

Wiping the slate clean: A lexical semantic exploration*

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Abstract

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This paper presents a case study in lexical semantic analysis aimed at uncovering syntactically relevant components of verb meaning. Our strategy is to investigate the nature of the lexical knowledge that a speaker of English possesses with respect to certain apparently semantically related verbs: a set of verbs that might as a first approximation be classed as verbs of removal. However, a closer examination of these apparently semantically related verbs reveals that their syntactic properties diverge. An exploration of the patterns of behavior of the verbs suggests that the initial class includes three linguistically significant subclasses. The components of meaning that are relevant to characterizing each subclass are identified by isolating those components of meaning that the members of each subclass share. The conclusion considers the implications of the meaning components identified in this study for a lexical semantic representation.

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1. Introduction

The lexicon has recently assumed an increasingly central place in many syntactic theories, as more and more facets of the syntactic configurations that verbs and other argument-taking elements are found in are seen to be projections of their lexical properties. Consequently, much effort has been devoted to investigating the nature of their lexical representation. Ideally, a lexical entry should minimize the amount of information necessary for any given word. This goal can be achieved by factoring any predictable information out of lexical entries. The meaning of a word must be part of its lexical entry, since an important part of knowing a word is knowing its meaning. The question is whether this is all that needs to be learned and, more specifically, whether a word's syntactic properties (i.e., the syntactic configuration(s) it can appear in) are predictable from its meaning. Chomsky (1986), for example, speculates that only the meaning of a verb needs to be learned. Much research has focused on precisely this issue by exploring to what extent the syntactic properties of verbs – the lexical category with the most complex properties – can be derived from their lexical semantic properties.

That the meaning of a verb plays a large part in determining its syntactic properties is clear from a variety of facts concerning the syntactic expression of arguments to verbs. To take a simple example, consider the frequently made observation that verbs that denote an agent acting on and causing an effect on a patient, such as *cut* or *destroy*, figure among the transitive verbs of any given language. Observations such as these indicate that the meaning of a verb plays some role in determining its syntactic properties. There are two open questions: first, how much does the meaning of a verb determine its syntactic properties; and, second, a question which will be the focus of this paper, to the extent that syntactic properties are predictable, what components of verb meaning figure in the relevant generalizations?

These two questions cannot be approached independently. There are many ways verbs can be potentially classified according to their meaning, and the wrong classification might well preclude the statement of the correct generalizations in the semantics to syntax mapping, suggesting that the relation between the two is more idiosyncratic than it actually is. Some illustrations will help to clarify this point.

To begin with a rather extreme example, a natural class of verbs from the point of view of meaning might be the set of verbs that describe things that can be done to books (essentially, the set of verbs that take the word *book* as one of their typical objects). An investigation of machine-readable dictionaries (Boguraev, 1991; Boguraev, Byrd, Klavans, & Neff, 1989), followed up by an investigation of on-line text corpora (Klavans, personal communication), reveals that this is quite a large class of verbs. Among its members are the verbs *abridge*, *autograph*, *ban*,

borrow, bowdlerize, catalogue, censor, commission, consult, entitle, print, publish, read, remainder, review, write. However, as far as we can tell, there is no evidence that this set of verbs is linguistically significant.

Recently the question of the extent to which the syntactic properties of verbs are semantically determined has also been debated in the linguistics literature in the context of the unaccusative hypothesis: a hypothesis concerning the nature of the intransitive verb class, first proposed by Perlmutter (1978) and later adopted and extended by Burzio (1986). This hypothesis concerns the syntactic configurations that intransitive verbs are found in. The proposal is that the single argument of some intransitive verbs, the unaccusative verbs, is an underlying object, while the single argument of others, the unergative verbs, is an underlying subject. Some researchers, including Perlmutter in his original paper on the unaccusative hypothesis, have argued that the status of an intransitive verb as unergative or unaccusative can be determined from its meaning. However, other researchers, including Rosen (1984), have concluded that the distinction between unaccusative and unergative verbs cannot be characterized in terms of meaning alone. To support her view, Rosen points out that, for example, Italian verbs of bodily processes show variable behavior: *russare* ('snore') manifests unergative properties, while *arrossire* ('blush') manifests unaccusative properties.

However, this particular example need not argue against the semantic determination of syntactic properties; rather it emphasizes the importance of identifying the appropriate semantic components. The verbs *russare* ('snore') and *arrossire* ('blush') would only be expected to show similar behavior if the semantic notion "bodily process" is relevant to determining the status of verbs with respect to the unaccusative hypothesis; if it is not, then similar behavior is not necessarily expected. Some bodily process verbs, including those Rosen cites, are open to more than one semantic characterization. The concept denoted by English *snore* can be classified as an activity, while that denoted by English *blush* is open either to an activity or to a change of state interpretation. Interestingly, Italian *arrossire* ('blush') literally means "become red", suggesting that in Italian this verb probably ought to be considered a change of state verb. There is evidence, in fact, that the semantic notions of activity and change of state, rather than the semantic notion of bodily process, are the aspects of meaning that figure in the determination of a verb's status (Levin & Rappaport Hovav, 1991; McClure, 1990; Tenny, 1987; Van Valin, 1990; Zaenen, in preparation).

As this example illustrates, it is not easy to uncover the components of meaning that figure in the statement of generalizations such as the one just discussed. Some of the problems said to face attempts to determine syntactic behavior from meaning might simply stem from the use of the wrong facets of meaning in the statement of generalizations. Given that regularities exist, it is important to determine the components of meaning that figure in determining a verb's syntactic properties, even if ultimately it turns out that not all of these

properties of a verb are fully predictable from its meaning (for some discussion see Jackendoff, 1990).

This paper presents a case study in lexical semantic analysis aimed at uncovering syntactically relevant components of verb meaning. Our strategy is to investigate the nature of the lexical knowledge that a speaker of English possesses with respect to certain apparently semantically related verbs: a set of verbs that might as a first approximation be classed as verbs of removal. However, the syntactic properties of these apparently semantically related verbs turn out on further examination to diverge. An exploration of the patterns of behavior of different verbs with respect to these syntactic properties suggests that the initial class includes three linguistically significant subclasses of verbs. The components of meaning that are relevant to characterizing each of the subclasses are identified by isolating those components of meaning that verbs in each subclass share. In the Conclusion we consider the implications of these meaning components for a lexical semantic representation.

2. Introducing the verbs

Our major focus throughout this paper is a variety of verbs that can be used to express the semantic notion of removal. We begin our investigation of such verbs by taking a detailed look at two verbs, the verbs *clear* and *wipe*, which can describe the removal of a substance or physical object – the *locatum* – from a *location*,¹ as in (1):

- (1) a. Doug cleared dishes from the table.
 b. Kay wiped the fingerprints from the counter.

As the examples below show, the verbs *clear* and *wipe* seem to express their arguments in the same way: the agent is expressed as the subject of the verb, the locatum is expressed as the direct object, and the location from which the locatum is removed is expressed via a prepositional phrase headed by one of the prepositions typically used to indicate sources in English. This set of prepositions includes *from*, *out (of)*, and *off (of)*, as well as combinations of *from* and other locative prepositions (e.g., *from under*, *from behind*). All these possibilities are attested with the verbs *clear* and *wipe*:

- (2) a. Doug cleared the dishes out of the cupboard.
 b. Doug cleared the dishes off of the shelf.
 c. Doug cleared the dishes from under the sink.

¹These terms are taken from Clark and Clark (1979).

- (3) a. Kay wiped the fingerprints out of the cupboard.
 b. Kay wiped the fingerprints off of the wall.
 c. Kay wiped the fingerprints from behind the stove.

The similar expression of the arguments of the verbs *clear* and *wipe* is perhaps not unexpected given their similar meanings. Moreover, it is precisely the way the verb *remove* itself expresses its arguments:²

- (4) Monica removed the groceries from the bag.

We might then assume that the lexical semantic representations associated with both *clear* and *wipe* identify them as verbs of removal, whatever form this representation takes. Linking rules (Carter, 1976, 1988; Ostler, 1979) – the rules that determine the mapping from the lexical semantic representation to the syntax – would then be responsible for associating the syntactic frame “NP V NP FROM NP”³ with these and other verbs of removal. We refer to this syntactic frame, which is characterized by a locatum expressed as direct object and a location expressed in a source prepositional phrase, as the *locatum-as-object variant*. Linking rules would specify which argument of a verb is associated or “linked” with which syntactic position in this frame.

The verbs *clear* and *wipe* share an alternative way of expressing their arguments. Both verbs also allow the location argument to be expressed as the direct object of the verb, as in (5), rather than via a source prepositional phrase as in (1). We refer to this alternative expression of the arguments as the *location-as-object variant*:

- (5) a. Doug cleared the table.
 b. Kay wiped the counter.

The alternation in the expression of arguments shown by the verbs *clear* and *wipe* might on an initial analysis be attributed to membership in the class of verbs of removal. However, the verbs *clear* and *wipe* diverge from the verb *remove* with respect to their ability to be found in the location-as-object variant. The verb *remove* does not allow this option, as shown in (6), which cannot mean “Monica

²There appears to be some variability among the *remove* verbs – the set consisting of the verb *remove* and other verbs that pattern like it such as those listed in (12) below – concerning which of the set of prepositions used to express the notion of source they allow. The verb *remove*, for example, is not found with *out (of)* and *off (of)*. We do not address this issue further here, but see Ostler (1980) for some relevant discussion of similar constraints.

³We use “FROM” to represent the set of prepositions used to indicate sources in English. Although we have only included NP as the object of “FROM” in this frame, when the preposition heading the PP is *from* itself, the object of the preposition can be either an NP or a PP, as shown by examples like (2c) and (3c).

emptied the bag”. This property is unexpected if the alternate realization of arguments is a property of verbs of removal:

(6) *Monica removed the bag.

Furthermore, the parallels in the expression of arguments do not carry through completely even for the verbs *clear* and *wipe*: these verbs differ from each other with respect to whether the locatum argument can still be expressed when the location is expressed as the object. With the verb *clear*, this is possible: the locatum argument can be expressed in a prepositional phrase headed by the preposition *of*, as in (7a). But the verb *wipe*, unlike *clear*, only marginally, if at all, allows the locatum argument to be expressed in an *of* phrase, thus the contrast in (7):

- (7) a. Doug cleared the table of dishes.
 b. *Kay wiped the counter of fingerprints.

The set of contexts that the verbs *clear* and *wipe* are found in are repeated below to highlight the similarities and differences between these two verbs:

- (8) a. Kay wiped the fingerprints from the counter.
 b. Kay wiped the counter.
 (9) a. Doug cleared dishes from the table.
 b. Doug cleared the table (of dishes).

The fact that the verb *remove* does not show alternate expressions of its arguments, when taken together with the fact that the verbs *clear* and *wipe* do not show uniform syntactic behavior, suggests that even if the notion “removal” is a syntactically relevant meaning component, it alone is not sufficient to explain the behavior of these three verbs. Furthermore, the differences in the verbs’ syntactic behavior cannot simply reflect idiosyncratic properties of the individual verbs, since there are other verbs which behave like each of the three verbs considered. Specifically, we find a few other verbs that behave like *clear*; these are listed in (10).⁴ Many verbs behave like *wipe*, among them those in (11). And the verbs in (12) behave like *remove* in not allowing alternative expressions of their arguments:

⁴The class of verbs that express their arguments like *clear* is sometimes taken to be larger than the class listed in (10), as in Fraser (1971) and Hook (1983), among others. For instance, the verbs *drain* and *strip* have been associated with this class. We believe that previous studies have grouped too large a class of verbs together, and that some of the additional verbs are actually somewhat different from the more narrowly defined *clear* class we identify here. For purposes of exposition, we use the more restricted conception of this class and return to the other verbs that have been included in the class in the appendix.

(12) behave like *remove* in not allowing alternative expressions of their arguments:

- (10) *Clear* verbs: clear, clean, empty
- (11) *Wipe* verbs: buff, brush, erase, file, mop, pluck, prune, rake, rinse, rub, scour, scrape, scratch, scrub, shear, shovel, sponge, sweep, trim, vacuum, wipe, . . .
- (12) *Remove* verbs: dislodge, draw, evict, extract, pry, remove, steal, uproot, withdraw, wrench, . . .

As the list of class members shows, the *clear* class is much smaller than the other two. We attribute this difference in size to the absence of a productive process that allows new members to be added to this class; see section 3 for discussion.

The attested patterns of behavior exhibited by these three types of verbs should receive a principled and systematic account. The alternations in the expression of arguments shown by the *clear* verbs and the *wipe* verbs (as well as the more general alternation these are considered to be instances of the locative alternation; see section 7) have sometimes been likened to the dative alternation – the alternation in the expression of arguments manifested by verbs such as *give* or *sell*:

- (13) a. Carla gave a present to Tina.
- b. Carla gave Tina a present.

Some accounts have assumed that a verb showing such an alternation has a single lexical semantic representation but allows alternate syntactic realizations of its arguments. Our approach will be that such a verb has two distinct but related lexical semantic representations and that the alternate expressions of arguments reflect the different meanings associated with these representations.

An examination of the meaning of the members of the three verb classes shows that each pattern of argument expression is restricted to a semantically coherent class of verbs and thus is clearly tied to verb meaning. Our next step, then, is to set out the components of meaning that are shared by verbs which pattern like *clear*, verbs which pattern like *wipe*, and verbs which pattern like *remove*.

3. A closer look at the meaning of the verbs

Although both the *clear* verbs and the *wipe* verbs appear to denote actions that involve the removal of a substance from a location, a closer examination of these two classes reveals a systematic difference in the meaning of their members. Each of the *clear* verbs specifies the state of the location as a result of the action denoted by the verb. The *clear* verbs differ from each other simply with respect to

the resultant state: being clean is different from being clear, which, in turn, is different from being empty. None of the *clear* verbs makes explicit how the resultant state is achieved. For instance, it is possible to clear an obstructed path in various ways: by raking, sweeping, or shovelling it. All that matters is that the path ends up unobstructed. Similarly, a blackboard can be cleaned in a number of ways: by erasing it, wiping it, washing it, and so on. As long as the erasing, wiping, or washing results in the removal of any writing or other marks from the blackboard's surface, the action can be described as cleaning the blackboard. We can say that the meaning of the *clear* verbs includes a resultant state, or, borrowing a term used by Talmy (1975, 1985), that these verbs *lexicalize* a resultant state.

Consistent with their meaning, the *clear* verbs are deadjectival;⁵ the adjectives that these verbs are derived from name the state that results from the action denoted by the *clear* verb: if someone clears a road, then the result is that the road is clear. However, while the action denoted by the verb necessarily implies the resultant state, the state denoted by the related adjective does not have to be the result of a specified or unspecified action or event. A clear blackboard does not have to be one which has been cleared:

- (14) a. clean the blackboard; a clean blackboard
 b. clear the road; the road is clear
 c. empty the drawer; an empty drawer

In contrast, none of the *wipe* verbs are zero-derived from adjectives, although they do have related adjectival passive participles: **the wipe table* versus *the wiped table*; **the sweep floor* versus *the swept floor*.

While the meaning of a *clear* verb does not make explicit how the removal of a substance from a location is effected, the meaning of a *wipe* verb does. Wiping a blackboard is not the same as washing or erasing it, even if all three actions can result in the blackboard being clean. The *wipe* verbs further differ from the *clear* verbs in not specifying the effect that the action they denote has on the location. Although the action of wiping a blackboard might typically result in cleaning it, it is possible to wipe a blackboard without making it clean. In contrast, a blackboard is always clean as a result of being cleaned.

⁵It is likely that the verbs *clear*, *clean*, and *empty* are derived from the adjectives with the same names (rather than the adjectives being derived from the verbs) since the meaning of each adjective is simpler and included within the meaning of the corresponding verb. Furthermore, there are pairs of verbs and adjectives that show the same semantic relation although the verb in the pair is more complex morphologically than the adjective, as we discuss in section 4 (e.g., *deepen/deep*; see (19)). We use the term *zero-derived* to indicate that the verb and adjective are identical in form; however, we do not take a position as to whether the derivational process involves a "zero" morpheme or no morpheme at all.

The *wipe* verbs fall into two subclasses according to whether their meaning specifies a manner, as in (15a), or an instrument, as in (15b):

- (15) a. buff, erase, pluck, prune, rinse, rub, scour, scrape, scratch, scrub, shave, skim, trim, wipe, . . .
 b. brush, file, mop, rake, shear, shovel, sponge, vacuum, . . .

The meanings of the manner subclass verbs *wipe* and *rub* make explicit the way in which the action the verbs denote is performed: these two verbs involve different types of moving contact with a surface. In contrast, the instrument subclass verbs *rake* and *mop* are denominal, denoting actions performed with the instruments from which these verbs take their names.⁶ The verb *mop* patterns like the verb *wipe* with respect to the expression of its arguments, as the following examples show:

- (16) a. Sylvia mopped the spots from the floor.
 b. Sylvia mopped the floor.
 c. *Sylvia mopped the floor of spots.

This similarity is not surprising since the instrument restricts the action denoted by the verb in the same way that a manner does. That is, each instrument implies an action of a certain sort: the action required to use the instrument to perform its intended function. We continue to refer to the larger class of verbs that includes both the manner and instrument subclasses as the *wipe* verbs, referring to the specific subclasses when necessary. We will say that the property that characterizes the *wipe* verbs is that they lexicalize a means component, where means component refers to either a manner or an instrumental component.⁷

This examination of the *clear* verbs and the *wipe* verbs can help explain the difference in size between the two classes. In their survey of the process of coining new zero-derived verbs from nouns in English, Clark and Clark (1979) note that this word-formation process is particularly productive with nouns referring to

⁶Some members of the manner subclass have associated zero-derived result nominals; these nominals are typically used in light verb constructions (*give the table a wipe*). As Sue Atkins has pointed out to us, it appears that the manner verbs that have zero-derived nominals are those where the action denoted by the verb need not necessarily be iterative, so that *buff* and *erase*, which involve several iterated small movements, do not produce **give something a buff/an erase*.

⁷Resultant state and means are better described as components of meaning than as features because each has multiple instantiations. It is the presence or absence of a particular type of meaning component that is syntactically relevant, rather than its particular instantiation. These meaning components may turn out not to be primitive elements of the lexical semantic representation, but rather may be notions defined over the elements of a more complex representation. Furthermore, we do not claim that these meaning components necessarily exhaust the meaning of these verbs; they simply number among the linguistically relevant components of verb meaning.

instruments. A verb derived from such a noun denotes the typical action involving the use of the instrument the noun refers to. If we were to coin an innovative verb from a newly invented instrument used for removal, we would predict that this verb will behave like the verb *mop*. And the verb *vacuum*, which could only have been coined after the invention of the vacuum cleaner, shows precisely this behavior. The small size of the *clear* class, when compared with the *wipe* class, probably reflects the fact that this very productive strategy for adding to the verb lexicon does not create verbs of the *clear* type. Assuming these verbs are deadjectival, it could be attributed to the absence of a productive process of creating verbs from adjectives. And furthermore, even if such a process were available, there is not continuing extensive growth in the adjective lexicon the way that there is in the noun lexicon.

Although we have referred to the *clear* and *wipe* verbs as verbs of removal, we have seen that these verbs do not consistently pattern like either the verb *remove* – arguably the prototypical verb of removal – or the other verbs of removal listed in (12). Furthermore, the difference extends to their meaning. Unlike the *clear* and *wipe* verbs, the *remove* verbs simply describe the removal of something from a location. The *remove* verbs do not specify how the action of removing was performed. For example, it is possible to remove snow from a road in a variety of ways: by shovelling, raking, sweeping, etc. Nor do the *remove* verbs specify what effect the removal has on the location: snow can be removed from a road without clearing the road. Thus the *remove* verbs lexicalize neither a means nor a resultant state. Rather these verbs mean roughly “cause an entity not to be at a location” and nothing more.

4. Reassessing the classification of the verbs

In the previous section we argued that the *clear* and *wipe* verbs lexicalize the meaning components resultant state and means, respectively. In this section we begin to investigate the part that these meaning components play in determining the semantic class membership of these verbs and, hence, their syntactic behavior. Our basic claim is that verbs often have “basic” and “extended” meanings. We suggest that the component of meaning lexicalized in the verb determines its basic meaning. The basic meaning of a lexical item is its simplest meaning, reflecting little more than the lexicalized meaning components. Extended meanings are *more complex meanings that are built on other meanings*. This section will focus on the basic meaning of the *clear* and *wipe* verbs; extended meanings will be discussed in following sections. We propose that the use of the *clear* and *wipe* verbs in the location-as-object variant involves the basic meaning of these verbs, and, that on this meaning these verbs are not verbs of removal, but rather belong to other well-defined classes of verbs. As evidence for this proposal, we show that

the *clear* and *wipe* verbs manifest properties associated with the members of these other verb classes when they are found in the location-as-object variant.

There is evidence that the *clear* verbs are basically change-of-state verbs, and that the meaning that they manifest in the location-as-object variant is roughly “cause an entity to come to be in the resultant state lexicalized by the verb”. In this variant, these verbs denote causing a change of state in what we have called the location argument, so that the label “location argument” is something of a misnomer, and this argument is more appropriately viewed as the entity that undergoes the change of state. As such, the location argument is expressed as a direct object – the typical expression of an argument that denotes an entity undergoing a change of state. The state is the state lexicalized in a *clear* verb.

Support for this suggestion comes from the fact that the verbs *empty* and *clear* can undergo the causative/inchoative alternation, as illustrated below:⁸

- (17) a. Martha emptied the tub.
 b. The tub emptied.
 (18) a. The strong winds cleared the skies.
 b. The skies cleared.

This alternation, where the semantic role of the subject of the intransitive use of a verb is the same as that of the object of the transitive use of the same verb, is characteristic of most verbs of change of state, such as those listed in (19)

⁸Despite the fact that the verb *clean* does not show the causative/inchoative alternation, we believe it is a change-of-state verb. If a verb is found in the causative/inchoative alternation, then it is a change-of-state verb (or at least a verb of change, since verbs of change of position such as *move* and *bounce* also show this alternation). However, not all change-of-state verbs show this alternation. For instance, the verbs *pasteurize* and *homogenize* are change-of-state verbs, but they have only transitive, and not intransitive, uses (*The farmer pasteurized/homogenized the milk*; **The milk pasteurized/homogenized*). We do not understand the conditions that prevent certain change-of-state verbs from having intransitive as well as transitive uses, but we suspect that these verbs are basically two-argument verbs meaning “cause to come to be in state”. In contrast those verbs with both transitive and intransitive uses are basically one-argument verbs meaning “come to be in state”, with the transitive use having a meaning “cause to come to be in state”. It appears that a verb can show both transitive and intransitive forms if the change of state can come about “naturally” (as if without the direct intervention of an animate causer). Homogenization, pasteurization, and cleaning all involve changes of state that as we know them require the intervention of an agent, and hence the verbs naming these actions are only found as two argument verbs. Although we are aware of studies that address the issue of why some verbs do not have transitive uses (Hale & Keyser, 1986, 1987; Smith, 1970), we do not know of studies directly addressing the opposite question: why some change-of-state verbs do not have intransitive uses, although the paper by Brousseau and Ritter (1991) begins to look at some relevant issues.

We assume that such studies will also clarify why the set of objects that some verbs of change of state, including the verb *clear*, permit in their transitive use is more restricted than the set of subjects they take in their intransitive use. For example, compare *Susan cleared the table*! **The table cleared* with *The wind cleared the sky*! *The sky cleared*. See Brousseau and Ritter (1991) for some other minimal pairs and for a discussion of factors that enter into these differences.

(Fillmore, 1967; Guerssel, Hale, Laughren, Levin & White Eagle, 1985; Hale & Keyser, 1986, 1987; among others). Furthermore, many change-of-state verbs, like the *clear* verbs, are deadjectival; they are either zero-derived from adjectives or formed from adjectives by the suffixation of *-en*, as the two subclasses in (19) show:

- (19) a. cool, dim, dry, narrow, open, shut, slow, steady, thin, warm, . . .
 b. broaden, darken, deepen, harden, redden, ripen, soften, thicken, . . .
- (20) a. Francesca cooled the coffee.
 b. The coffee cooled.
- (21) a. Jane thickened the sauce.
 b. The sauce thickened.

Many change-of-state verbs, particularly those whose name is related to an adjective, have a sense in which they function as predicates whose single argument is the entity that undergoes a change of state and comes to be in the state lexicalized in the verb; this state is the one that the related adjective also describes. On this sense these verbs mean “come to be in state”. These verbs also have a second sense that could be paraphrased as “cause to come to be in state”; this sense involves two arguments: one denoting the entity that undergoes the change of state, and the other denoting the agent/cause of the change of state. (Some change-of-state verbs, however, have only one of these two senses; see footnote 8.) We are claiming that the verb *empty*, as used in (17a), is a causative change-of-state verb, and that all that this sentence denotes is the causation of a specific change in the state of the tub (to a state where its contents are gone). Thus what sets verbs like *clean*, *clear*, and *empty* apart from other verbs of change of state is that they denote a change of state in an entity that typically is brought about by removing something from that entity. Other changes of state are brought about in different ways; for instance, by changes in chemical composition, structure, etc.

It may seem odd to claim that a verb like *clear*, which denotes an action which necessarily involves removal, is not classified as a verb of removal. However, this aspect of the real-world event denoted by a verb does not necessarily have to be reflected in its linguistic characterization. The evidence from the syntactic behavior of the *clear* verbs indicates that these verbs in the location-as-object variant are linguistically classified as change-of-state verbs and not as verbs of removal. A single real-world event may be described in different ways, necessitating the use of verbs from different linguistically significant semantic classes.

What about the *wipe* verbs? We propose that like the *clear* verbs, they too are not verbs of removal in their basic sense (see also Jackendoff, 1990, p. 296, who makes a similar claim). However, the *wipe* verbs are not change-of-state verbs either. We take the sense of *wipe* in the location-as-object variant (*Kay wiped the*

counter) to be its basic sense, as we do with the *clear* verbs, although we take the principle which determines the expression of a location argument as object to be different in the two instances. The *wipe* verbs can be characterized in terms of their aktionsart – the inherent temporal structure of the events they denote. Each of the *wipe* verbs is an activity verb in the sense of Vendler (1957). Activity verbs denote events that, in the absence of a specific goal or temporal endpoint, have indefinite duration. The *wipe* verbs, like activity verbs in general, can be subdivided into a number of syntactically relevant semantically coherent subclasses. We discuss two subclasses that account for many of the *wipe* verbs.

Many members of the manner subclass of the *wipe* verbs are verbs denoting contact with a surface through motion of some entity, as also proposed by Jackendoff (1990); among them are the verb *wipe* itself, as well as the verbs *rub*, *scrape*, and *scrub*. Each verb in this subclass describes a particular type of surface contact that involves moving an entity against a surface. The surface is what we have called the location argument, while the moved entity is only optionally expressed with these verbs via an instrumental phrase (*Kay wiped the counter with a wet sponge*). The verbs in this subclass differ from each other in the specific type of motion that is involved in the surface contact, and, if an instrument is involved, in the type of instrument used. For instance, wiping usually involves a cloth or a sponge, but a cloth would not be a possible instrument for scraping.

A property that suggests that some *wipe* verbs are verbs of surface contact through motion is that many of them are found in the conative construction illustrated in (22b), as well as in the locatum-as-object variant (22a):

- (22) a. Kay rubbed/scraped the counter.
 b. Kay rubbed/scraped at the counter.

The conative construction is characterized by a change in the transitivity of the verb (the verb is used intransitively in the conative construction, with the noun phrase that was the direct object when the verb was used transitively expressed in a prepositional phrase headed by the preposition *at*), as well as by a slight change in meaning. This construction is attested with verbs whose meaning includes notions of both movement and contact (Guerssel et al., 1985; Laughren, 1988). The verbs found in this construction are drawn from several semantic classes; they include verbs of impact by contact, such as *hit* or *kick*, and verbs of contact and effect, such as *cut* or *hack*. Simple verbs of contact and simple verbs of motion are not found in this construction (**Terry touched at the cat*, **Nina moved at the table*). The conative construction is also not found with verbs of change of state, including the *clear* verbs (**Francesca cooled at the coffee*, **Martha emptied at the tub*), since they lack the appropriate meaning components. As expected, there are verbs that qualify as verbs of contact through motion but which are not understood as verbs of removal; for example, the verb *dab*, which like other verbs of

contact through motion, undergoes the conative alternation (*Shelly dabbed at her face*).

As Jackendoff (1990) points out, it is possible to wipe a table even if its surface is already clean and clear so that there is nothing to remove from it. This property is consistent with the characterization of the verb *wipe* as a verb of surface contact through motion rather than as a verb of removal. In fact, this observation can be taken further. There is another property of the *wipe* verbs that receives a natural explanation if these verbs are not verbs of removal in their basic sense: some of these verbs are used not only as verbs of removal but also as verbs of putting, as shown in (23):

- (23) a. Kay wiped the polish onto the table.
b. Lynn scraped the leftovers into a bowl.

This property is problematic if these verbs are basically verbs of removal since putting and removing are opposite activities. But if the putting and removal senses of these verbs are both extended senses of these verbs, as we will suggest in section 5, then no problem arises.

The verb *shovel* and the other members of the instrument subclass of the *wipe* verbs are again activity verbs. They simply denote the activity typically performed with the instrument from which the verb takes its name (see Clark & Clark, 1979, for discussion). These verbs also are not necessarily verbs of removal. As illustrated in (24) and (25), some of them can also be used as verbs of putting:

- (24) Sylvia shovelled the snow onto the lawn.
(25) Kelly raked the leaves into the gutter.

It appears that whether a verb that takes its name from an instrument can be used as a verb of removal or as a verb of putting depends on the nature of the instrument involved. Thus there are verbs that take their names from instruments that are not understood as either verbs of removal or verbs of putting, such as *microwave* and *saw*.

The *wipe* verbs also contrast with the *clear* verbs in not participating in the causative/inchoative alternation. A similar contrast can be observed elsewhere in the English lexicon. Consider the verbs *cut* and *break*, which both appear to denote actions that involve a “separation in the material integrity” of some entity (Hale & Keyser, 1986, 1987). The verb *cut* lexicalizes a means component (the use of a sharp instrument). The verb *break* does not lexicalize a means component – entities can be broken in a variety of ways – but it does lexicalize a resultant state. Thus the meanings of the verbs *cut* and *break* contrast in much the same way as those of *wipe* and *clear*. Furthermore, the verb *cut* is not found in the causative/inchoative alternation (*Kelly cut the cake*/**The cake cut*), though the verb *break* is (*Sharon broke the glass*/*The glass broke*).

It appears that verbs that lexicalize a means component cannot be used intransitively in the sense associated with the inchoative variant of the causative/inchoative alternation (see also Guerssel et al., 1985). We attribute this property to the means component, whose presence requires the verb to select an explicit agent or cause as an argument. This requirement cannot be met in the inchoative variant, which simply describes a change of state without specifying its cause. The causative construction must be used when the cause must be expressed.⁹

In this section we have argued that the *clear* and *wipe* verbs in their basic sense are not verbs of removal. Rather the *clear* verbs are verbs of change of state, and the *wipe* verbs are activity verbs. The elements of meaning which are lexicalized in these verbs determine the basic classification of the verbs and their behavior. What we have called the location-as-object variant is simply the way these two types of verbs express their arguments. The *clear* verbs and the *wipe* verbs might appear to be verbs of removal even in the location-as-object frame, but this impression results from real-world knowledge associated with the events these verbs denote and is not part of their linguistic classification. The analysis of the meaning of the *clear* and *wipe* verbs proposed in this section explains why these verbs behave differently from verbs of removal. In section 6 we show that these classifications also account for the differences between the *clear* and *wipe* verbs with respect to the possibility noted in section 2 of expressing the locatum argument in an *of* phrase. But first we turn to the question of why these verbs, if they are not verbs of removal, are found in the syntactic frame associated with verbs like *remove*.

5. The locatum-as-object variant again

Suppose we take the expression of arguments manifested by the verb *remove* to be that characteristic of verbs of removal. That is, verbs of removal express their arguments as in the locatum-as-object variant (“NP V NP FROM NP”). We could propose that when verbs such as *clear* and *wipe* express their arguments like *remove* they are indeed verbs of removal, even though when found in the location-as-object variant they belong to another semantic class. Thus the *clear* and *wipe* verbs would have several distinct but related meanings. Is there evidence for this approach? And is there a way to explain the multiple classification of these verbs?

In English, verbs may systematically acquire additional meanings through a process of *lexical extension*, described in detail by Levin and Rapoport (1988). This process systematically creates extended senses of a verb in a regular manner

⁹This property is consistent with our suggestion in footnote 8 that when a verb denotes an action in which an agent is inherently implicated the verb cannot show an inchoative form.

from its basic sense. For example, lexical extension would relate the basic sense of the verb *bake* as a change-of-state verb (*Tracy baked the potatoes*) to its extended sense as a verb of creation (*Tracy baked a cake*), where the verb means roughly “create by means of change of state *bake*” (see Atkins, Kegl, & Levin, 1988). Similarly, verbs of sound emission manifest a wide range of extended senses, including an extended sense as verbs of motion – “move while emitting the characteristic sound” – as in *The bullet whistled by her* or *A large truck rumbled down the street* (Levin, 1991).¹⁰

Knowledge of possible extended senses and the factors that license them are an important part of the lexical knowledge of a speaker of English. Such systematically related extended senses are typically licensed by a combination of necessary conditions (the word’s basic semantic class membership) and sufficient conditions (properties related to those aspects of a word’s meaning that set it apart from other class members). For example, belonging to one of several semantic classes, including the class of verbs of sound emission, is necessary for a verb to show an extended sense as a verb of motion; the sufficient condition that a verb of sound emission must meet is that the sound is one that is emitted as the movement happens. Thus the verb *purr* only has an extended sense as a verb of motion for certain choices of subject. Contrast **The cat purred down the street*, which is unacceptable since purring is not a necessary concomitant of a cat’s motion, with *The beautiful new Mercedes purred along the autobahn*,¹¹ where the motion of a car is necessarily accompanied by the sound of its engine. Consider also *The bullet whistled by her*, where whistling is the sound emitted as a bullet moves.

Levin and Rapoport (1988) represent lexical extension as a process of subordination which relates lexical semantic representations of verb meaning that take the form of predicate decompositions (see also Laughren, 1988). When a verb undergoes lexical subordination, the lexical semantic representation associated with its basic meaning is subordinated under a newly introduced primitive predicate using a subordinating function. For instance, a subordinating function “by means of” is used in deriving creation *bake*, which means roughly “create by means of change of state *bake*”, from change of state *bake*.¹² A verb’s semantic class membership will shift when it manifests an extended meaning, and the verb will take on the behavior appropriate to the semantic type of the extended meaning. As a consequence, a verb’s syntactic behavior will be different in its basic and extended meanings. (See Atkins et al., 1988; Laughren, 1988; and

¹⁰Lexical extension is not restricted to the verb lexicon. For example, nouns like *reel* or *cup*, which refer to a container, can be used to refer to the quantity of material held in such a container (*a reel of thread* or *a cup of milk*) For further discussion, see Apresjan, 1973; Atkins, 1991; Brugman and Lakoff, 1988; Cruse, 1986; Leech, 1981; Norvig, 1989; among others.

¹¹We thank a reviewer for pointing this example out to us.

¹²See Levin and Rapoport (1988) for explicit lexical semantic representations. See Pustejovsky (1989) for a somewhat different approach to the relation between change of state *bake* and creation *bake*.

Levin, 1991, for some discussion.) For instance, as discussed by Atkins et al., only change of state *bake*, and not creation *bake*, shows the causative/inchoative alternation typical of change-of-state verbs; creation *bake* shows properties that are appropriate to verbs of creation, such as the benefactive alternation (*bake a cake for someone/bake someone a cake*).

Let us look now at the *wipe* verbs. We suggest that when a *wipe* verb is found in the syntactic frame associated with verbs of removal (“NP V NP FROM NP”), it is manifesting an extended use as a verb of removal. Although the *wipe* verbs are basically various types of activity verbs such as verbs of surface contact through motion, those *wipe* verbs that denote activities that can effect the removal of something from a location can take on an extended sense as verbs of removal. Removal *wipe* would mean “remove by means of surface contact through motion *wipe*”. As a verb of removal, *wipe* would be expected to express its arguments like other verbs of removal. Furthermore, removal *wipe* should show the properties associated with verbs of removal and not those associated with verbs of surface contact through motion. For instance, verbs of removal are not found in the conative construction, as shown in (26), and, in fact, the conative construction is not possible with those *wipe* verbs that are otherwise found in the conative alternation when they are used in the removal sense, as shown in (27) (compare (22b)):

- (26) a. Monica removed the groceries from the bag.
 b. *Monica removed at the groceries from the bag.
 (27) a. Kay rubbed the fingerprints from the counter.
 b. *Kay rubbed at the fingerprints from the counter.

As mentioned in the previous section, the *wipe* verbs can be used either as verbs of putting or as verbs of removal. The putting and removal senses of the *wipe* verbs share the same component of meaning lexicalized in the verb: the means component. However, the verb *wipe* would mean “remove by means of surface contact through motion *wipe*” in its removal sense, and “put by means of surface contact through motion *wipe*” in its putting sense. The means component determines the basic sense of the *wipe* verbs, as well as their possible extended senses. Our knowledge of the potential real-world uses of the means lexicalized in these verbs determines which of the extended senses of the *wipe* verbs are possible. The option of demonstrating removal and putting senses seems to be available when the means can effect either removing or putting, as with the verbs *wipe*, *scrape*, and *shovel*. When the means can be used only to remove something or only to add something, then the dual senses are not found. For example, the verb *vacuum* can only have the verb of removal extended sense and not the verb of putting extended sense (*Andrea vacuumed the sand off the floor*! **Andrea vacuumed the sand into the corner*).

A lexical extension analysis can also be applied to the *clear* verbs to explain their use in the locatum-as-object variant. We might propose that removal *clear* means something like “remove by means of change of state *clear*”.¹³ Again, due to the class shift associated with the extended meaning, the *clear* verbs in their removal sense should show the properties of verbs of removal and not those of verbs of change of state. Evidence in favor of this comes from examining the behavior of *clear* verbs in the middle construction (Keyser & Roeper, 1984; Hale & Keyser, 1987; among others). This construction resembles the inchoative (intransitive) variant in the causative/inchoative alternation superficially, but differs from it in several respects. Sentences (28b) and (28c) illustrate, respectively, inchoative and middle uses of the verb *dry*:

- (28) a. Tony dried the cotton clothes.
 b. The cotton clothes dried.
 c. Cotton clothes dry easily.

First, the middle construction, unlike the inchoative construction, does not denote an event. Second, the middle construction may imply an agent, but the inchoative construction need not. Third, the middle construction typically includes an adverbial phrase such as *easily*. Finally, the middle construction is found with some verbs that are not found in the causative/inchoative alternation, such as *cut* (*Freshly baked bread cuts easily*/**The freshly baked bread cut.*)

Change-of-state verbs are among the types of verbs found in the middle construction (Hale & Keyser, 1987), but removal verbs are not, as shown by the contrast in (29). The *clear* verbs are only found in the middle construction on their change-of-state sense, as shown by (30a) and (31a), and not on their removal sense, as shown in (30b) and (31b):¹⁴

- (29) a. Cotton clothes dry easily.
 b. *Groceries remove from bags easily.
 (30) a. This new oven cleans without any trouble.
 b. *Even the toughest grease spots clean with no bother from this oven.
 (31) a. This new type of bathtub empties in a flash.
 b. *Even the dirtiest water empties easily from this new bathtub.

¹³It is likely that the subordinating function “by means of” is not quite appropriate here, and that the list of subordinating functions needs to be expanded. See Laughren (1988), for discussion of a range of subordinating functions found in the Australian language Warlpiri.

¹⁴Some speakers have said that the verb *remove* might be found in the middle construction in sentences such as *?Some ink spots remove easily*, but this sentence involves a different, change-of-state, sense of *remove*, which might be paraphrased as “cause to disappear” rather than “cause to change location”. Notice that the example degrades with the addition of a *from* phrase, as in *??Some ink spots remove easily from cotton fabrics*, since the presence of this phrase favors the removal interpretation.

6. The *of* phrase

As discussed in section 2, the *clear* verbs are set apart from the *wipe* verbs with respect to the syntactic frames they are found in. Only the *clear* verbs are found in the *of* variant:

(32) Doug cleared the table of dishes.

This property of the *clear* verbs can be explained in part by noting that the set of adjectives related to the *clear* verbs can each take a complement expressed by means of an *of* phrase:

(33) clear of snow, clean of bugs, empty of water

The ability of these adjectives to take a complement can be attributed to the type of state they denote: it is a state that is characterized by a lack of something. Adjectives denoting such states are basically two-place predicates. Like all adjectives, one of their arguments is the entity that the state denoted by the adjective is predicated of: the “subject” of the adjective. Their second argument, expressed in the *of* phrase, is the thing with respect to which this state of being without holds. For example, if a table is clear of dishes, then the state of being clear holds with respect to dishes, and the table itself may not be totally clear.

The use of an *of* phrase is not restricted to the *clear* verbs and related adjectives. Such *of* phrases are also found with other adjectives that are similar in meaning to those in (33), even though not all of these adjectives have similarly related verbs:¹⁵

(34) bare of furniture, bereft of friends, devoid of content, free of debts

These *of* phrases also occur with some verbs that are found only in the “NP V NP *of* NP” frame that characterizes the *of* variant; that is, they do not show the alternate expressions of arguments available to the *clear* verbs:

¹⁵The verbs *bare* and *free* are deadjectival, although they do not behave like the *clear* verbs. We assume that they exemplify the idiosyncrasies that are associated with the lexicon. Specifically, as a reviewer points out, the meaning of the verb *bare* has become more lexicalized than that of some of the other verbs examined; its meaning is something like “reveal” or “expose”, rather than “cause to be bare”, the sense that would be parallel to the *clear* verbs. The verb *free* is found in the same syntactic frames as *clear*, but never with a single set of noun phrases filling the argument slots (*free a bird from a cage!* **free a cage of a bird*; *free a man of responsibilities!* **free responsibilities from a man*). We believe that there are different senses of the verb *free* involved in the different syntactic frames, and that these senses can be shown to have meanings compatible with the syntactic frames they are found in. However, showing this would require an extensive and detailed study of the meaning of this verb that would go beyond the scope of this paper.

- (35) *Deprive* verbs: bilk, cheat, defraud, denude, deprive, dispossess, fleece, rid, rob, . . .
- (36) a. The government cannot deprive the accused of the right to a fair trial.
 b. *The government cannot deprive the right to a fair trial from the accused.

Like the *clear* verbs when they are found in the *of* variant, the meaning of these verbs, which we refer to as the *deprive* verbs, is roughly “cause to come to be in a state of being without”. These verbs differ from the *clear* verbs in one other fundamental respect: they are not found in the causative/inchoative alternation. It is possible that they lack this property because they denote events in which agents are inherently implicated (see footnote 8).

It is difficult to characterize precisely the relationship that holds between the locatum and location arguments in the “NP V NP *of* NP” syntactic frame associated with both the *clear* verbs and the *deprive* verbs. This relationship is different from the one in the locatum-as-object variant, where it is simply a relationship of location: the locatum is located at the location. The relationship in the *of* variant involves something more; there must be some sort of “inherent” connection between the locatum and location. This relationship might be compared to the relationship that holds between the first object and the second object when *give* and other dative alternation verbs are found in the double object variant, (37b), but not in the *to* variant, (37a):¹⁶

- (37) a. Carla gave a present to Tina.
 b. Carla gave Tina a present.

With dative verbs, the double object variant is used to express the notion “cause to have”, which could involve a transfer of possession (*give someone a present*), but might also involve a more abstract notion of “cause to have” which does not actually involve a transfer of possession (*give someone a headache*, *give someone an idea*). Semantically, the *of* variant of the *clear* verbs appears to be the inverse of the double object variant of the dative alternation verbs. Just as the double object variant is used to express “cause to have”, the *of* variant is used to express “cause not to have”. The parallel is particularly strong as the *of* variant is used to express a range of meanings: from instances where “cause not to have” could involve actual removal from a location (*clear the table of dishes*) to instances where a more abstract sense of “cause not to have” is involved, one that involves no actual physical movement (*clear someone of guilt*).

The fact that the “NP V NP *of* NP” construction is used to express more than simple location is reflected in the fact that with the *clear* verbs not all instances of

¹⁶See studies of the dative alternation such as Green (1974) or Oehrle (1976) for more discussion of this relationship.

the *of* variant can be paraphrased by a locatum-as-object variant involving the same *clear* verb, just as it has been noted that not all instances of the double object variant with dative alternation verbs can be paraphrased by the *to* variant (*give someone a headache* but **give a headache to someone*). Consider the following example:

- (38) a. The judge cleared the accused of guilt.
 b. *The judge cleared guilt from the accused.

Guilt is an abstract property that must be associated with a person; the relationship between the two is not one of location. Such properties are frequently expressed in *of* phrases, both with *clear* verbs, as in (39), and *deprive* verbs, as in (40); some of the *deprive* verbs are almost exclusively found with such *of* phrases:

- (39) a. . . . an initial probe had cleared him of wrongdoing. (Example from the AP news wire)
 b. Under cross-examination, Jefferies testified that on March 30, 1987, he emptied his office of notes on his daily activities after October 1986. (Example from the AP news wire)
- (40) a. . . . the plan deprived them of political power and fair representation. (Example from the AP news wire)
 b. . . . they were being robbed of their civilized values . . . (Example from the AP news wire)

An examination of naturally occurring instances of the *clear* and *deprive* verbs in the AP news wire¹⁷ confirms that there is an inherent connection between the location and locatum in the syntactic frame “NP V NP *of* NP”. The most prevalent examples of the verb *clear* in the *of* variants take the following form: clearing people, companies, or governments of wrongdoing, allegations, charges, suspicion, complicity. These examples all involve abstract properties. Other examples include: clearing a complex of militants, a building of personnel, a mine of fumes, a ship of debris, and a patient of port wine stains. All these examples could be viewed as instances of inalienable possession, where inalienable possession is interpreted in a broad sense.

The fact that an *of* phrase cannot appear with the *wipe* verbs can be attributed to the fact that these verbs do not lexically specify a resultant state, let alone a resultant state that the *of* phrase can be associated with. However, if an appropriate resultant state could be added to the meaning of a *wipe* verb then we might expect an *of* phrase to appear. The state that results from the action denoted by a *wipe* verb can be introduced periphrastically using the resultative

¹⁷These examples were provided by D. Hindle of AT&T Bell Laboratories.

construction, as in (41):

- (41) a. Kay wiped the counter clean.
 b. Sylvia shovelled the walk clear.

When a *wipe* verb is used as the main verb in a resultative construction, the state of the location argument that results from the action denoted by the verb can be expressed explicitly in an adjective phrase predicated of this argument. For instance, in (41a) the counter becomes clean as a result of being wiped, while in (41b) the walk becomes clear as a result of being shovelled. When adjectives like *clear* are used in the resultative construction, they can still take an *of* phrase which describes the element with respect to which the state holds. In this way the locatum argument of a *wipe* verb can be expressed when the location is expressed as the object:

- (42) a. Kay wiped the counter clean of fingerprints.
 b. . . . it was said she had worked like a Trojan to scrub the house clean of decades of muddy boot-prints . . . (S. Webster, *Small Tales of a Town*, 1988, p. 19)
 c. Army troops shovelled Pennsylvania Avenue clear of snowdrifts. (Example from the AP news wire)

The asymmetry in the way that the *clear* and *wipe* verbs express the locatum argument is tied to the fact that the *wipe* verbs do not lexically encode a resultant state. The nature of this difference confirms the characterization of the basic meaning of the members of the two verbs classes proposed in section 3.

However, occasionally *wipe* verbs are found taking an *of* phrase directly, as in the following examples:

- (43) a. Although this year the school was shorn of his name and the Marxist curriculum, Karl Marx remains in the glass-covered courtyard. (A. Shelley, "Behind the Facades, Surprises in Budapest", *NYT Travel Section*, 22 July, 1990, p. 29)
 b. . . . but Uncle Mosin, who skimmed the city of scandal and news, had warned that there were rumours of riots. (A. Hosain, *Sunlight on a Broken Pillar*, Virago, London, 1988, p. 71)
 c. . . . the palm trees are trimmed of unsightly brown fronds . . . (S. Grafton, "*A*" is for *Alibi*, Bantam, New York, 1987, p. 8)

We suggest that when a *wipe* verb is used in this way, it manifests a sense that is consistent with the meaning we have previously seen to be associated with the frame "NP V NP *of* NP". That is, the verb means "cause something to come to be in a state of being without". In fact, the means component becomes almost incidental in the examples in these uses of the *wipe* verbs and sometimes even

disappears completely. For instance, (43a) simply means that the school was deprived of its name; there is no sense in which the school lost its name through the use of shears. Such uses of the *wipe* verbs may come about since the action denoted by each of the *wipe* verbs in its basic sense may result in a change in the state of the locatum arguments – often a change into a state of being without. It is significant that the verbs are in the adjectival passive form in several of the examples in (43), since the adjectival passive necessarily focuses on the state that results from an action. As in the other instances of the “NP V NP of NP” syntactic frame, there is an inherent connection between the location and locatum. For instance, a frond is an inalienable part of a palm tree and a name must be attached to a person, animal, or place. The existence of such a sense of the *wipe* verbs gives the impression that the *wipe* verbs pattern like *clear* verbs, although they are not inherently change-of-state verbs in their basic sense.

7. The locative alternation revisited

The verbs *clear* and *wipe*, as well as other verbs that pattern like them, have sometimes been considered a subclass of the larger class known as the *locative alternation verbs* (see, for example, Fraser, 1971; Hook, 1983; Rappaport & Levin, 1988), a set of verbs whose best-known members are the much discussed *spray/load* verbs (Anderson, 1971; Jackendoff, 1990; Jeffries and Willis, 1984; Rappaport & Levin, 1988; Schwartz-Norman, 1976; among others). The *clear* verbs and the *wipe* verbs have been grouped with the *spray/load* verbs because, as shown in a squib by Fraser (1971), the two classes of verbs share a variety of properties, including the ability to participate in a comparable alternation in the expression of arguments. The alternation shown by the *spray/load* verbs is illustrated in (44):

- (44) a. The farmer loaded hay on the truck.
 b. The farmer loaded the truck with hay.
 (45) a. Phyllis sprayed the wall with paint.
 b. Phyllis sprayed paint on the wall.

From the perspective of meaning, the *clear* and *wipe* verbs could be considered inverses of the *spray/load* verbs. The *spray/load* verbs describe the putting of a locatum at some location; as mentioned, the *clear* and *wipe* verbs can be roughly characterized as describing the removal of a locatum from a location. The ability to express the location either as direct object or via a prepositional phrase is probably the most important of the properties that the verbs *clear* and *wipe* share with the *spray/load* verbs. The property has led to the suggestion that *clear* and *wipe*, as well as *spray* and *load*, are part of a larger set of locative alternation verbs.

We now briefly consider the implications of our lexical semantic analysis of the *clear* and *wipe* verbs for the nature of the locative alternation. We have proposed that each alternate expression of arguments of these verbs is associated with a distinct sense of the verb and is determined by that sense of the verb. The verb senses in the different variants are related by the process of lexical extension and, therefore, share certain components of meaning, which create a relationship between the variants. As mentioned in section 2, we claim that the locative alternation as manifested by the *clear* and *wipe* verbs is not a simple alternation in the expression of the arguments of verbs that each have a single sense.

Our analysis of the *clear* and *wipe* verbs raises the question of whether the range of data grouped under the label “locative alternation” constitutes a unified phenomenon. On this analysis, the relationship between the variants of the *clear* and *wipe* verbs is different from the relationship between the variants of the *spray/load* verbs, as characterized in Rappaport and Levin (1988). Although our account of the *spray/load* verbs also appealed to the notion of lexical extension to explain the relationship between the variants, we proposed that the sense of a *spray/load* verb in the locatum-as-object variant, (44a), is basic, while that in the location-as-object variant, (44b), is derived via lexical extension. We assume that in the locatum-as-object variant these verbs denote a simple change of location, and in the location-as-object variant these verbs denote a change of state brought about by means of the change of location.¹⁸

A comparison of this analysis of the *spray/load* verbs with that of the *clear* and *wipe* verbs shows that the two analyses reverse which of the variants is associated with the basic sense of the verb and which with the extended sense. For the *clear* and *wipe* verbs, we claim that the locatum-as-object variant involves the extended sense of the verbs, while the location-as-object variant involves the basic sense. However, with both types of verbs, each variant realizes its arguments in accordance with independently necessary linking rules, given the semantic type of the verb sense in that variant.¹⁹

¹⁸In Rappaport and Levin (1988), we offer some justification for this choice of which variant reflects the basic sense of the verb and which the extended sense, using considerations other than lexicalization. But the component of meaning lexicalized can also be used to make this decision: the means/manner lexicalized by the *spray/load* verbs often imposes strict selectional restrictions on the locatum, but not on the location.

¹⁹The locative alternation verbs have attracted attention because they demonstrate what has become known as the holistic/partitive effect: when the location argument is expressed as the object of the verb, there is an implication that the location is wholly affected by the action denoted by the verb that does not necessarily hold when the location is expressed via a prepositional phrase. For example, in *clear dishes from the table*, some dishes may still be left on the table, while in *clear the table of dishes*, it is unlikely that any dishes are left on the table. There is much debate concerning the characterization and nature of this effect; see Anderson, 1971; Jeffries and Willis, 1984; Schwartz-Norman, 1976; among others for discussion. The holistic/partitive effect as manifested with the *clear* verbs might well be linked to the nature of the *of* variant and the location-as-object variant: both denote a change of state in the location argument. A similar suggestion is made by Rappaport and Levin (1988) to account for the effect as it is found with *spray/load* verbs.

8. Conclusion

This study shows how a careful examination of verb meaning reveals that what at first might appear to be idiosyncratic properties concerning the expression of the arguments of a variety of verbs reflect differences in their meaning. We started by examining a set of verbs that all appeared to be associated with the notion of removal. We identified various semantically coherent subclasses among these verbs, each with distinctive behavior, and we showed that the members of two of these classes, the *clear* and *wipe* verb classes, were not inherently verbs of removal. Two components of meaning were shown to be important in the characterization of the meaning of the members of these classes: means and resultant state.

This observation is significant because other lexical semantic investigations suggest that essentially the same meaning components are relevant to the characterization of other linguistically significant classes of verbs. As discussed in Levin and Rappaport (1989) and Levin and Rappaport Hovav (1991), verbs of motion fall into a class of verbs of inherently directed motion, the *arrive* verbs, and a class of verbs of manner of motion, which further subdivides into two classes, the *run* and *roll* verbs; see the examples in (46):

- (46) a. *arrive* class: arrive, come, go, depart, fall, return, descend . . .
 b. *roll* class: roll, slide, move, swing, spin, rotate . . .
 run class: run, walk, gallop, jump, hop, skip, swim . . .

The *arrive* verbs specify a direction of motion but no manner or means of motion, while the *run* and *roll* verbs specify a manner or means of motion but no direction. The notion of direction is in some sense analogous to the notion of resultant state; both can be viewed as providing an event with a type of goal. Furthermore, Gentner (1978) suggests that verbs of combining can also be subdivided according to whether they describe the manner or means of combining (e.g., *stir*, *shake*, or *beat*) or the result of this process (e.g., *mix* or *blend*). The importance of the notions of result/direction and manner/means in the organization of verb meaning has also received considerable support from research in child language acquisition. Gentner (1978), Gropen (1989), Gropen, Pinker, Hollander, and Goldberg (1991), and Pinker (1989) have suggested that children are sensitive to this distinction in their acquisition of new words.

We conclude by pointing out an interesting generalization about possible verb meanings that emerges from these studies: there do not seem to be verbs in English that lexicalize both manner/means and result/direction components. Why should these meaning components be in complementary distribution? In Levin and Rappaport Hovav (1991), we suggest that results and directions, unlike means or manners, can be used to delimit the time course of an event.

Specifically, the notions of result and direction seem to be closely tied to the notion of telicity (boundedness in time), which figures prominently in the literature on the lexical aspect of verbs – the inherent temporal structure of the event denoted by a verb (Dowty, 1979; Vendler, 1957; among others). In contrast, the notions of means and manner appear to be connected to the notion of durativeness. The complementary distribution of these meaning components may reflect the impossibility of having a verb that denotes an event that is both bounded and not bounded in time. Further research will perhaps give more insight into this aspect of the “syntax of lexical semantics”.

Appendix: How many *clear* verbs are there?

In this appendix, we briefly discuss why the set of *clear* verbs has sometimes been taken to be larger than we have suggested in this paper; see, for example, Fraser (1971), Hook (1983).²⁰ A variety of other verbs have been cited as showing the same possible pattern of expression of arguments as *clear*, and particularly the ability to be found in the “NP V NP *of* NP” syntactic frame. However, many of these verbs are more accurately grouped with the *wipe* verbs in their basic sense; these include the verb *prune*, cited by Fraser, and the verbs *shear*, *skim*, *shave*, and *wring*, cited by Hook, and the verb *trim* cited by both Fraser and Hook. These verbs lexicalize a means component, and, like other *wipe* verbs, are not found in the causative/inchoative alternation. Despite being grouped with the *clear* verbs in some work, they are only occasionally found with *of* phrases, again under the same circumstances as the other *wipe* verbs. The presence of these phrases can receive the explanation we proposed in section 6 for *of* phrases found with *wipe* verbs.

The verb *strip* is one of two verbs frequently found with *of* phrases that require slightly different treatment. We believe that, despite this property, this verb is not a *clear* verb. It does not participate in the causative/inchoative alternation that is a hallmark of change of state verbs (*Monica stripped the dresser*/**The dresser stripped*). Furthermore, only when used to describe the stripping of furniture or walls does it lexicalize a manner component. Although this verb is found more often in the “NP V NP *of* NP” frame than other *wipe* verbs, it is significant that in this frame the manner component – removing strips – is completely lost. The verb *strip* in this frame become a *deprive* verb and simply means “cause to come to be in a state of being without”, as in (47); such uses cannot be paraphrased by the “NP V NP FROM NP” frame:

²⁰Hook’s list of alternating verbs is much more extensive than Fraser’s. We find that a number of verbs he lists do not easily enter into the same range of syntactic frames as *clear*: among them are *abstract*, *loot*, *plunder*, and *sap*. None of these verbs alternates easily for us. We do not consider them further.

- (47) Rastropovich was stripped of his Soviet citizenship in 1978 . . . (Example from the AP news wire)

We suggest that this shift in the meaning of *strip* is an idiosyncratic property of this verb, an idiosyncrasy of the kind we expect to find in the lexicon.

Finally, we turn briefly to the verb *drain*, which again shows the expression of arguments typical of *clear* verbs. We chose not to include it among the *clear* verbs in our earlier discussion for expository purposes, although we believe, that, like the *clear* verbs, it is a verb of change of state. Like other change-of-state verbs, *drain* participates in the causative/inchoative alternation (*The lifeguard drained the pool/The pool drained slowly*); however, unlike the *clear* verbs listed in (10), it does not take its name from a resultant state, as reflected in the fact that it is not deadjectival. This verb is not unique in this respect; there are other change of state verbs that are not related to adjectives (e.g., *thaw, freeze, melt, break, shrink*), suggesting that the verb *drain* has been correctly included with the *clear* verbs in other work.

References

- Anderson, S.R. (1971). On the role of deep structure in semantic interpretation. *Foundations of Language*, 7, 387–396.
- Apresjan, Ju.D. (1973). Regular polysemy. *Linguistics*, 142, 5–32.
- Atkins, B.T. (1991). Building a lexicon: The contribution of lexicography. *International Journal of Lexicography*, 4:4. To be co-published in M. Bates & R. Weischedel (Eds.), *Challenges in natural language processing*. Cambridge, UK: Cambridge University Press.
- Atkins, B.T., Kegl, J., & Levin, B. (1988). Anatomy of a verb entry: From linguistic theory to lexicographic practice. *International Journal of Lexicography*, 1, 84–126.
- Boguraev, B. (1991). Building a lexicon: The contribution of computers. *International Journal of Lexicography*, 4:4. To be co-published in M. Bates & R. Weischedel (Eds.), *Challenges in natural language processing*. Cambridge, UK: Cambridge University Press.
- Boguraev, B., Byrd, R.J., Klavans, J.L., & Neff, M. (1989). From structural analysis of lexical resources to semantics in a lexical knowledge base. Position paper prepared for the Workshop on Lexicon Acquisition. IJCAI, Detroit.
- Brousseau, A.-M. & Ritter, E. (1991). A non-unified analysis of agentive verbs. *Proceedings of the Tenth West Coast Conference on Formal Linguistics*.
- Brugman, C., & Lakoff, G. (1988). Cognitive topology and lexical networks. In S. Small, G. Cottrell & M. Tanenhaus (Eds.), *Lexical ambiguity resolution* (pp. 477–508). Los Altos, CA: Morgan Kaufmann.
- Burzio, L. (1986). *Italian syntax: A government-binding approach*. Dordrecht: Reidel.
- Carter, R.J. (1976). Some constraints on possible words. *Semantikos*, 1, 27–66.
- Carter, R.J. (1988). *On linking: Papers by Richard Carter* (Lexicon Project Working Papers 25), B. Levin & C. Tenny (Eds.). Cambridge, MA: Center for Cognitive Science, MIT.
- Chomsky, N.A. (1986). *Knowledge of language*. New York: Praeger.
- Clark, E.V., & Clark, H.H. (1979). When nouns surface as verbs. *Language*, 55, 767–811.
- Cruse, D. (1986). *Lexical semantics*. Cambridge, UK: Cambridge University Press.
- Dowty, D.R. (1979). *Word meaning and Montague grammar*. Dordrecht: Reidel.

- Fillmore, C.J. (1967). The grammar of *hitting* and *breaking*. In R. Jacobs & P. Rosenbaum (Eds.), *Readings in English transformational grammar* (pp. 120–133). Waltham, MA: Ginn.
- Fraser, B. (1971). A note on the *spray paint* cases. *Linguistic Inquiry*, 2, 603–607.
- Gentner, D. (1978). On relational meaning: The acquisition of verb meaning. *Child Development*, 49, 988–998.
- Green, G. (1974). *Semantics and syntactic regularity*. Bloomington, IN: Indiana University Press.
- Gropen, J. (1989). *Learning locative verbs: How universal linking rules constrain productivity*. Unpublished doctoral dissertation, MIT, Cambridge, MA.
- Gropen, J., Pinker, S., Hollander, M., & Goldberg, R. (1991). Affectedness and direct objects: The role of lexical semantics in the acquisition of verb argument structure. *Cognition*, this volume.
- Guerssel, M., Hale, K., Laughren, M., Levin, B., & White Eagle, J. (1985). A cross-linguistic study of transitivity alternations. In W.H. Eilfort, P.D. Kroeber, & K.L. Peterson (Eds.), *Papers from the parasession on causatives and agentivity* (pp. 48–63). Chicago, IL: Chicago Linguistic Society.
- Hale, K.L., & Keyser, S.J. (1986). *Some transitivity alternations in English* (Lexicon Project Working Papers 7). Cambridge, MA: Center for Cognitive Science, MIT.
- Hale, K.L., & Keyser, S.J. (1987). *A view from the middle* (Lexicon Project Working Papers 10). Cambridge, MA: Center for Cognitive Science, MIT.
- Hook, P.E. (1983). The English abstrument and rocking case relations. *Papers from the Nineteenth Regional Meeting of the Chicago Linguistic Society*, 183–194.
- Jackendoff, R.S. (1990). *Semantic structures*. Cambridge, MA: MIT Press.
- Jeffries, L. & Willis, P. (1984). A return to the spray paint issue. *Journal of Pragmatics*, 8, 715–729.
- Keyser, S.J., & Roeper, T. (1984). On the middle and ergative constructions in English. *Linguistic Inquiry*, 15, 381–416.
- Laughren, M. (1988). Towards a lexical representation of Warlpiri verbs. In W. Wilkins (Ed.), *Thematic relations* (pp. 215–242). New York: Academic Press.
- Leech, J. (1981). *Semantics*. Cambridge, UK: Cambridge University Press.
- Levin, B. (1991). Building a lexicon: The Contribution of Linguistic Theory. *International Journal of Lexicography* 4:4. To be co-published in M. Bates & R. Weischedel (Eds.), *Challenges in natural language processing*. Cambridge, UK: Cambridge University Press.
- Levin, B., & Rappaport, M. (1989). Approaches to unaccusative mismatches. *Proceedings of the 19th Annual Meeting of the North-Eastern Linguistics Society*, 314–328.
- Levin, B., & Rappaport Hovav, M. (1991). The lexical semantics of verbs of motion: The perspective from unaccusativity. In I. Roca (Ed.), *Thematic structure: Its role in grammar*. Berlin: Walter de Gruyter.
- Levin, B., & Rapoport, T.R. (1988). Lexical subordination. *Papers from the 24th Regional Meeting of the Chicago Linguistic Society*, 275–289.
- McClure, W. (1990). A lexical semantic explanation for unaccusative mismatches. In K. Dziwirik, P. Farrell, & E. Mejias-Bikandi (Eds.), *Grammatical relations: A cross-theoretical perspective* (pp. 305–318). Stanford, CA: CSLI.
- Norvig, P. (1989). Building a large lexicon with lexical network theory. In U. Zernik (Ed.), *Proceedings of the First International Lexical Acquisition Workshop*.
- Oehrle, R.T. (1976). *The grammatical status of the English dative alternation*. Unpublished doctoral dissertation, MIT, Cambridge, MA.
- Ostler, N.D.M. (1979). *Case-linking: A theory of case and verb diathesis applied to classical Sanskrit*. Unpublished doctoral dissertation, MIT, Cambridge, MA. Revised as N.D.M. Ostler (1980). *A theory of case linking and agreement*. Bloomington, IN: Indiana University Linguistics Club.
- Ostler, N.D.M. (1980). Origins, orientations and endpoints: Evidence for a finer analysis of thematic relations. *Studies in English Linguistics*, 8, 10–23.
- Perlmutter, D.M. (1978). Impersonal passives and the unaccusative hypothesis. *Proceedings of the Fourth Annual Meeting of the Berkeley Linguistics Society*, 157–189.
- Pinker, S. (1989). *Learnability and cognition: The acquisition of argument structure*. Cambridge, MA: MIT Press.
- Pustejovsky, J. (1989). *The generative lexicon*. Unpublished manuscript, Brandeis University, Waltham, MA.

- Rappaport, M., & Levin, B. (1988). What to do with theta-roles. In W. Wilkins (Ed.), *Thematic relations* (pp. 7–36). New York: Academic Press.
- Rosen, C. (1984). The interface between semantic roles and initial grammatical relations. In D.M. Perlmutter & C. Rosen (Eds.), *Studies in relational grammar 2* (pp. 38–77). Chicago, IL: University of Chicago Press.
- Schwartz-Norman, L. (1976). The grammar of “content” and “container”. *Journal of Linguistics*, 12, 279–287.
- Smith, C.S. (1970). Jespersen’s “move and change” class and causative verbs in English. In M.A. Jazayery, E.C. Palome, & W. Winter (Eds.), *Linguistic and literary studies in honor of Archibald A. Hill: Vol 2. Descriptive linguistics* (pp. 101–109). The Hague: Mouton.
- Talmy, L. (1975). Semantics and syntax of motion. In J.P. Kimball (Ed.), *Syntax and semantics 4* (pp. 181–238). New York: Academic Press.
- Talmy, L. (1985). Lexicalization patterns: Semantic structure in lexical forms. In T. Shopen (Ed.), *Language typology and syntactic description 3. Grammatical categories and the lexicon* (pp. 57–149). Cambridge, UK: Cambridge University Press.
- Tenny, C. (1987). *Grammaticalizing aspect and affectedness*. Unpublished doctoral dissertation, MIT, Cambridge, MA.
- Van Valin, R.D., Jr. (1990). Semantic parameters of split intransitivity. *Language*, 66, 221–260.
- Vendler, Z. (1957). Verbs and times. *Philosophical Review*, 56, 143–160. Reprinted in Z. Vendler (1967). *Linguistics in philosophy*. Ithaca, NY: Cornell University Press.
- Zaenen, A. (in preparation). Unaccusativity in Dutch: An integrated approach. In J. Pustejovsky (Ed.), *Semantics and the lexicon*. Dordrecht: Kluwer.