University of Texas at Austin dissertation.

Bäckstrom, Linnea, Lyngfelt, Benjamin, and Emma Sköldberg. Submitted. Towards interlingual constructicography. On correspondence between construction resources for English and Swedish. In B. Lyngfelt and T. Torrent (eds.), Interlingual Constructicography. Amsterdam/Philadelphia: John Benjamins.

Baker, Collin and Josef Ruppenhofer. 2002. FrameNet's Frames vs. Levin's Verb Classes. In J. Larson and M. Paster (eds.), *Proceedings of the 28th Annual Meeting of the Berkeley Linguistics Society*, 27–38. UC Berkeley: Berkeley Linguistics Department.

Baker, Collin, Charles J. Fillmore, and Beau Cronin. 2003. "The structure of the FrameNet database." *International Journal of Lexicography* 16(3). 281-296.

Baker, Collin, Michael Ellsworth, and Katrin Erk. 2007. SemEval'07 task 19: frame semantic structure extraction. In *Proceedings of the 4th International Workshop on Semantic Evaluations (SemEval'07, ACL)*, 9–104, Stroudsburg, PA, USA.

Baker, Collin F. and Christiane Fellbaum. 2009. WordNet and FrameNet as complementary resources for annotation. In *Proceedings of the third linguistic annotation workshop*, 125–129. Association for Computational Linguistics.

Barðdal, Jóhanna. 2008. *Productivity. Evidence from Case and Argument Structure in Icelandic*. Amsterdam/Philadelphia: John Benjamins.

Berlin, Brent and Paul Kay. 1969. *Basic Color Terms: Their Universality and Evolution*. Berkeley: University of California Press.

Bierwisch, Manfred. 1970. Semantics. In J. Lyons (ed.), *New horizons in linguistics*, 166–184. Harmondsworth: Penguin.
Boas, Hans C. 2001. Frame Semantics as a framework for describing polysemy and syntactic structures of English and German motion verbs in contrastive computational lexicography. In P. Rayson, A. Wilson, T. McEnery, A. Hardie & S. Khoja (eds.), *Proceedings of Corpus Linguistics 2001*, 64–73.
Boas, Hans C. 2002. Bilingual FrameNet dictionaries for machine translation. In M. González Rodríguez & C. Paz Suárez Araujo (eds.), *Proceedings of the Third International Conference on Language Resources and Evaluation*, Vol. IV, 1364–1371. Las Palmas, Spain.
Boas, Hans C. 2003a. *A constructional approach to resultatives*. Stanford: CSLI Publications.
Boas, Hans C. 2003b. A lexical-constructional account of the locative alternation. In L. Carmichael, C.-H. Huang, and V. Samiian (eds.), *Proceedings of the 2001 Western Conference in Linguistics. Vol. 13*, 27–42
Boas, Hans C. 2005a. From theory to practice: Frame Semantics and the design of FrameNet. In S. Langer and D. Schnorbusch (eds.), *Semantik im Lexikon*, 129–160. Tübingen: Narr.
Boas, Hans C. 2005b. Semantic frames as interlingual representations for multilingual lexical databases. *International Journal of Lexicography* 18(4). 445–478.
Boas, Hans C. 2008a. Resolving Form-meaning Discrepancies in Construction Grammar. In J. Leino (ed.), *Constructional Reorganization*, 11–36. Amsterdam/Philadelphia: Benjamins.
Boas, Hans C. 2008b. Determining the structure of lexical entries and grammatical constructions in Construction Grammar. *Annual Review of Cognitive Linguistics* 6. 113–144.
Boas, Hans C. 2008c. Towards a frame-constructional approach to verb classification. In E. Sosa Acevedo and F. J. Cortés Rodríguez (eds.), *Grammar, Constructions, and Interfaces. Special Issue of Revista Canaria de Estudios Ingleses* 57. 17–48.
Boas, Hans C. (ed.) 2009. *Multilingual FrameNets in Computational Lexicography*. Berlin/New York: Mouton de Gruyter.
Boas, Hans C. 2010a. Linguistically relevant meaning elements of English communication verbs. *Belgian Journal of Linguistics 2*. 54–82.
Boas, Hans C. 2010b. Comparing constructions across languages. In H.C. Boas (ed.), *Contrastive Studies in Construction Grammar*, 1–20. Amsterdam/Philadelphia: Benjamins.
Boas, Hans C. 2011a. Zum Abstraktionsgrad von Resultativkonstruktionen. In S. Engelberg, K. Proost, and A. Holler (eds.), *Sprachliches Wissen zwischen Lexikon und Grammatik*, 37–69. Berlin/New York: Mouton de Gruyter.
Boas, Hans C. 2011b. A frame-semantic approach to syntactic alternations with *build*-verbs. In P. Guerrero Medina (ed.), *Morphosyntactic alternations in English*, 207–234. London: Equinox.
Boas, Hans C. 2013a. Cognitive Construction Grammar. In T. Hoffmann and G. Trousdale (eds.), *The Oxford Handbook of Construction Grammar*, 233–254. Oxford: Oxford University Press.
Boas, Hans C. 2013b. Wie viel Wissen steckt in Wörterbüchern? Eine frame-semantische Perspektive. *Zeitschrift für Angewandte Linguistik* 57. 75-97.

Boas, Hans C. 2013c. Frame Semantics and translation. In A. Rojo and I. Ibarretxte-Antuñano (eds.), *Cognitive Linguistics and Translation*, 125–158. Berlin/New York: Mouton de Gruyter.
Boas, Hans C. 2014a. Zur Architektur einer konstruktionsbasierten Grammatik des Deutschen. In A. Ziem and A. Lasch (eds.), *Grammatik als Inventar von Konstruktionen? Sprachliches Wissen im Fokus der Konstruktionsgrammatik*, 37-63. Berlin/New York: de Gruyter.
Boas, Hans C. 2014b. *What happened to Frame Semantics?* Invited plenary lecture at the 8th International Conference on Construction Grammar, Osnabrück, Sept. 3-6, 2014.
Boas, Hans C. 2017. Computational Resources: FrameNet and Constructicon. In B. Dancygier (ed.), *The Cambridge Handbook of Cognitive Linguistics*, 549-573. Cambridge: Cambridge University Press.
Boas, Hans C. and Ryan Dux. 2013. Semantic frames for foreign language education: Towards a German frame-based dictionary. *Veridas On-line. Special Issue on Frame Semantics and its Technological Applications*. 82–100. http://www.ufjf.br/revistaveredas/edicoes-2013
Boas, Hans C. and Francisco Gonzalvez-Garcia. 2014. *Romance perspectives on Construction Grammar*. Amsterdam/Philadelphia: John Benjamins.
Boas, Hans C., Ryan Dux, and Alexander Ziem. 2016. Frames and constructions in an online learner's dictionary of German. In S. De Knop and G. Gilquin (eds.), *Applied Construction Grammar*, 303-326. Berlin: de Gruyter.
Boas, Hans C. and Ivan A. Sag (eds.). 2012. *Sign-based Construction Grammar*. Stanford: CSLI Publications.
Borin, Lars., Dannells, D., Forsberg, M., Toporowska Gronostaj, M., & Kokkinakis, D. 2010. The past meets the present in the Swedish FrameNet++. *14th EURALEX International Congress*, 269-281.
Bouveret, Myriam. 2012. GIVE frames and constructions in French. In: M. Bouveret and D. Legallois (eds.), *Constructions in French*, 99–126. Amsterdam/Philadelphia: John Benjamins.
Burchardt, Aljoscha, Katrin Erk, Anette Frank, Andrea Kowalski, Sebastian Padó, and Manfred Pinkal. 2009. Using FrameNet for the semantic analysis of German: annotation, representation, and automation. In Hans C. Boas (ed.), *Multilingual FrameNets: Methods and Applications*, 209–244. Berlin/New York: Mouton de Gruyter.
Busse, Dietrich. 2012. *Frame-Semantik. Ein Kompendium*. Berlin/New York: Mouton de Gruyter.
Croft, William. 2003. Lexical rules vs. constructions: A false dichotomy. In H. Cuyckens, T. Berg, R. Dirven and K.-U. Panther (eds.), *Motivation in Language: Studies in Honor of Günther Radden*, 49–68. Amsterdam/Philadelphia: John Benjamins.
Croft, William A. 2009. Connecting frames and constructions: A case study of *eat* and *feed*. *Constructions and Frames* 1(1). 7–28.
Croft, William. 2012. *Verbs*. Oxford: Oxford University Press.
Croft, William. 2013. Radical Construction Grammar. In T. Hoffmann and G. Trousdale (eds.), *The Oxford Handbook of Construction Grammar*, 211–232. Oxford: Oxford University Press.

Croft, William and Alan Cruse. 2004. *Cognitive Linguistics*. Cambridge: Cambridge University Press.
Das, Dipenjan, Schneider, Nathan, Chen, Desai, and Noah A. Smith. 2010. Probabalistic frame-semantic parsing. In Proceedings of HLT '10 Human Language Technologies: The 2010 Annual Conference of the North American Chapter of the Association of Computational Linguistics, 948-956.
Das, Dipanjan. Desai Chen, André FT Martins, Nathan Schneider, and Noah A Smith. 2014. Frame-semantic Parsing. *Computational Linguistics* 40(1). 9-56.
Dolbey, Andrew. 2009. *BioFrameNet: A FrameNet extension to the domain of molecular biology*. Unpublished Ph.D. dissertation, University of California, Berkeley.
Dux, Ryan. 2011. *A frame-semantic analysis of five English verbs evoking the Theft frame*. M.A. Thesis, The University of Texas at Austin.
Dux, Ryan. 2016. *A usage-based approach to verb classes in English and German.* Ph.D. dissertation, The University of Texas at Austin.
Dux, Ryan. In press. Frames, verbs, and constructions: German constructions with verbs of stealing. In: Alexander Ziem and Hans C. Boas (eds.): *Constructional Approaches to Argument Structure in German*. Berlin/New York: Mouton de Gruyter.
Engelberg, Stefan, König, Svenja, Proost, Kristel, and Edeltraud Winkler. 2011. Argumentstrukturmuster als Konstruktionen? In S. Engelberg, A. Holler, and K. Proost (eds.), *Sprachliches Wissen zwischen Lexikon und Grammatik*, 71–112. Berlin/New York: De Gruyter.
Faulhaber, Susen. 2011. *Verb valency patterns*. Berlin/New York: Mouton de Gruyter.
Fellbaum, Christiane. 1990. English verbs as a semantic net. *International Journal of Lexicography* 3(4). 278-301.
Fellbaum, Christiane (ed.). 1998. *WordNet: An electronic lexical database*. Cambridge, MA: The MIT Press.
Fillmore, Charles J. 1968. The case for case. In E. Bach & R. Harms (Eds.), *Universals in Linguistic Theor*y, 1–90. New York: Rinehart & Winston.
Fillmore, Charles J. 1975. An alternative to checklist theories of meaning. *Proceedings of the First Annual Meeting of the Berkeley Linguistic Society (BLS)*, 123–131.
Fillmore, Charles J. 1976. Frame semantics and the nature of language. *Annals of the New York Academy of Sciences: Conference on the origin and development of language and speech*, 280, 20–32.
Fillmore, Charles J. 1977a. Topics in Lexical Semantics. In P. Cole (ed.), *Current Issues in Linguistic Theory*, 76–136. Bloomington: Indiana University Press.
Fillmore, Charles J. 1977b. Scenes-and-frames semantics. In A. Zampolli (ed.), *Fundamental Studies in Computer Science*, 55–88. Dordrecht: North Holland Publishing.
Fillmore, Charles J. 1978. On the organization of semantic information in the lexicon. *Papers from the Parasession on the Lexicon, Chicago Linguistic Society*, 148–173.
Fillmore, Charles J. 1982. Frame Semantics. In: *Linguistics in the Morning Calm*, ed. Linguistic Society of Korea, 111–38. Seoul: Hanshin.

Fillmore, Charles J. 1985. Frames and the Semantics of Understanding. *Quaderni di Semantica* 6. 222–254.
Fillmore, Charles J. 1986. Pragmatically controlled zero anaphora. *Proceedings of the Berkeley Linguistics Society*, 95–107.
Fillmore, Charles, J. 1987. A private history of the concept 'frame.' In R. Dirven and G. Radden (eds.), *Concepts of Case*, 28-36. Tübingen: Gunter Narr Verlag.
Fillmore, Charles J. 1988. The mechanisms of "Construction Grammar". *Proceedings of the Fourteenth Annual Meeting of the Berkeley Linguistic Society (BLS)*, 35–55.
Fillmore, Charles J. 2007. Valency issues in FrameNet. In T. Herbst and K. Götz-Vetteler (eds.), *Valency: theoretical, descriptive, and cognitive issues*, 129–160. Berlin/New York: Mouton de Gruyter.
Fillmore, Charles J. 2008. Border Conflicts: FrameNet meets Construction Grammar. *Proceedings of the XIII EURALEX International Congress* (Barcelona, 15–19 July 2008), 49–68.
Fillmore, Charles J. 2013. Berkeley Construction Grammar. In T. Hoffmann and G. Trousdale (eds.), *The Oxford Handbook of Construction Grammar*, 111–132. Oxford: Oxford University Press.
Fillmore, Charles J. & Beryl T.S. Atkins. 1992. Toward a Frame-based Lexicon: The Semantics of RISK and its Neighbors. In: A. Lehrer and E. Kittay (eds.), *Frames, Fields and Contrasts: New Essays in Semantic and Lexical Organization*, 75–102. Hillsdale: Erlbaum.
Fillmore, Charles J. and B.T.S. Atkins. 2000. Describing polysemy: The case of *crawl*. In Y. Ravin and C. Leacock (eds.), *Polysemy: Linguistic and computational approaches*, 91–110. Oxford: Oxford University Press.
Fillmore, Charles J. and Colin Baker. 2010. A frames approach to semantic analysis. In B. Heine and H. Narrog (Eds.), *The Oxford Handbook of Linguistic Analysis*, 313–340. Oxford: Oxford University Press.
Fillmore, Charles J. and Paul Kay. 1993. *Construction Grammar Course Book*. UC Berkeley: Department of Linguistics.
Fillmore, Charles J., Paul Kay, and Mary O'Connor. 1988. Regularity and idiomaticity in grammatical constructions: The case of 'let alone.' *Language* 64, 501–538.
Fillmore, Charles J., Johnson, Chris, and Miriam Petruck. 2003. Background to FrameNet. *International Journal of Lexicography* 16, 235–251.
Fillmore, Charles, Lee-Goldman, Russell, and Russell Rhomieux. 2012. The FrameNet Constructicon. In: H.C. Boas and I. Sag (eds.), *Sign-based Construction Grammar*, 309–372. Stanford: CSLI Publications.
Fontenelle, Thierry. 1997. Using a bilingual dictionary to create semantic networks. *International Journal of Lexicography* 10(4). 275–303.
Forsbert, Markus, Johansson,Richard, Bäckström, Linnea, Borin, Lars, Lyngfelt, Benjamin, Olofsson, Joel, and Julia Prentice. From construction candidates to constructicon entries. *Constructions and Frames* 6(1). 114–135.

Heppin, Karin Friberg, and Håkan Friberg. (2012). Using FrameNet in communicative language teaching. In *Proceedings of the XV EURALEX International Congress*. 640-647.
Gargett, Andrew, Josef Ruppenhofer, and John Barnden. 2014. Dimensions of metaphorical meaning. In *Proceedings of the 4th Workshop on Cognitive Aspects of the Lexicon (COGALEX)*.166-173.
Gemmell, Maggie. 2015. *Semantic role alignment in metaphor: A frame semantic approach to metaphoric meaning*. Unpublished Ph.D. dissertation, The University of Texas at Austin.
Gildea, Daniel, and Daniel Jurafsky. 2002. Automatic labeling of semantic roles. *Computational Linguistics* 28(3). 245-288.
Goldberg, Adele. 1995. *Constructions: A Construction Grammar Approach to Argument Structure*. Chicago: University of Chicago Press.
Goldberg, Adele. 2006. *Constructions at work*. Oxford: Oxford University Press.
Hanks, Patrick. 2012. Corpus Evidence and Electronic Lexicography. In: S. Granger and M. Paquot (eds.), *Electronic Lexicography*. Oxford University Press.
Hasegawa, Yoko, Lee-Goldman, Russell, and Charles J. Fillmore. 2016. On the universality of frames. In M. Hilpert and J.-O. Östman (eds.), *Constructions across Grammars*, 34-66. Amsterdam/Philadelphia: John Benjamins.
Hasegawa, Yoko, Lee-Goldman, Russell, Ohara, Kyoko Hirose, Fuji, Seiko, and Charles J. Fillmore. 2010. On expressing measurement and comparison in English and Japanese. In H.C. Boas (ed.), *Contrastive Studies in Construction Grammar*, 169–200. Amsterdam/ Philadelphia: John Benjamins.
Heid, Ulrich. 1996. Creating a multilingual data collection for bilingual lexicography from parallel monolingual lexicons. In *Proceedings of the VIIth EURALEX International Congress*, Gothenburg 1996, 573–559.
Herbst, Thomas. 2011. The status of generalizations: Valency and argument structure constructions. In T. Herbst and A. Stefanowitsch (eds.), Argument structure: valency and/or construction? Special issue of *Zeitschrift für Anglistik und Amerikanistik*, 59(4). 347–367.
Herbst, Thomas. 2014. The valency approach to argument structure constructions. In Thomas Herbst, Hans-Jörg Schmid, Susen Faulhaber (eds.), *Constructions – Collocations – Patterns*. Berlin: de Gruyter Mouton.
Hermann, Karl Moritz. 2014. *Distributed Representations for Compositional Semantics*. Ph.D. thesis, University of Oxford.
Hilpert, Martin. 2010. What can synchronic gradience tell us about reanalysis? Verb-first conditionals in written German and Swedish. In: E.C. Traugott and G. Trousdale (eds.), *Gradience, gradualness and grammaticalization*, 181-201. Amsterdam/ Philadelphia: John Benjamins.
Hoffmann, Thomas and Graeme Trousdale (eds.). 2013. *The Oxford Handbook of Construction Grammar*. Oxford: Oxford University Press.
Iwata, Seizi. 2008. *Locative alternation: a lexical-constructional approach*. Amsterdam/ Philadelphia: John Benjamins.

Jackendoff, Ray. 1990. *Semantic structures*. Cambridge, MA: The MIT Press.
Kay, Paul and Charles J. Fillmore. 1999. 1999. Grammatical constructions and linguistic generalizations: The 'What's X doing Y?' Construction. *Language* 75. 1–33.
Lambrecht, Knud and Kevin Lemoine. 2005. Definite null objects in (spoken) French. In M. Fried and H.C. Boas (eds.), *Grammatical Constructions – Back to the Roots*, 13–56. Amsterdam/Philadelphia: John Benjamins.
Lasch, Alexander. 2016. *Nonagentive Konstruktionen des Deutschen*. Berlin/Boston: De Gruyter.
Lee-Goldman, Russell and Miriam Petruck. Submitted. The FrameNet Constructicon in action. In: B. Lyngfelt, L. Borin, K. Ohara and T. Torrent (eds.), *Constructicography: Construction development across languages.*
Leino, Jaakko. 2010. Results, cases, and constructions: Argument structure constructions in English and Finnish, In: H.C. Boas (ed.), *Contrastive Studies in Construction Grammar*, 103–136. Amsterdam/Philadelphia: Benjamins.
Levin, Beth. 1993. *English verb class and alternations*. Chicago: Chicago University Press.
Levin, Beth and Malka Rappaport Hovav. 2005. *Argument Realization*. Cambridge: Cambridge University Press.
Lyngfelt, Benjamin. 2012. Re-thinking FNI. On null instantiation and control in Construction Grammar. *Constructions and Frames* 4(1). 1–23.
Lyngfelt, Benjamin, Lars Borin, Markus Forsberg, Julia Prentice, Rudolf Rydstedt, Emma Sköldberg and Sofia Tingsell. 2012. Adding a constructicon to the Swedish resource network of Språkbanken. – In: Proceedings of KONVENS 2012, Vienna, 452-461.
Michaelis, Laura. 2013. Sign-based Construction Grammar. In T. Hoffmann and G. Trousdale (eds.), *The Oxford Handbook of Construction Grammar*, 133–152. Oxford: Oxford University Press.
Michaelis, Laura, and Josef Ruppenhofer. 2001. *Beyond Alternations*. Stanford: CSLI Publications.
Miller, George A. 1995. WordNet: A lexical database for English. *Communications of the ACM* 38(11). 39–41.
Nemoto, Noriko. 1998. On the polysemy of ditransitive SAVE: The role of frame semantics in Construction Grammar. *English Linguistics* 15, 219-242.
Nemoto, Noriko. 2005. Verbal polysemy and Frame Semantics in Construction Grammar: some observations about the locative alternation. In M. Fried and H.C. Boas (eds.), *Grammatical Constructions. Back to the Roots*, 119–138. Amsterdam/Philadelphia: John Benjamins.
Nilsen, Don L. F. 1973. *The instrumental case in English: Syntactic and semantic considerations*. The Hague: Mouton.
Ohara, Kyoko. 2009. Frame-based contrastive lexical semantics in Japanese FrameNet: The case of risk and kakeru. In: H.C. Boas (Ed.), *Multilingual FrameNets: Methods and Applications*, 163–182.
Ohara, Kyoko, Fujii, Seiko, Ohori, Toshio, Suzuki, Ryoko, Saito, Hiroaki, and Shun Ishizaki. 2004. The Japanese FrameNet Project: An introduction. In: *Fourth International Conference on*

Language Resources and Evaluation (LREC 2004). Proceedings of the Satellite Workshop "Building Lexical Resources from Semantically Annotated Corpora", 9–11.
Ohara, Kyoko. 2013. Toward Constructicon Building for Japanese in Japanese FrameNet. *Veredas* 17(1). 11-27.
Osswald, Rainer and Robert D. Van Valin Jr. 2014. Framenet, frame structure and the syntax-semantics interface. In R. Osswald T. Gamerschlag, D. Gerland and W. Petersen (eds.), *Frames and concept types: Applications in language and philosophy*, 125–156. Heidelberg: Springer.
Petruck, Miriam R.L. 1996. Frame Semantics. In: Verschueren, J., J-O Östman, J. Blommaert and C. Bulcaen (eds.), *Handbook of Pragmatics*, 1–13. Amsterdam/Philadelphia: Benjamins.
Petruck, Miriam R.L. 2009. Typological considerations in constructing a Hebrew FrameNet. In H.C. Boas (Ed.), *Multilingual FrameNets: Methods and Applications*, 183–208. Berlin/New York: Mouton de Gruyter.
Petruck, Miriam R.L. and Hans C. Boas. 2003. All in a Day's Week. In E. Hajicova, A. Kotesovcova & Jiri Mirovsky (eds.), *Proceedings of CIL 17*. CD-ROM. Prague: Matfyzpress.
Petruck, Miriam R. L., Charles J. Fillmore, Collin Baker, Michael Ellsworth, and Josef Ruppenhofer. 2004. Reframing FrameNet data. In *Proceedings of the 11th EURALEX International Congress*, Lorient, France, 405–416.
Pinker, Steven. 1989. *Learnability and Cognition*. Cambridge, Mass.: MIT Press.
Rappaport Hovav, Malka and Beth Levin. 1998. 1998. Building Verb Meaning. In M. Butt & W. Geuder (eds.), *The Projection of Arguments*, 97–134. Stanford: CSLI Publications.
Rosch, Eleanor. 1973. Natural categories. *Cognitive Psychology* 4. 328–350.
Ruppenhofer, Josef. 2004. *The interaction of valence and information structure*. Unpublished Ph.D. dissertation, University of California, Berkeley.
Ruppenhofer, Josef & Laura A. Michaelis. 2010. A Constructional Account of Genre-Based Argument Omissions. *Constructions and Frames*, 2. 158–184.
Ruppenhofer, Josef, Michael Ellsworth, Miriam R. L. Petruck, Chris Johnson, and Jan Scheffczyk. 2010. *FrameNet II: Extended theory and practice*. Available at [http://framenet.icsi.berkeley.edu].
Ruppenhofer, Josef, Boas, Hans C., and Collin Baker. 2013. The FrameNet approach to relating syntax and semantics. In R.H. Gouws, U. Heid, W. Schweickhard, and H.E. Wiegand (eds.), *Dictionaries. An International Encyclopedia of Lexicography*, 1320–1329. Berlin/New York: Mouton.
Ruppenhofer, Josef, and Ines Rehbein. 2012. Yes we can!? Annotating the senses of English modal verbs. *Proceedings of the 8th International Conference on Language Resources and Evaluation (LREC)*. 1538–1545.
Ruppenhofer, Josef, Boas, Hans C., and Collin Baker. In press. FrameNet. In P. A. Fuertes-Olivera (ed.), The Routledge Handbook of Lexicography. London: Routledge.
Sag, Ivan A. 2010. English Filler-Gap Constructions. *Language* 86. 486-545.
Sag, Ivan A. 2012. Sign-based Construction Grammar: An informal synopsis. In: H.C. Boas and I.A. Sag (eds.), *Sign-based Construction Grammar*, 69–202. Stanford: CSLI Publications.

Schmidt, Thomas. 2009. The Kicktionary – A multilingual lexical resource of football language. In H.C. Boas (ed.), *Multilingual FrameNets: Methods and Applications*, 101–134. Berlin/New York: Mouton de Gruyter.
Subirats, Carlos. 2009. Spanish FrameNet: A frame-semantic analysis of the Spanish lexicon. In: H.C. Boas (ed.), *Multilingual FrameNets: Methods and Applications*, 135–162. Berlin/New York: Mouton de Gruyter.
Subirats, Carlos and Miriam Petruck. 2003. Surprise: Spanish FrameNet! *Proceedings of CIL 17*. CD-ROM. Prague: Matfyzpress.
Sullivan, Karen. 2013. *Frames and constructions in metaphoric language.* Amsterdam/Philadelphia: John Benjamins.
Timyan, Napasri and Benjamin Bergen. 2010. A contrastive study of the caused-motion and ditransitive construction in English and Thai: Semantic and pragmatic constraints. In H.C. Boas (eds.), *Contrastive Studies in Construction Grammar,* 137–168. Amsterdam/Philadelphia: John Benjamins.
Torrent, Tiago, Maria Margarida Salomão, Fernanda Campos, Regina M.M. Braga, Ely Edison Matos, Maucha Gamonal, Julia Gonçalves, Bruno Souza, Daniela Gomes, and Simone Peron. 2014. "Copa 2014 FrameNet Brasil: a frame-based trilingual electronic dictionary for the Football World Cup." In *COLING (Demos)*, 10-14.
VanNoy, Annika. 2017. *Culture specific aspects of semantic frames in multilingual frame descriptions*. Unpublished Ph.D. dissertation, The University of Texas at Austin.
Wierzbicka, Anna. 2006. *English: Meaning and culture*. Oxford: Oxford University Press.
Willems, Dominique. 2012. Verb typology: Between construction and lexicon. In: M. Bouveret and D. Legallois (eds.), *Constructions in French*, 23–48. Amsterdam/Philadelphia: John Benjamins.
Ziem, Alexander. 2008. *Frames und sprachliches Wissen: kognitive Aspekte der semantischen Kompetenz*. Berlin/New York: Mouton de Gruyter.
Ziem, Alexander. 2014a. Von der Konstruktionsgrammatik zum FrameNet: Frams, Konstruktionen und die Idee eines Konstruktikons. In: A. Lasch and A. Ziem (eds.), *Grammatik als Inventar von Konstruktionen? Sprachwissen im Fokus der Konstruktionsgrammatik*, 263-290.cBerlin: De Guyter.
Ziem, Alexander. 2014b. *Frames of understanding in text and discourse: Theoretical foundations and practical applications.* Amsterdam/Philadelphia: John Benjamins.
Ziem, Alexander. 2015. Metaphors meet G-FOL. Zur Integration von Metaphern in eine Lehr- und Lernplattform für DaF. In: M. Dalmas and E. Piirainen (eds.), *Figurative Sprache*, 201-220. Tübingen: Stauffenburg.
Ziem, Alexander, Boas, Hans C., and Josef Ruppenhofer. 2014. Grammatische Konstruktionen und semantische Frames für die Textanalyse. In: J. Hagemann and S. Staffeldt (eds.), *Syntaxtheorien. Analysen im Vergleich*, 297-333. Tübingen: Stauffenburg.

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