

A frame-semantic approach to syntactic alternations: The case of build verbs*

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1 Introduction

Levin (1993: 1) proposes that “the behavior of a verb, particularly with respect to the expression and interpretation of its arguments, is to a large degree determined by its meaning”. To demonstrate this relationship between form and meaning Levin identifies a number of syntactic alternations. The idea is that verbs that are closely related in meaning show similar alternating behavior.

While this methodology has been applied successfully to a broad number of English verb classes and alternations, more recent work by Nemoto (1998), Baker and Ruppenhofer (2002), Goldberg (2002), Boas (2003a, 2008b), Iwata (2008), and Neale (this volume) has shown that Levin’s verb classes are not as homogeneous as previously thought. This paper contributes to this ongoing discussion by offering a frame-semantic analysis of the various syntactic alternations claimed by Levin to occur with her so-called *build* verbs.

The remainder of the paper is structured as follows. §2 reviews Levin’s (1993: 173–174) analysis of *build*-verbs such as *arrange*, *assemble*, *bake*, and *build*, which are claimed to exhibit a number of specific alternations. Section 3 tests Levin’s claims and shows that not all of her *build*-verbs exhibit identical alternating behavior. Following Boas (2003a, 2008a) I claim that the differences in syntactic behavior are best explained in terms of the different polysemy networks of senses associated with each verb. Section 4 offers an alternative approach to syntactic alternations with *build*-verbs. Adopting key ideas from Fillmore’s (1982) Frame Semantics

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and its practical implementation in FrameNet (Fillmore *et al.* 2003), I claim that syntactic behavior is not always the most effective method for determining membership in a semantic class of verbs. Section 5 summarizes my findings and provides an outlook on further research.

2 Levin's (1993) analysis of *build* verbs

Levin's (1993) seminal work is based on the idea that the syntactic behavior of a verb can be predicted from its meaning (see also Fillmore 1967; Hale and Keyser 1987, among others, on this idea). In this view, "verbs that fall into classes according to shared behavior would be expected to show shared meaning components" (Levin 1993: 5). Levin's verb classification is based on a total of 79 syntactic alternations, leading her to posit 193 distinct verb classes that cover 3024 verbs (or 4186 senses), such as verbs of putting, verbs of communication, etc. One of her verb classes is the so-called *build* verbs, a sub-type of verbs of creation and transformation, which includes the following members:

- (1) *Build* verbs: arrange, assemble, bake, blow (bubbles, glass), build, carve, cast, chisel, churn, compile, cook, crochet, cut, develop, embroider, fashion, fold, forge (metal), grind, grow, hack, hammer, hatch, knit, make, mold, pound, roll, sculpt, sew, shape, spin (wool), stitch, weave, whittle. (Levin, 1993: 173)

According to Levin (1993: 174), these verbs form a specific class because they are closely related in meaning, i.e., they "describe the creation of a product through the transformation of raw materials". As such, they also exhibit similar syntactic behavior with respect to a number of syntactic alternations. More specifically, *build* verbs occur in the material/product alternation, as in (2), the unspecified object alternation, as in (3), and the benefactive alternation, as in (4):

- (2) (a) Martha carved a toy out of the piece of wood.
(b) Martha carved the piece of wood into a toy.
- (3) (a) Martha carves toys.
(b) Martha carves.
- (4) (a) Martha carved a toy (out of a piece of wood) for the baby.
Martha carved the baby a toy (out of a piece of wood).
(b) Martha carved a piece of wood (into a toy) for the baby.
*Martha carved the baby a piece of wood (into a toy).

Examples taken from Levin (1993: 173).

With respect to the benefactive alternation in (4), Levin (1993: 174) points out that *build* verbs may exhibit particular properties of other verb classes: "If the creation is done on someone's behalf, then these verbs are like verbs of obtaining and, like the *get* verbs, are found in the benefactive alternation." In other words, *build* verbs may take on syntactic properties of *get* verbs, if the context allows for the appropriate interpretation. While all *build* verbs are capable of participating in the alternations in (2)–(4), according to Levin, they share another property, namely that they disallow other types of alternations, such as the total transformation alternation (transitive) as in (5), among others.

- (5) (a) Martha carved the piece of wood into a toy.
(b) *Martha carved the piece of wood from a branch into a toy.
Examples taken from Levin (1993: 173)

Interestingly, *build* verbs do not always exhibit clear-cut syntactic behavior. For example, Levin (1993: 173) observes that only some verbs but not others participate in the raw material subject alternation as in (6) and the sum of money subject alternation as in (7).

- (6) (a) Martha carved beautiful toys out of this wood.
(b) This wood carves beautiful toys.
Examples taken from Levin (1993: 173)
- (7) (a) The contractor will build (you) a house for \$100,000.
(b) \$100,000 will build (you) a house.
Examples taken from Levin (1993: 174)

The irregular behavior of *build* verbs with respect to the alternations in (6) and (7) suggests that there are some inconsistencies when systematically predicting a verb's syntactic behavior based on its meaning. Another problem is that not all *build* verbs may occur – like *carve* – in the material/product alternation as in (2) (e.g. *Joe builds houses out of bricks*/**Joe builds bricks into houses*) or in the unspecified object alternation in (4) (e.g. *Joe builds houses*/**Joe builds*; *Miriam assembles toys*/**Miriam assembles*; etc.) In other words, despite the fact that all the verbs in (1) are classified by Levin (1993) as *build* verbs, this verb class membership does not seem to be predictive of a verb's syntactic behavior as claimed by Levin.

3 Problems with syntactic alternations as classificatory criteria

I propose that the irregular syntactic behavior of verbs in the *build* class is caused by the fact that there is not always a one-to-one mapping between semantics and syntax across the board. In other words, a number of verbs describing “the creation of a product through the transformation of raw materials” (Levin 1993: 174) participate in the syntactic alternations, but a fair number of verbs do not despite their semantic similarities.

3.1 Exclusion of semantically related verbs based on syntactic criteria

Consider Levin’s characterization of *build* verbs as describing “the creation of a product through the transformation of raw materials” (Levin 1993: 174). Given this definition, we would expect *construct*, which involves the creation of a product through the transformation of raw materials, to be a member of the *build* class. However, it does not exhibit the same syntactic alternation characteristics of other *build* verbs, and is therefore not included in Levin’s *build* class.

- (8) (a) Lena constructed a building out of the bricks.
(b) *Lena constructed the bricks into a building.
- (9) (a) Lena constructs buildings.
(b) *Lena constructs.

The examples show that *construct* does not occur in the material/product alternation as in (8) and the unspecified object alternation as in (9). This raises the following question: If only some *build* verbs occur in these two alterations, and others do not, what is the practical value of syntactic alternations for determining class membership? In other words, how many syntactic alternations should a verb participate in (or not) in order to be classified as belonging to a particular verb class?

A comparison with the alternating behavior of other verbs that fit the semantic characterization of *build* verbs such as *erect* presents similar problems. This verb does not exhibit the characteristic syntactic behavior of *build* verbs, and is not classified by Levin (1993) as a *build* verb, yet it is clearly capable of expressing the semantics of *build* verbs (“the creation of a product through the transformation of raw materials”) by other syntactic means as in *They erected the skyscraper* where the materials used to create

the end product are implicitly understood and do not need to be mentioned.

Next, consider the definition of *weld*, which also fits the semantic characteristics of the *build* class: *To soften by heat and join together (pieces of metal, esp. iron, or iron and steel) in a solid mass, by hammering or by pressure; to forge (an article) by this method* (OED).

- (10) (a) Samuel welded a sword out of the iron.
(b) Samuel welded the iron into a sword.
- (11) (a) Samuel welds swords.
(b) Samuel welds (again).
- (12) (a) Samuel welded a sword (out of iron) for his friend.
(b) Samuel welded his friend a sword (out of iron).

The examples in (10)–(12) show that *weld* occurs in three of Levin's syntactic alternations used to characterize the *build* verb class. At the same time, *weld* does not appear in the total transformation alternation (transitive), the causative alternations, the raw material subject alternation, and the sum of money subject alternation. Given these syntactic characteristics, one would expect *weld* to also be classified as a *build* verb, but it is not. Instead, Levin (1993: 161–162) classifies *weld* as a *shake* verb, which specifies “the manner in which things are combined, rather than the result of the combining”.

The data demonstrate that although alternating syntactic behavior may be taken as an indication of verb class membership, it does not always work, thereby excluding other relevant verbs from the same semantic class. While some *build* verbs such as *carve* neatly fulfill all of Levin's syntactic criteria, others do not. Furthermore, verbs with meanings that would warrant a semantic classification as *build* verbs such as *construct* or *weld* are not included in this semantic class because they either do not fulfill the syntactic criteria set out by Levin, or they are grouped into a different semantic class based on other syntactic alternations. In sum, the fact that the putative members of Levin's *build* class do not behave uniformly challenges the very notion of a verb class based on syntactic criteria alone.

3.2 Syntactic criteria are often unreliable

In my view, this problem is largely due to the fact that Levin's verb classes are not defined independently of syntactic criteria. To this end, Baker and Ruppenhofer (2002) argue that Levin's syntactic classification system does not always provide clear-cut results. Drawing on earlier insights by Dang

et al. (1998) they discuss cases in which verbs that occur in the same set of alternations are classified as belonging to different semantic classes, which is inconsistent with Levin's approach. This leads them to argue that Levin's classes are at least partially semantically motivated and that "a classification rigorously and solely based on alternations would give much finer distinctions, including splitting of many semantically coherent classes" (Baker and Ruppenhofer 2002: 37). Similarly, Schnorbusch (2004: 36) points out that Levin's classification does not provide any inventory of meaning components that would allow for a systematic comparison and classification based on semantic criteria. This observation leads him to claim that Levin's classification is at least partially circular because semantic properties are not defined or motivated independently of syntactic properties. Thus, Schnorbusch points out, syntactic alternations are always taken as an indicator of semantic differences despite no systematic discussion of these semantic differences.

All of these issues point to a common problem with Levin's classification system, namely the heavy reliance on syntactic alternations to define semantic classes without recognizing that these alternations do not work across the board. To illustrate this point, consider *arrange*, which is a member of Levin's *build* class, and *erect*, which is not. The former alternates in the material/product alternation (transitive), but the latter does not, hence its exclusion from that class:

- (13) (a) They arranged piles out of the rocks.
 (b) They arranged the rocks into piles.
- (14) (a) They erected skyscrapers out of steel and concrete.
 (b) *They erected steel and concrete into skyscrapers.

This contrast illustrates that although both verbs are very close in meaning (they describe the creation of an entity out of smaller parts), they are not grouped in the same semantic class because of different alternating behavior. Given their closely related meanings it does not make sense to classify them differently according to syntactic criteria.

Another issue with Levin's (1993) syntactic classification concerns the availability of independently motivated criteria for deciding what types of syntactic patterns should be regarded as valid classificatory diagnostics. Recall from §2 that not all of Levin's *build* verbs behave uniformly in the raw material subject alternation and the sum of money subject alternation. If verbs from the same class differ with respect to their ability to occur in these two alternations, what empirical status do these two alternations have? In other words, what are the criteria used to identify a specific alternation as a valid classificatory instrument to determine verb class

membership? If we were to apply a similar line of thinking to the classification of *erect*, we might be led to classify it as a *build* verb as well despite its inability to occur in the material/product alternation (transitive) (see (14)) because it occurs in the benefactive alternation. To put it differently, what number and what types of syntactic alternations does a verb have to participate in order to be classified as belonging to a specific class? What criteria are used to characterize the number and types of alternations and how can these be falsified, if at all?

Closely related to this issue is the theoretical status of other syntactic patterns that do not necessarily participate in any alternations. Consider, for example, Levin's (1993: 95–106) "other constructions" such as the cognate object construction, reaction object construction, and resultative construction, among many others. Sometimes these other constructions are discussed among the syntactic properties of Levin's verb classes (even when they do not occur in those constructions), sometimes they are not. More specifically, these other constructions are not included in Levin's discussion of *build* verbs. This omission raises the question of whether there are any objective criteria that would indicate when an alternation or other syntactic construction should be considered in the discussion of a verb class and when not.

Next, consider the many syntactic patterns that are not covered by Levin's alternations and other syntactic constructions. What is their theoretical status? Why are they not investigated in more detail to arrive at a more complete picture about the syntactic distributions of the members of a verb class? To answer these questions, consider the following syntactic frames that occur with *build*, arguably the most prototypical member of Levin's *build* class, and other verbs from the same syntactic class.

- (15) (a) We built a house.
(b) *We arranged a hut.
- (16) (a) We are building our way out of the housing crisis.
(b) *We are rolling our way out of the dough crisis.
- (17) (a) We need to build windows into the house.
(b) *We need to assemble the screw into the furniture.
- (18) (a) They built the house on a bad foundation.
(b) They carved a toy on a couch.

The examples in (15)–(18) represent a small number of syntactic patterns that may occur with *build*, but not with other verbs of the *build* class. They show that despite their common semantic classification these verbs differ substantially with respect to their syntactic distribution, reminiscent of

the syntactic variation pointed out by Salkoff (1983) for verbs occurring in the locative alternation. These differences clearly show that Levin's semantic classification of verbs based on syntactic alternations is insufficient when it comes to accounting for a more complete syntactic distribution of verbs in the *build* class. In the following section I address some of the reasons why Levin's classification exhibits these issues and propose a frame-semantic alternative that seeks to overcome these problems.

4 Towards a frame-semantic classification of *build* verbs

4.1 Frame Semantics and FrameNet

Frame Semantics (Fillmore 1982) is based on the idea that "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" (Fillmore and Atkins 1992: 76–77). In this view, meanings of words are understood in terms of semantic background frames that motivate the concept encoded by a word. Since the late 1990s, Frame Semantics has been applied to the construction of a corpus-based lexical database of English, FrameNet, which is built around the concept of semantic frames that can be evoked by words (Fillmore *et al.* 2003).¹ FrameNet differs from other lexical databases in that it is not structured around sense relation like WordNet (Fellbaum 1998). Instead, semantic frames are taken as structuring devices to model the types of knowledge necessary for interpreting utterances in the language (see Petrucci 1996; Boas 2005).

FrameNet describes lexical units (LUs) in terms of the semantic frames they evoke, and presents for each LU a lexical entry that lists different types of interconnected information (see Ruppenhofer *et al.* 2006 for details).² Consider the verb *load*, which has multiple senses, and is thus represented in terms of multiple LUs in FrameNet. One such LU evokes the Filling frame, which is also evoked by other LUs such as *fill*, *glaze*, *smear*, *spatter*, *spray*, and *tile*, among many others. The lexical entry of the LU *load* in the Filling frame consists of three parts: the frame description, an exhaustive inventory of how frame elements are realized syntactically, and annotated example sentences from the British National Corpus. Each frame description consists of frame elements (FEs) that are essential for a full understanding of the associated situation type.

For example, the frame description of the Filling frame is defined as “words relating to filling CONTAINERS and covering AREAS with some thing, things or substance, the THEME. The AREA or CONTAINER can appear as the direct object with all these verbs, and is designated GOAL because it is the goal of motion of the THEME. Corresponding to its nuclear argument status, it is also affected in some crucial way, unlike goals in other frames. The AGENT is the actor who instigates the filling.” The frame description also contains detailed definitions of all FEs as well as a list of all LUs that evoke the frame (see Ruppenhofer *et al.* 2006). The second part of a lexical entry, the Lexical Entry Report, provides a definition for that LU (*load*: fill a container-like entity with something, often in abundance), a list of FEs and their syntactic realizations, and the valence patterns (see Figure 9.1), illustrating how frame element configurations (FECs) are realized syntactically by that LU.

The third part of a lexical entry contains the Annotation report, which provides annotated corpus sentences from the BNC exemplifying how the FEs are realized in context. Compare, for example, the following sentences illustrating how the FEs of the Filling frame are realized syntactically.

- (19) (a) [Two girls]_{AGENT} are loading^{gr} [the donkeys]_{GOAL} [with water containers and sacks]_{THEME}
- (b) Did you know that [Cecil Beaton]_{AGENT} couldn't even load^{gr} [his own camera]_{GOAL}? <INI>
- (c) We'd have [our packs]_{GOAL} loaded^{gr} [with various weights]_{THEME} ...

Number Annotated	Patterns		
	Agent	Goal	Theme
15 TOTAL			
(3)	CNI --	NP Ext	PP[with] Dep
(1)	CNI --	NP Obj	PP[with] Dep
(1)	NP Ext	DNI --	INI --
(1)	NP Ext	DNI --	PP[with] Dep
(2)	NP Ext	NP Obj	INI --
(7)	NP Ext	NP Obj	PP[with] Dep

Figure 9.1. Valence Information for *load* in Filling frame³

In contrast to Levin (1993), who classifies verbs according to their ability to appear in syntactic alternations, Frame Semantics assumes that semantic criteria are primary for identifying whether a given LU belongs to a semantic class. In this alternative view, semantic frames are structuring devices that help linguists to identify verb classes based on their ability to describe similar types of scenes or situations. While identifying frames and contrasting them with other frames may sometimes raise a number of problems (see Petruck *et al.* 2004; Ruppenhofer *et al.* 2006), frame-semantic definitions are nevertheless advantageous because they are intuitive and can be checked against corpus evidence. Another benefit of Frame Semantics is that syntactic criteria are regarded as secondary for the identification of verb classes, thereby steering clear of the problems associated with Levin's syntactic approach. This does not imply that syntactic information is irrelevant. As Figure 9.1 and the examples in (19) show, FrameNet provides syntactic information by presenting information about how frame element configurations are realized syntactically. Note, however, that the type of syntactic information presented by FrameNet is only secondary as it relies on the presence and combinations of FEs, which are defined semantically. Thus, if certain aspects of the semantics of a frame are not perspectivized by a particular LU, they do not occur syntactically either. This methodology also implies that no special preference is given to particular syntactic alternations, grammatical constructions, or other syntactic patterns, thereby avoiding the issue of having to arrive at independent criteria that would allow us to empirically identify (or falsify) those syntactic patterns that are relevant for the definition of a particular verb class (see also Baker and Ruppenhofer 2002).

Such a frame-semantic classification not only makes it possible to avoid the problems associated with Levin's (1993) syntactic approach discussed above. In addition, frame-semantic criteria allow for a more systematic cross-linguistic application and comparison without having to rely on syntactic differences and idiosyncrasies between languages. For example, several studies have investigated how semantic frames developed on the basis of English data such as Commitment (Subirats 2009), Communication (Subirats and Petruck 2003; Boas 2005b), Revenge (Petruck *et al.* 2004; Petruck 2009), Risk (Fillmore and Atkins 1992; Ohara 2009), and Self_motion (Fillmore and Atkins 2000; Boas 2001; Iwata 2002) can be applied to the analysis of other languages such as Spanish, German, Japanese, French, and Hebrew. The consensus emerging from these studies is that frame-semantic information allows us to characterize semantically coherent classes, both within a single language and cross-linguistically (see Boas 2009 for details). At the same time, however, these studies also point out

that the range of syntactic frames occurring with a given LU is to a certain degree idiosyncratic, and cannot always be automatically deduced from semantic information.

4.2 Syntactic alternations in FrameNet

At this point one might wonder about the status of syntactic alternations in FrameNet. In other words: how are they captured and analyzed? Because FN does not regard syntactic information as primary for the identification of verb classes (LUs are classified based on the frames they evoke), it does not provide an inventory of alternations *per se*. However, since FN lexical entries provide exhaustive valence information for each LU, the types of syntactic alternations discussed by Levin are included in FN, but not overtly. Consider, for example, our discussion of *load* in the previous section, where I pointed out that it evokes the Filling frame (cf. *Michael loaded the table with books*). In fact, FN contains a second LU for *load*, which evokes a different frame, namely the Placing frame (cf. *Michael loaded the books on the table*).

This frame describes situations in which an AGENT places a THEME at a LOCATION (the GOAL), which is profiled. The THEME is under the control of the AGENT at the time of its arrival at the GOAL. The Placing frame is also evoked by a number of different LUs, such as *archive*, *brush*, *hang*, *heap*, and *smear*. As such, the lexical entry for the LU *load* in the Placing frame points to the frame description (including its FEs), includes a definition of this particular sense of *load*, lists the valence information (which are different from those in Figure 9.1 above), and provides annotated corpus sentences similar to the ones in (19) above.

The comparison of the two LUs of *load* shows that they evoke two different frames, and that their two lexical entries contain the relevant syntactic information about how the semantics of the two frames are realized. However, FrameNet does not provide any explicit link between the different syntactic patterns of the two lexical entries so that the alternating behavior of *load* (cf. *Michael loaded the books onto the table* vs. *Michael loaded the books on the table*) would become immediately apparent. Given our observations regarding the primacy of semantic information over syntactic information in FrameNet, this does not come as a surprise. But how is it possible to account for syntactic alternations?

When verbs exhibit alternating behavior of the type cataloged by Levin (1993), they evoke different semantic frames in FrameNet. With *load*, this means that both the Placing frame and the Loading frame are evoked by

two separate LUs of *load*. Frames differ in their level of granularity and how they are related to each other. Figure 9.2 illustrates a small part of the complex ontology of frames from the domain of Transitive_Action. Figure 9.2 is a partial representation of the relations between frames in FrameNet, with “parent” frames pointing to “child” frames. Various frame-to-frame relations capture semantic relationships between frames, including: 1. Inheritance (a child frame is a more specific elaboration of a parent frame); 2. Subframe (used to characterize the different sequential parts of a complex event); 3. Perspective_on (expressing different points of view of an event); 3. Using (when a part of the scene evoked by the Child frame refers to the Parent frame); and others (for more details, see Petruck *et al.* 2004; Ruppenhofer *et al.* 2006). For example, both the Placing and Filling frames inherit from the Transitive_action frame, which is at a more abstract level in the ontology of frames. In addition, the Filling frame also uses the Placing frame, because reaching the endpoint of a filling event requires a number of placing events that temporally precede this endpoint.

Since the frame-to-frame relations depicted in Figure 9.2 are all at the semantic level, they do not directly represent the syntactic behavior of verbs. However, if one looks at the frame descriptions of the Placing and Filling frames, one sees that the latter has a use-relation with the former, and is therefore semantically related to it. Thus, if both frames are evoked

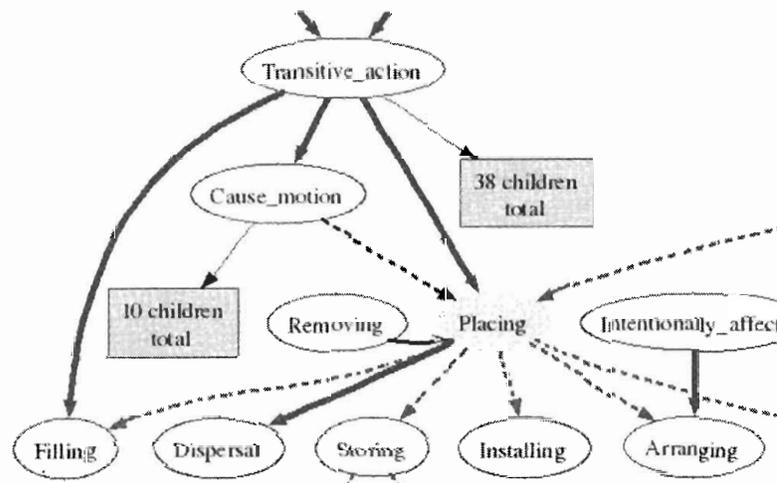


Figure 9.2. Frame-to-frame relation between Placing and Filling frames in FrameNet

by two LUs with the same name, such as *load*, then we know that the two LUs are related to each other because the frames they evoke are related to each other. This means that if we look at the syntactic frames of the two LUs of *load* (one evoking the Placing frame, the other the Filling frame) we are able to learn more about their syntactic behavior, including the types of alternations cataloged by Levin (1993).

Capturing syntactic alternations by relating those semantic frames to each other that are evoked by two related LUs means that if one wants to learn about alternating verb behavior, one must first know whether semantic frames are related to each other (see Figure 9.2). If a semantic frame is not related to another semantic frame, then one would not expect any semantic relatedness between the LUs evoking the two frames either. The next step involves a comparison between the lists of LUs that evoke the two different frames. For example, in comparing an alphabetically organized sample of

Table 9.1. Sample of alphabetically ordered LUs evoking the Placing and Filling frames

<i>Placing frame</i>	<i>Filling frame</i>
<i>hang</i>	<i>hang</i>
<i>heap</i>	<i>heap</i>
<i>immerse</i>	
<i>implant</i>	
<i>inject</i>	<i>inject</i>
<i>insert</i>	
<i>jam</i>	<i>jam</i>
<i>lay</i>	
<i>lean</i>	
<i>load</i>	<i>load</i>
<i>lodge</i>	
<i>pack</i>	<i>pack</i>
	<i>paint</i>
	<i>panel</i>
<i>park</i>	
<i>perch</i>	
	<i>pave</i>
<i>pile</i>	<i>pile</i>
	<i>plant</i>
	<i>plaster</i>
	<i>pump</i>
	<i>scatter</i>
	<i>seed</i>

LUs evoking the Placing frame with an alphabetically organized sample of LUs evoking the Filling frame, we see that some LUs are found in both lists. Compare the two lists in Table 9.1.

The samples of alphabetically ordered verbal LUs from the two frames illustrate how some verbs have two LUs that evoke different semantic frames. Those that are found in both lists such as *hang*, *heap*, *load*, and *pack* are semantically related (they are polysemous and hence alternate syntactically) because their semantic frames are related to each other (cf. Figure 9.2). The alternating behavior of these verbs can then be compared by looking at the FN entries of the two LUs side by side. LUs which do not have counterparts in the respective other frame such as *immerse*, *implant*, and *park* in the Placing frame or *paint*, *panel*, and *pave* in the Filling frame in Table 9.1 do not alternate because there is no corresponding LU whose lexical entry could provide the corresponding syntactic frame to “provide” the alternating behavior.

There are a number of advantages to capturing syntactic alternations with Frame Semantics. First, the splitting approach to polysemy allows for a more finely-grained analysis of verb meanings. This implies that the different meanings associated with the individual members of pairs of syntactic frames that make up syntactic alternations can be captured more straightforwardly. Second, syntactic alternations are not given any special status for identifying semantic verb classes. Instead, syntactic alternations are an epiphenomenon caused by a significant type frequency of semantically related verbs, there is no need to pay special attention to the role of syntactic alternations. This means that the syntactic frames of the alternations are treated like any other syntactic frames and can be compared and contrasted using the same set of criteria. Third, the frame-semantic approach to syntactic alternations provides a set of semantic criteria that can be verified (and falsified) on independent grounds. More specifically, the definitions of semantic frames are structured in such a way that it is relatively easy to determine whether a given LU evokes a frame or not, given the frame’s description and coverage. Fourth, and perhaps most importantly, this alternative methodology allows for a finer-grained analysis of semantic verb classes that avoids the problems noted with Levin’s (1993) approach: 1. not all members of a semantic verb class exhibit the same alternating behavior; 2. verbs that should be included in a semantic class are not included because they do not alternate; 3. verbs that show similar alternating behavior are not included in the verb class because their semantics are not similar enough; and 4. syntactic patterns that are not part of alternations are less important (see also Baker and Ruppenhofer 2002).

4.3 The role of frame-semantic criteria for identifying subclasses in Levin's *build* class

Returning to our discussion of *build* verbs, it should now be clear that the inconsistent syntactic distribution of Levin's *build* verbs is due to their different polysemy patterns. In other words, some verbs exhibit similar polysemy patterns where their respective LUs evoke the same semantic frames. At the same time, however, other verbs do not exhibit the same types of polysemy patterns, and their respective LUs may differ in number and types of semantic frames they evoke. To illustrate, consider *carve*, which occurs in the material/product alternation, the unspecified object alternation, and the benefactive alternation (see (3)–(5) above). Recall Levin's claim that other verbs should also be considered as belonging to the *build* verb class, because they share the syntactic behavior of *carve* and are semantically similar.

In contrast to Levin (1993), an alternative frame-semantic approach analyzes the alternating behavior of *build* verbs by first determining the different types of LUs associated with each verb, and the types of semantic frames these LUs evoke. Then it is necessary to find out which valence patterns (syntactic frames) represent the overt realization of the semantics of a LU evoking a specific semantic frame. To illustrate, let us see which semantic frames are evoked by the two syntactic frames of the material/product alternation. First, consider the Building frame in FrameNet, which describes assembly or construction actions, where an AGENT joins COMPONENTS together to form a CREATED_ENTITY, which is profiled, and hence the object of the verb. Verbal LUs evoking the Building frame include *assemble, build, construct, erect, fashion, fit together, glue, make, piece together, put together, raise, and weld*, but not *carve*.⁴ This raises the following question: why do some verbs categorized as *build* verbs by Levin (1993) evoke the Building frame, but not others? To answer this question, let us take a closer look at the semantic definition of Levin's *build* class, which states that its members "describe the creation of a product through the transformation of raw materials" (1993: 174). Comparing this definition with the definition of the Building frame reveals a number of important differences.

First, Levin's characterization of the activities described by her 35 *build* verbs is rather coarse-grained, labeling them as "creation." In contrast, the Building frame specifies the activities denoted by its 12 verbal LUs as "assembly or construction actions". As such, the Building frame does not only specify in greater semantic detail the types of activities considered as

building actions. It also offers a more fine-grained semantic distinction between Levin's *build* verbs, thereby identifying a specific sub-class. Thus, while some of Levin's *build* verbs such as *assemble*, *build*, and *construct* clearly fall within the definition of the Building frame, others do not because they do not fit the definition of building activities. In other words, *carve* does not evoke the Building frame because it does not typically denote assembly or construction actions. Instead, *carve* describes an activity by which an object is transformed into a different object by altering its original shape (typically by using an instrument to take off parts so it takes on a different shape). In short, *carve* does not evoke the Building frame because of a crucial difference in the type of creation activity. Note also that one of Levin's syntactic criteria for defining membership in the *build* class – ability to participate in the material/product alternation – becomes superfluous: Some of Levin's *build* verbs such as *carve* occur in the material/product alternation, but do not evoke the Building frame. In contrast, verbs that are typically considered as prototypical *build* verbs, such as *build* itself, do not exhibit this alternating behavior despite belonging both to Levin's *build* class and evoking the Building frame (e.g. *Joe builds houses out of bricks!*/**Joe builds bricks into houses*). This unsystematic alternating behavior demonstrates once again the problematic nature of relying on syntactic criteria for identifying semantic classes of verbs.

The second difference concerns the nature of the entity that results from the activity. Levin (1993) characterizes entities resulting from the activities of her 35 *build* verbs as "product". In contrast, the Building frame offers more specific semantic information by defining the product as resulting from an AGENT joining COMPONENTS together to form a CREATED_ENTITY. As in the previous paragraph, this difference in semantic granularity has direct consequences for the range of Levin's *build* verbs that can also evoke the Building frame. For example, some of Levin's *build* verbs such as *assemble*, *build*, and *fashion* also fit the definition of the Building frame because the CREATED_ENTITY is the result of the AGENT joining components together. Other verbs such as *cut*, *grind*, and *hammer* do not involve the joining of COMPONENTS to form a CREATED_ENTITY and do therefore not evoke the Building frame. Note also that these verbs do not appear in the same alternations as *carve* (Levin's example verb for illustrating alternating behavior of *build* verbs): they do not participate in the material/product alternation, the unspecified object alternation, or the benefactive alternation.

The third difference lies in the types of raw materials. Levin's 35 *build* verbs differ quite drastically in terms of the types of raw materials being transformed. While some verbs do not provide any specific information

with respect to the quality or type of the materials (*arrange, assemble, compile, make, and shape*), other verbs are more specific, such as *bake* and *cook* (requiring some edible materials), or *knit, spin, stitch, and weave* (requiring some type of clothes or thread). In contrast, the Building frame offers a definition of raw materials that is both more specific and more general at the same time. It is more specific because “an AGENT joins COMPONENTS” implies the presence of different parts that can be put together. This definition is more specific than Levin’s “raw materials” because it requires the COMPONENTS to be able to be joined together (as opposed to *hack*, which assumes separation; or *blow bubbles/glass*, which assumes creation of a new entity (not joining existing parts together)). As such, this definition of the types of materials is more fine-grained than Levin’s raw materials. At the same time, this frame-semantic definition is more general because it involves any type of COMPONENTS that can be joined together by an AGENT to form a CREATED_ENTITY and therefore has the potential of applying to a broader variety of verbs. Given this definition, *glue* and *weld* also evoke the Building frame. However, these two verbs are not included in Levin’s (1993) *build* class – perhaps because they do not fulfill Levin’s syntactic criteria.

Returning to the initial question (“Why do some verbs categorized as *build* verbs by Levin (1993) evoke the Building frame, but not others?”), it should be clear by now that the different classifications are due to: 1. granularity of verb sense and verb class definitions; 2. reliance on syntactic criteria for establishing semantic classes; and 3. irregular relationships between a verb’s meanings and its syntactic distribution. More specifically, Levin’s *build* class encompasses a fairly large group of verbs because its semantic definition is rather broad. The verbs in this class share only a relatively broad range of definitional criteria, such as “creation”, “product”, “transformation”, and “raw materials”. This differs from the Building frame, which offers a more nuanced set of classificatory criteria that cover only a small sub-set of Levin’s 35 *build* verbs. At the same time, however, these fine-grained semantic criteria also cover semantically related verbs such as *glue* or *weld*, which are not included in Levin’s *build* class. In contrast to Levin’s approach, which heavily relies on syntactic alternation criteria to establish semantic classes of verbs, the frame-semantic approach relies primarily on semantic criteria to determine which verbs (or: LUs) evoke a particular semantic frame and should therefore be classified as belonging to the same class.

To substantiate my proposals, I now present a case study of how frame-semantic criteria can be implemented to arrive at alternative classifications of Levin’s *build* verbs without having to rely on syntactic criteria. Consider

the verb *grind*, which is also classified by Levin as a *build* verb because it involves the creation of a product through the transformation of raw materials. Although this classification appears to be unproblematic at first sight, there are a number of issues that argue for a re-classification of *grind*.

The first issue concerns the verb's ability to conform to the alternation patterns most characteristic of Levin's *build* class verbs. While *grind* occurs in the benefactive alternation, it is typically not acceptable in the material/product alternation (e.g. **Michael grinds fine powder out of the coriander seeds*/*Michael grinds the coriander seeds into fine powder*) and the unspecified object alternation (e.g. *Russell grinds pepper*!/**Russell grinds*). The second issue concerns the broader syntactic distribution of *grind*. Compare the following examples:

- (20) (a) She is grinding her cigarette to ash.
 (b) *She is assembling the rocks to piles.
 (c) She is cutting the wood to pieces.
 (d) *She is knitting the wool to sweaters.
 (e) *She is sewing the rags to clothes.
 (f) She is hammering the metal to pieces.

The examples in (20) show that not all verbs from Levin's *build* class exhibit the same syntactic behavior in resultative constructions. Some allow a resultative PP headed by *to*, while others do not. This observation has led me to argue that each sense of a verb should be represented in terms of a mini-construction, representing the particular syntactic, semantic, and pragmatic restrictions of individual verb senses (Boas 2003a). While there are parallels in the distribution of syntactic frames among semantically related verbs (e.g. (20a) and (20c)), I have also demonstrated that certain types of semantic generalizations are best reached by comparing the distributional properties of particular verb senses with respect to specific grammatical constructions (Boas 2003a, 2008a). In the case of resultatives, the distribution is often highly irregular. In other cases, such as the locative alternation, the distribution is more regular, but still with a fair number of exceptions (for examples, see Boas 2003b; Iwata 2008).

At this point, the following question is fairly obvious: What does it mean to have a semantic class such as the *build* class that is supposedly predictive of syntactic behavior? As seen above, it does not predict the same alternation patterns for all members of a semantic class, and it also does not help predict other syntactic patterns. This suggests that such a semantic class does not provide us with notable predictive powers about alternating behavior.⁵ However, I would argue that some of Levin's alternation classes are fairly close to an intersection or overlapping of two

frame-semantic classes. In other words, verbs that share a common pair of semantic frames might participate in the same pair of syntactic patterns. On this view, we need two related semantic frames for accounting for a single syntactic alternation. Another problem, which we already discussed at length, concerns membership in a specific class. That is, in the case of *grind*, we know that it is included in Levin's *build* class. But what about other semantically related verbs that also involve the creation of a product through the transformation of raw materials such as *pulverize*, *shred*, *grate*, and *flake*, among others? Why are these not included in Levin's *build* class?

In my view, the frame-semantic approach to verb classification offers a more elegant alternative by capturing the relevant semantic distinctions between verbs, thereby arriving at a more coherent verb classification. Instead of classifying *grind* as a *build* verb together with a broad range of 34 other vaguely related verbs, I suggest that we pay more attention to the individual semantics of *grind* and the type of frame it evokes. In other words, while *grind* involves the "creation of a product through the transformation of raw materials" (Levin 1993: 174), it also involves much more idiosyncratic information. To wit, FrameNet contains a particular Grinding frame, in which "a GRINDER or a GRINDING_CAUSE causes an UNDERGOER to be broken into smaller pieces. A RESULT or GOAL can be present."⁶ Verbal LUs evoking the Grinding frame include *crumble*, *crunch*, *crush*, *flake*, *grate*, *grind*, *mill*, *pulverize*, and *shred*, among others. As with other FN entries, each entry for these LUs contains information about their specific valence patterns, together with annotated example sentence. The important point here is that the classification of verbs (or: LUs) is based on frame-semantic criteria, and not on syntactic criteria, while at the same time still capturing the syntactic distribution of LUs evoking the Grinding frame. To illustrate this point, compare the syntactic distribution of the core FEs of the Grinding frame among the verbs evoking it.

Table 9.2 summarizes the valence patterns of the nine verbal LUs evoking the Grinding frame in FrameNet. The top row lists the names of FEs (GRINDER and UNDERGOER, and GRINDING_CAUSE and UNDERGOER) together with their varied syntactic realizations in terms of phrase types and grammatical functions. For example, the third column from the left represents one particular type of FE realization where the GRINDER is realized as an external NP, and the UNDERGOER is realized as an object, which is also a NP. Eight of the nine verbs share this valence pattern. In contrast, the sixth column from the left lists which LUs realize the GRINDER as a dependent PP headed by *by* and the UNDERGOER as an external NP. Only one out of the nine verbs exhibits this particular valence pattern.

Table 9.2. Comparison of valence patterns of verbal LUs in the Grinding frame
Grinder, Undergoer

	(CNI/-), (NP/Ext) Grinder, Undergoer	(CNI/-), (NP/Obj) Grinder, Undergoer	(NP/Ext), (NP/Obj) Grinder, Undergoer	(CNI/-), (CNI/-) Grinder, Undergoer	(DNI/-), (NP/Ext) Grinder, Undergoer	(PP[by]/Dep), (NP, Ext) Grinding_cause, Undergoer	(NP/Ext), (NP/Obj) Grinding_cause, Undergoer	(PP [beneath]/Dep), (NP/Ext) Grinding_cause, Undergoer	(PP[by]/Dep), (NP/Ext) Grinding_cause, Undergoer
<i>crumble</i>	X	X	X				X		
<i>crunch</i>			X				X		
<i>crush</i>		X	X	X	X		X	X	X
<i>flake</i>	X	X							
<i>grate</i>		X	X						
<i>grind</i>	X	X	X				X		
<i>mill</i>	X		X						
<i>pulverize</i>	X		X						
<i>shred</i>		X	X			X			X

Comparing the valence patterns of the nine LUs evoking the Grinding frame reveals a rather divergent range of valence patterns. Of the nine verbs, there are only two groups of two LUs each of which share the same set of valence patterns. The first group consists of *crumble* and *grind*, the second group consists of *mill* and *pulverize*. The remaining five LUs exhibit idiosyncratic valence patterns that differ from each other as well as from the two pairs that each share a common set of valence patterns. Taken

together, the distribution of valence patterns in Table 9.2 demonstrates that finding syntactic generalizations among LUs closely related in meaning is complicated (see also Salkoff 1983; Gross 1994). More specifically, the rather high degree of syntactic variation demonstrates that using syntactic criteria for identifying semantic classes of verbs is highly problematic. Note that the valence information in Table 9.2 does not even capture alternating behaviors of verbs, but only represents the valence patterns of verbal LUs evoking one semantic frame. In sum, our discussion of LUs evoking the Grinding frame has shown that a classification of verbs based on frame-semantic criteria offers a more coherent methodology for identifying semantically related verbs than a classification that heavily relies on syntactic information.

4.4 Modeling alternating behavior of *build* verbs

Based on the identification of one semantically coherent class of verbs such as those evoking the Grinding frame, the question remains as to how to account for their assumed alternating behavior – after all, *grind* is classified by Levin as a *build* verb. However, when one considers the range of alternations used by Levin to identify verbs belonging to her *build* class, an interesting observation emerges: Verbs evoking the Grinding frame do not typically participate in the alternations in which *build* verbs are assumed to participate, such as the material/product alternation and the unspecified object alternation. However, they may occur, like other *build* verbs, in the benefactive alternation (e.g. *Carlos grated some parmesan for Michael/ Carlos grated Michael some parmesan*). Whether this alternating behavior is best modeled in terms of semantic classes of verbs whose members all participate in this alternation is not entirely clear. For example, Goldberg (1995) argues for an alternative constructional account involving the ditransitive construction. On this view, lexical entries of verbs can fuse with independently existing meaningful constructions in order to license different kinds of syntactic frames. Thus, the occurrence of verbs like *grate* in Levin's benefactive alternation is not necessarily due to their membership in a particular semantic class. Instead, verbs such as *grate* exhibit this varied syntactic distribution because their semantics are compatible with different types of grammatical constructions, each licensing distinct syntactic realizations of a verb's Frame Elements.

This short overview shows that a sub-class of Levin's *build* verbs – those evoking the Grinding frame – does not exhibit the specific types of alternating behaviors that characterize Levin's (1993) class of *build* verbs.

As such, our frame-semantic analysis does not need to account for their alternating behavior as we did for verbs participating in the locative alternation in §4.2 above.⁷ There we saw that we needed to posit two separate but related frames, namely Placing and Filling to account for the alternating behavior of verbs such as *load* and *spray*.

But what about the alternating behavior of other *build* verbs? Because of space limitations I only discuss a few illustrative examples and sketch out a methodology for applying my proposals to the full range of Levin's *build* verbs. Consider the alternating behavior of another group out of 35 of Levin's *build* verbs, namely those evoking the Building frame, as discussed in §4.3. As the following examples illustrate, the picture is rather mixed as some verbs exhibit alternating behavior while others do not.

- (21) (a) They assembled the pile out of rocks.
 (b) They assembled the rocks into a pile.
- (22) (a) They built a new house out of old bricks.
 (b) *They built old bricks into a new house.

Both (21a) and (22a) are licensed by LUs evoking the Building frame (which requires that the CREATED_ENTITY be profiled, and hence the object of the verb), i.e. *assemble* and *build*. However, while *assemble* participates in the material/product alternation, *build* does not. To capture this distinct syntactic behavior, I tentatively propose that the syntactic frame in (21b) is licensed by a distinct LU of *assemble* that evokes a semantic frame different from Building.⁸ This frame, which I tentatively call Assemble, and which is semantically related to Building, is evoked by LUs such as *assemble*, *piece*, *put together*, *tack*, and *tack together*. This frame differs from Building in that it does not profile the CREATED_ENTITY, but rather the COMPONENTS used in creating it. While some verbs, such as *assemble* and *put together*, have LUs that evoke both the Building and the Assemble frames, others have only one LU that evoke only one of the two frames. This means that alternating verbs such as *assemble* have two distinct LUs evoking different semantic frames, while non-alternating verbs such as *build* or *piece* have only one LU evoking only one of the two frames. Similar to the analysis of the locative alternation in §4.2, the different valence patterns expressing the syntactic alternations are a part of the lexical entries of the respective LUs.

This brief discussion of how to capture the alternating behavior of two sub-classes of Levin's *build* verbs (i.e. those evoking the Grinding, Building, and Assembly frames) offers a roadmap for the further analysis of the remaining *build* verbs without having to depend on unreliable syntactic criteria. To achieve this goal it will first be necessary to identify the different

types of semantic frames evoked by the verbs in Levin's *build* class. The discussion above suggests that this step may result in a much broader variety of semantic (sub-)classes that may also cover many more verbs (cf. our discussion of *glue* and *weld* above, which – despite their semantic similarity – are not included in Levin's *build* class). Next, it will need to be determined which LUs evoking a particular frame truly exhibit alternating behavior and which ones do not. As outlined above, this investigation will result in a list of related semantic frames, each of which will be evoked by a LU that is related to the original LU. Verbs that alternate will have two distinct LUs, each evoking semantic frames that are related to each other in some way. Finally, the alternating behavior of *build* verbs will be captured in terms of valence patterns contained in the lexical entries of LUs of the same verb that evoke semantically related frames.

5 Conclusions and outlook

In this paper I proposed an alternative frame-semantic classification of Levin's (1993) *build* verbs. Showing that Levin's syntactic criteria for identifying semantic class membership do not always provide adequate results led me to argue that her definitions of semantic classes is too coarse-grained (see also Neale, this volume). More specifically, while some verbs of her *build* class exhibit alternating behavior with respect to her range of definitional criteria, others do not. Other verbs, which are semantically closely related to Levin's *build* class and should therefore be classified as *build* verbs are not included because they do not exhibit the relevant alternating behavior.

Levin's inconsistent syntactic criteria for defining verb class membership led me to propose an alternative frame-semantic approach toward defining verb classes and identifying their members. Based on previous work by Baker and Ruppenhofer (2002) and Boas (2003b, 2008b), I argued that verb classes defined in terms of frame-semantic criteria offer a number of advantages. First, frame-semantic criteria offer a more coherent methodology for identifying semantically related verbs than a classification that heavily relies on syntactic information. In other words, determining the number of LUs of a verb and the different types of semantic frames they evoke allows us to distinguish clearly between the different senses of verbs.

Second, a frame-semantic classification of verbs also captures the alternating behavior of verbs more systematically. Although this alternative approach does not rely on syntactic criteria for verb classification, it includes

the relevant valence information in the lexical entry of each LU. Thus, alternating verbs are associated with (at least) two different LUs that each evokes different but semantically related frames. The alternating behavior of these verbs is accounted for by the different valence patterns of the two LUs associated with the verb. This means that certain non-alternating verbs that are closely related in meaning to alternating verbs are associated with only one LU evoking one of the two frames evoked by one of the two LUs of the alternating verb, but not a second LU. Following this approach captures a verb's alternating behavior (or, non-alternating behavior) while at the same time ensuring that semantic classes contain only those LUs that really evoke the same frame.

Third, the frame-semantic approach allows us to establish more finely-grained categories of verb classes which in turn allow for a broader coverage. Recall that Levin's *build* class includes 35 verbs. My analysis in §4 has shown that Levin's class is both too broad and too narrow at the same time. It is too broad because it includes verbs that differ quite drastically in their meanings, e.g. the types of products derived as the result of the activity described by the verb, or the kinds of activities involved. This observation led me to describe and analyze three distinct semantic sub-classes of Levin's *build* verbs, namely those evoking the Building, Grinding, and Assembling frames. Applying the same methodology will result in the identification of further distinct semantic frames evoked by the remaining members of Levin's *build* verbs. I proposed above that these differences in meaning may perhaps be causing the varying alternating behaviors of Levin's 35 *build* verbs. Levin's *build* class is too narrow, because it does not include verbs such as *glue* or *weld* that fit the semantic description of her *build* class, which are excluded on the grounds that they do not exhibit the alternating behavior characteristic of Levin's other *build* verbs.

I am not abandoning Levin's (1993) basic assumption, namely that certain aspects of a verb's meaning may determine its syntactic behavior. Her groundbreaking research is the first systematic work on the English verb lexicon to arrive at this important insight. However, I think I have convincingly shown that her methodology of using syntactic criteria to arrive at coherent semantic classes predictive of syntactic behavior is problematic. I have argued that since syntactic alternations are an epiphenomenon caused by a significant type frequency of semantically related verbs, there is no need to pay special attention to the role of syntactic alternations. This means that the syntactic frames of the alternations are treated like any other syntactic frames and can be compared and contrasted using the same set of criteria.

The frame-semantic approach outlined in this paper is only a first step toward developing a broad-scale alternative account of Levin's (1993) verb classes. Future research needs to identify the other semantic frames evoked by the remaining members of Levin's *build* class to see whether the types of proposals put forward in this paper can be applied across the board. Next, this methodology should be applied to other verb classes identified by Levin (1993). At the same time some important questions remain: 1. How finely-grained should semantic verb classes be (see, e.g., Croft 2003; Boas 2003a, 2008a; Iwata 2008)? 2. Is it possible to arrive at systematic predictions about a verb's syntactic distribution based on its frame-semantic classification (see, e.g., Taylor (1996), Boas (2006, 2008b))? 3. If certain aspects of meaning do in fact influence a verb's syntactic behavior, are these meaning components the same cross-linguistically (see, e.g., Frense and Bennett 1996 and the papers in Boas 2009)? Clearly, much research remains to be done.

Notes

1. Thanks to Marc Pierce, Seizi Iwata, Jaakko Leino, Francisco González-García, and the editors of this volume for extensive comments. The usual disclaimers apply. FrameNet: <http://framenet.icsi.berkeley.edu>
2. A lexical unit is a word in one of its senses (see Cruse 1986). Throughout this paper I often use the terms LU and verb interchangeably because a verb may have separate senses each of which evokes a different semantic frame and hence represents a different LU.
3. Please see Fillmore *et al.* (2003) for how the valence information is structured.
4. Other LUs evoking the Building frame include nouns such as *assembly* and *construction*.
5. In this paper I limit my critique of Levin's approach to *build* verbs, further investigations need to determine whether the same issues are found with other verb classes identified by Levin.
6. The non-core FEs of the Grinding frame are the following: DURATION, GOAL, INSTRUMENT, LOCUS, MANNER, MEANS, PLACE, PURPOSE, RESULT, and TIME.
7. This assumes a constructional analysis of the benefactive alternation in terms of Goldberg's (1995) ditransitive construction.
8. See Jackendoff (1990) for an alternative analysis involving the determiner restriction.

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