

12 Morphology and Lexical Semantics

BETH LEVIN AND
MALKA RAPPAPORT HOVAV

The relation between lexical semantics and morphology has not been the subject of much study. This may seem surprising, since a morpheme is often viewed as a minimal Saussurean sign relating form and meaning: it is a concept with a phonologically composed name. On this view, morphology has both a semantic side and a structural side, the latter sometimes called “morphological realization” (Aronoff 1994, Zwicky 1986b). Since morphology is the study of the structure and derivation of complex signs, attention could be focused on the semantic side (the composition of complex concepts) and the structural side (the composition of the complex names for the concepts) and the relation between them.

In fact, recent work in morphology has been concerned almost exclusively with the composition of complex names for concepts – that is, with the structural side of morphology. This dissociation of “form” from “meaning” was foreshadowed by Aronoff’s (1976) demonstration that morphemes are not necessarily associated with a constant meaning – or any meaning at all – and that their nature is basically structural. Although in early generative treatments of word formation, semantic operations accompanied formal morphological operations (as in Aronoff’s *Word Formation Rules*), many subsequent generative theories of morphology, following Lieber (1980), explicitly dissociate the lexical semantic operations of composition from the formal structural operations of composition, focusing entirely on the latter. Carstairs-McCarthy (1992), following Corbin (1987), calls such theories “dissociative” theories of morphology, while Beard (1990) calls them “separationist.” Although attention is often paid to “theta-role” operations, such as the addition, suppression, binding, or merger of “theta-roles,” which accompany morphological operations (Baker 1985, 1988a; Bresnan 1982c; Bresnan and Kanerva 1989; Bresnan and Moshi 1990; Grimshaw and Mester 1988; Lieber 1983; Marantz 1984a; S. T. Rosen 1989; E. Williams 1981a; among others), many of these operations are syntactic, rather than semantic, in nature, as we argue in section 3.2.

The lack of attention paid to the relation between lexical semantics and morphology stems in part from the absence of a comprehensive theory of lexical semantic representation that can provide a context in which to study such a relation. Yet, such a study could shed light on lexical semantics as well as morphology (Carstairs-McCarthy 1992). In fact, there have recently been advances in the area of lexical semantics that make it possible to pose initial questions concerning the relation between it and morphology, and to venture initial answers to some.¹

In section 1, we outline the basic elements of the lexical representation of verbs. We distinguish between the lexical syntactic representation, often called "argument structure," and the lexical semantic representation which, following Hale and Keyser (1986, 1987), has come to be known as the "lexical conceptual structure" (LCS); we then focus on the latter. (See Sadler and Spencer, *MORPHOLOGY AND ARGUMENT STRUCTURE*, for an overview of the former.) We concentrate solely on the lexical semantic representation of verbs, since verbs have been the focus of most of the lexical semantic research in the generative tradition. (See Pustejovsky 1991a for discussion of the lexical semantic representation of nouns.) In this overview, we stress those aspects of verb meaning that are most likely to be relevant to morphology.

In section 2, we suggest that the relation between lexical semantics and morphology can best be investigated by asking how names are attached to the lexical semantic representations that are made available by a theory of lexical semantics. We show that languages differ systematically in terms of which representations can be associated with names, and also in the morphological composition of such names.

In section 3, we pose some questions that arise in the context of the discussion in sections 1 and 2. Given the nature of the lexical representations described in section 1, it is possible to define different types of relations between the representations of pairs of verbs. We show that certain kinds of relations are systematically instantiated in language. We then ask whether verbs with related lexical representations have morphologically related names, and if so, whether there are any generalizations involved in the assignment of such names. We hypothesize that languages in general distinguish morphemes that signal the relation between verbs with the same LCS but different argument structures from those that signal the relation between distinct, though related, LCSS. We illustrate both types of morphological relations, although we concentrate on the second type, since operations on argument structure are the topic of another chapter (Sadler and Spencer, *MORPHOLOGY AND ARGUMENT STRUCTURE*). Finally, we speculate that certain types of systematically related meanings are never morphologically encoded.

1 The nature of the lexical semantic representation of verbs

In dealing with the lexical representation of verbs and other argument-taking lexical items, it is important to distinguish between the lexical semantic representation proper, often called a lexical conceptual structure (LCS), and another lexical representation, often called a predicate–argument structure (PAS), or simply an argument structure. There are different conceptions of argument structure, but most share the assumptions that argument structure is syntactic in nature and encodes the “adicity” or “valence” of a predicator – the number of arguments it requires – together with an indication of the hierarchical organization of these arguments. The example below, which is taken from Rappaport and Levin 1988: 15, illustrates one view of argument structure. This particular representation specifies that the verb *put* takes three arguments, and that one is an external argument, one is a direct internal argument, and one is an argument governed by a locative preposition.

(1) $x < \underline{y}, P_{loc} z >$

An argument structure does not contain any explicit lexical semantic information about the verb or its arguments (Grimshaw 1990, Rappaport and Levin 1988, Zubizarreta 1987), although it is projected via general principles from the LCS (Carrier and Randall 1992, Grimshaw 1990, Jackendoff 1990, Levin and Rappaport Hovav 1995).²

The distinction between LCS and argument structure is an important one, not recognized in all theories of lexical representation. We argue that this distinction finds empirical support in the morphologies of the languages of the world, which in general distinguish between morphemes that signal the relation between words with distinct but related LCSS and morphemes that signal the relation between words with common LCSS but distinct argument structures. This morphological division of labor is all the more striking since, as is well known, affixes tend to be associated with more than one function. Therefore, if the multiple functions associated with a given affix are consistently either of the type that derive new LCSS or of the type that derive new argument structures, this dissociation strongly supports the positing of these two distinct lexical representations. In this section we sketch the elements of LCS in order to explore these issues further.

Much research in lexical semantics has been aimed at elucidating the lexical semantics–syntax interface, and advances in this area have been made possible by exploiting the realization that some aspects of meaning are relevant to the grammar and others are not (Grimshaw 1993; Jackendoff 1990; Levin and Rappaport Hovav 1992, 1995; Pesetsky 1995; Pinker 1989). Research aimed at isolating the grammatically relevant meaning components has focused on

those aspects of the syntactic behavior of verbs that seem to be determined by their semantic properties, most prominently, the possible syntactic expressions of arguments.

Many lexical semantic studies have illustrated how the syntactic expression of the arguments of a verb is to a large degree determined by its membership in semantically coherent verb classes (Fillmore 1970, Guerssel et al. 1985, B. Levin 1993, Pinker 1989, among others). However, the verb classes cross-classify in intricate ways with respect to the syntactic behavior of their members. This extensive cross-classification suggests that the verb classes themselves are not primitive; rather, they arise because their members share certain basic components of meaning. Thus, generalizations that involve semantically coherent classes of verbs are probably best formulated in terms of these meaning components, just as phonological rules are stated in terms of the basic building blocks of distinctive features.

Explicit representations of verb meaning have generally been of two types: semantic role lists and predicate decompositions (B. Levin 1994). In a semantic role list approach, the meaning of a verb is reduced to a list of the semantic roles that its arguments bear. For example, the causative change-of-state verb *dry* of *Kim dried the clothes* might receive the representation in (2).

(2) *dry*: <Agent, Patient>

In a predicate decomposition approach, a verb's meaning is represented using members of a fixed set of primitive predicates together with constants – typically chosen from a limited set of semantic types. The constants either fill argument positions associated with these predicates or act as modifiers to the predicates. A verb's arguments are represented by the open argument positions associated with these predicates. Thus, the causative change-of-state verb *dry* might be given the predicate decomposition in (3); in this decomposition *DRY* is a constant representing the state associated with the verb *dry*, and *x* and *y* represent the verb's arguments.³

(3) *dry*: [[*x* ACT] CAUSE [*y* BECOME *DRY*]]

The information contained in a semantic role list can be extracted from a predicate decomposition; the semantic roles of a verb's arguments can be identified with particular argument positions associated with the predicates in a decomposition (see Jackendoff 1972, 1987). For example, the Agent could be identified as the argument of *ACT* and the Patient as the first argument of *BECOME* (see (3)). It appears, however, that the grammatically relevant components of meaning can be better represented using the predicate decomposition approach than the semantic role list approach; see Gropen et al. 1991, Jackendoff 1987, Pinker 1989, Rappaport and Levin 1988, among others, for discussion.

Typically, predicate decompositions are selected so that verbs belonging to the same semantic class have decompositions with common substructures,

including common constant positions filled by constants of a particular semantic type. Such recurring substructures are what Pinker (1989) calls “thematic cores”; we refer to them as “lexical semantic templates.” Pinker identifies about a dozen of these templates; they include analogues of certain repeatedly cited combinations of predicates. As an example, causative change-of-state verbs would have the lexical semantic template in (4), where “[]_{STATE}” represents the constant that will distinguish one change-of-state verb from another (cf. (3)).

- (4) [[X ACT] CAUSE [y BECOME []_{STATE}]]

Most theories of the lexical semantics–syntax interface include a set of rules that effect the mapping from the LCS to argument structure; following Carter (1976, 1988b), these rules are often called “Linking Rules.” The LCSs of verbs are chosen to facilitate the perspicuous formulation of the Linking Rules. Therefore, it is appropriate to describe the lexical semantic templates as determining the syntactic properties of the members of the verb classes. The templates that are most widely cited as defining grammatically relevant semantic classes bear a striking resemblance to the predicate decompositions suggested by Dowty (1979) for representing the lexical aspectual classes of verbs. In fact, Foley and Van Valin (1984), in adopting aspectually motivated decompositions, implicitly claim that these are the grammatically relevant lexical semantic representations of verbs. Tenny (1987, 1992, 1994) goes further, proposing the Aspectual Interface Hypothesis: only aspectual information is relevant to the mapping between lexical semantics and syntax.⁴

Following Vendler (1957), four major lexical aspectual classes of verbs are identified: activities, accomplishments, achievements, and states. Various decompositional representations have been suggested for these four classes (Dowty 1979; Foley and Van Valin 1984; Pustejovsky 1991b, 1995; among others). All take as their starting point Kenny’s (1963) insight that achievements embed a state, and that accomplishments are complex events including an activity and an achievement. The representations used by Foley and Van Valin (1984) and more recently by Van Valin (1990, 1993), which are adopted with slight modifications from Dowty (1979), are presented in (5). In these representations **predicate’** represents a state, except in (5c), where it represents an atomic activity (Van Valin 1990: 224; 1993: 35–6).⁵

- (5) (a) STATE: **predicate’** (x) or (x, y)
 (b) ACHIEVEMENT: BECOME **predicate’** (x) or (x, y)
 (c) ACTIVITY (+/–Agentive): (DO (x)) [**predicate’** (x) or (x, y)]
 (d) ACCOMPLISHMENT: ϕ CAUSE ψ , where ϕ is normally an activity predicate and ψ an achievement predicate

(Van Valin 1990: 224, table 2)

Each of these decompositions specifies the lexical semantic template associated with the members of a particular lexical aspectual class.

Of course, there are more than four grammatically relevant semantic classes of verbs, as a cursory glance at the classes of verbs listed in B. Levin 1993 reveals. It is likely that primitive predicates other than those employed in (5) will have to be introduced, and indeed Jackendoff (1990), in what is perhaps the most fully articulated system of lexical semantic representation today, includes additional predicates. But it is primarily through the use of constants that lexical semantic templates such as those in (5) are further differentiated, and the various grammatically relevant verb classes are defined by constraints on the type of constant that can fill particular argument positions in the decompositions. A few examples will illustrate this point.

Although all accomplishments have the decomposition in (5d), particular subtypes can be derived by choosing constants to fill particular argument positions. For example, denominal verbs such as *pocket* and *butter* have the basic decompositional structure of accomplishment verbs, but differ both in the type of constant and in the positions of the constant within the decomposition, as shown in (6) (Carter 1976; Jackendoff 1983, 1990).⁶

- (6) (a) *butter*: [[x ACT] CAUSE [[BUTTER]_{THING} BECOME P_{loc} z]]
 (b) *pocket*: [[x ACT] CAUSE [y BECOME P_{loc} [POCKET]_{PLACE}]]

As the examples in (6) show, the placement of a constant in a particular position derives individual verbs.⁷ Classes of such verbs can be defined by more general restrictions on the ontological type of what can fill that position. Thus, the lexical semantic template in (7a) is associated with the class of verbs which includes *butter*, and the one in (7b) with verbs like *pocket*. In these decompositions “[I_{THING} ” and “[I_{PLACE} ” indicate the position that is filled by a constant, and specify the ontological type of that constant.

- (7) (a) [[x ACT] CAUSE [[I_{THING} BECOME P_{loc} z]]
 (b) [[x ACT] CAUSE [y BECOME P_{loc} [I_{PLACE}]]

The *butter* and *pocket* verb classes both belong to the more general class called “verbs of putting” by Carter (1976), whose members share the representation in (8):

- (8) [[x ACT] CAUSE [y BECOME P_{loc} z]]

In addition to filling argument positions in LCSS, as in the examples so far, constants may modify predicates, as in the LCS for the verb *walk* in (9):

- (9) *walk*:
 ACT(x)
 |
 [WALK]_{MANNER}

In this LCS, the constant *WALK* represents the essence of walking; the vertical line connecting this constant to a predicate indicates that the constant modifies the predicate, and the subscript on the square brackets around the constant specifies the constant's ontological type: it is a manner constant. There is a large class of manner constants that serve to modify an activity predicate in a LCS. The LCSS of *walk* and other verbs of manner of motion such as *jog*, *run*, and *trot* contain such a constant. They all share the same lexical semantic template, which includes a manner constant; but the particular constant differs for each, since it represents what is distinct about each form of motion. Thus, classes of verbs can be defined according to whether or not particular predicates in their LCSS are modified by constants, just as such classes can be defined according to whether or not particular argument positions in their LCSS are filled by constants. Furthermore, constants of the second type are most likely to be elements representing entities in the world, as in (6); constants of the first type might be what Jackendoff (1990) refers to as "action patterns." See Pinker 1989 and Jackendoff 1983, 1990, 1996, for further discussion of the types of constants found in LCSS.

As pointed out by Carter (1976), the use of constants provides the decompositional approach to lexical semantic representations with much of its power.⁸ By allowing constants to fill selected positions in a LCS, it is possible to give a finite characterization of the possible verb meanings in a language, while allowing for the coining of new verbs. A language will have a fixed set of lexical semantic templates, but new verbs can be created through the use of new constants in these templates.

As already mentioned, the hypothesis implicit in work on lexical semantic representation is that the predicates used in decompositions represent the principal grammatically relevant aspects of meaning. What is less often appreciated is that the presence or absence of a certain kind of constant in a decomposition may be relevant to a verb's classification, although the content of the constant itself is not. The content of the constant is, by hypothesis, opaque to the grammar (Grimshaw 1990, Jackendoff 1990, Pinker 1989). For example, the existence of a manner modifier – one type of constant discussed here – in a verb's LCS may affect its syntactic behavior, but its syntactic behavior will not be sensitive to the particular instantiation of the modifier. Thus, there are rules which distinguish verbs of manner of motion from verbs of motion whose meaning does not include a manner specification, such as *arrive*, *come*, and *go*. For example, only verbs of manner of motion can undergo causativization in English (Levin and Rappaport Hovav 1995); compare *The general marched the soldiers across the field* to **The driver arrived the car in front of the house*. By contrast, we know of no rule that is, say, like the English passive rule, but that applies only to verbs of fast motion. Similar observations about the grammatical "inertness" of the components of verb meaning associated with constants are made by Grimshaw (1993), Jackendoff (1990), and Pesetsky (1995).

With this background, we now turn to the central focus of this chapter: the relationship between lexical semantics and morphology.

2 The pairing of names with meanings

A fully articulated theory of lexical semantic representation should be a generative theory that allows for the characterization of all possible word meanings in a language (Carter 1976; Pustejovsky, 1991a, 1995). Many of the possible meanings are meanings of actual words. Those meanings that are realized need to be associated with a name. In order to study the relation between lexical semantics and morphology, we can ask how names are associated with the available meanings. We continue to restrict our attention to verbs, though comparable questions about possible meanings have been asked and answered with respect to the noun lexicon, and to a lesser extent the adjective lexicon, primarily by psychologists interested in concept formation and word learning (Carey 1994; Landau 1994; Markman 1989, 1994; Waxman 1994; and references cited therein).

Setting sound symbolism aside, the pairing of a morphologically simple phonological form with a particular verb meaning is arbitrary (Saussure 1959); for example, there seems to be no reason why the phonological form of the verb *lend* could not have been paired with the meaning associated with the verb *borrow*, and vice versa. However, one aspect of this pairing does not seem arbitrary: the fact that certain LCSS can be associated with monomorphemic names, while others cannot. There appear to be some absolute constraints on the complexity of the LCSS that can be associated with such names (Carter 1976). For instance, Carter points out that there are no verbs meaning “change from *STATE1* to *STATE2*,” unless *STATE1* can be characterized as “not *STATE2*.” That is, there is no English verb meaning “change from pink to white,” although there is a verb *whiten*, meaning “change from not white to white.” Furthermore, as we illustrate below, not all languages allow monomorphemic names to be associated with the same LCSS. The question of which LCSS can receive monomorphemic names may be considered by some not to fall under the purview of morphology, but rather to be part of the study of the lexicon. (See Aronoff 1994 and Carstairs-McCarthy 1992 for an articulation of such a view.) Nevertheless, in order to understand the relationship between lexical semantics and morphology, we need to consider this question.

Let us clarify this question with an example. It has often been noted in the literature on lexical aspect (e.g. Declerck 1979; Dowty 1979; Vendler 1957; Verkuyl 1972, 1993) and unaccusativity (e.g. Hoekstra 1984; Levin and Rappaport Hovav 1992, 1995; L. Levin 1986; Van Valin 1990; Zaenen 1993) that English verbs of manner of motion have a dual aspectual classification. For example, the verb *walk* can be used as an activity verb, as in *Sandy walked (for an hour)*; or, in the presence of a goal phrase, it can be used as an accomplishment verb, as in *Sandy walked to the store*. There is reason to assume that the meaning of the activity use is more basic than the meaning of the accomplishment use. We can, therefore, take *walk* to have a basic classification as an activity verb and a derived classification as an accomplishment verb in the

presence of a goal phrase. This dual aspectual classification is open to all English verbs of manner of motion; *amble, jog, limp, swim, and trudge* also have both classifications. Thus, there are two relevant facts about the English verb lexicon: (i) for a given manner of motion both activity and accomplishment meanings are available (the exact nature of the relation between these two meanings still needs to be established), and (ii) the same monomorphemic name can be associated with the LCSS associated with both meanings.

There are languages that differ from English in both these respects. As discussed by Carter (1988a), Levin and Rapoport (1988), Schlyter (1978, 1981), Talmy (1975, 1985), Wienold (1995), and others, French does not allow a manner of motion verb to appear with a goal phrase, and hence to receive an accomplishment interpretation. Although (10a) is ambiguous in English, allowing either an activity or an accomplishment interpretation, its French translation (10b) has only the activity interpretation.

- (10) (a) The mouse is running under the table.
(b) La souris court sous la table.

As (10b) shows, French does have verbs of manner of motion, but these only have a meaning comparable to the activity sense of English verbs of manner of motion. In French, the sense conveyed by the English accomplishment uses of verbs of manner of motion cannot be expressed by the addition of a goal phrase to a verb of manner of motion. Instead, such meanings must be expressed periphrastically: in (11) and (12) the English (a) sentence could receive the French translation in (b).

- (11) (a) Blériot flew across the Channel.
(b) Blériot traversa la Manche en avion.
'Blériot crossed the Channel by plane.'
(Vinay and Darbelnet 1958: 105)

- (12) (a) An old woman hobbled in from the back.
(b) Une vieille femme arriva en boitant de l'arrière-boutique.
'An old woman arrived in limping from the back-store.'
(ibid.)

As these examples illustrate, in French the manner of motion is typically expressed in a subordinate clause or adverbial phrase, and the goal of motion is expressed through the use of the appropriate verb of directed motion as the main verb (Vinay and Darbelnet 1958). The generalization that emerges is that English manner of motion constants can be associated with both activity and accomplishment lexical semantic templates, while French allows such constants to be associated only with activity lexical semantic templates.

Russian differs from both French and English. Although Russian makes both activity and accomplishment meanings available to verbs of manner of

motion, the two meanings are not always associated with the same name, although the names are always morphologically related. In Russian, as in French and English, morphologically simple verbs of manner of motion have the activity sense, as in (13).

- (13) (a) On begal po komnate.
he (NOM) ran over room-DAT
 'He ran around the room.'
- (b) On plaval v ozere.
he (NOM) swam in lake-PREP
 'He swam in the lake.'

Unlike French, Russian also allows an accomplishment sense for verbs of manner of motion; however, unlike English, it uses the morphologically simple verb name only for the activity sense. In the accomplishment sense, the verb's name is morphologically complex, including one of a range of directional prefixes indicating the goal of motion, as in (14) (Talmy 1975, 1985). Many of the prefixes are homophonous with prepositions. For example, in (14a) the prefix *v-* is homophonous with the preposition *v* 'in'; in this example, the goal is further specified in the prepositional phrase.

- (14) (a) On v-bežal v komnatu.
he (NOM) in-ran in room-ACC
 'He ran into the room.'
- (b) On pere-plyl čerez reku.
he (NOM) across-swam across river-ACC
 'He swam across the river.'

It appears, then, that in Russian, lexical semantic templates of a certain complexity cannot be associated with a monomorphemic name. The complexity of the template is reflected in the morphological makeup of the name.

Having set the context by introducing our conception of LCSS and having briefly explored the attachment of names to meanings, we return now to the relationship between lexical semantics and morphology.

3 The morphological expression of lexical relatedness

Several types of relations can be defined over the elements of the lexical representations introduced in section 1. In this section we identify these relations and ask whether they are morphologically signaled, and if so, how. First, we examine the morphological relation between verbs with distinct but related

LCSS; then we consider the morphological relation between verbs with a single LCS but distinct argument structures.⁹

3.1 *Verbs with distinct but related LCSS*

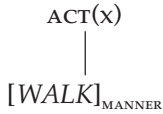
In section 2 we identified two major components of LCSS: the predicates and the constants. Given these elements, there are several possible relations between LCSS. LCSS can be related by virtue of containing a shared constant, though the constant itself is found in different lexical semantic templates. Alternatively, LCSS can be related by a shared lexical semantic template, while differing in the identity of the constant filling a particular position in this template.¹⁰ We consider each possibility in turn, examining whether these relations are reflected in the names associated with the LCSS.

3.1.1 *Verbs with a shared constant* We begin with LCSS that involve different lexical semantic templates with a shared constant. A survey of such pairs in languages of the world reveals that there are two dominant patterns concerning the morphological relation between the members of such pairs. Either the two members bear the identical name with no morphological derivational relation between them, or the members have different names which share a common base, where the affixes used to signal the morphological relation between the members are drawn from the class of affixes employed for signaling lexical aspect. We begin with a discussion of the first pattern using English for illustration.

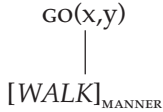
In English the name of a verb often derives from the name associated with the constant in its LCS, as can be seen from the *pocket* and *butter* examples in (6). Given this, when two English verbs have LCSS related by a shared constant, it is most natural for them to share the same name – a name that simply reflects the identity of the constant. In fact, many English verbs follow this pattern. The verb *shovel*, for example, though basically an activity verb (*She shoveled all afternoon*), can be used as a verb of either putting (*shovel the gravel onto the road*) or removing (*shovel the snow off the walk*), showing the properties of an accomplishment in both cases. The names associated with the activity, putting, and removing meanings (or LCSS) are identical, and there is no overt derivational morphological relation between them.

English is notoriously poor in morphology, and the absence of an overt derivational morphological relation between the various senses of *shovel* may reflect nothing more than this property. However, there are other languages with richer systems of verbal derivational morphology than English, where the relations between verbs with different lexical semantic templates and shared constants are not necessarily signaled morphologically. We exemplify this with verbs of manner of motion. As the discussion in section 2 implies, the LCSS for the activity and accomplishment uses of a verb of manner of motion such as *walk* involve different lexical semantic templates with a shared constant. Possible LCSS are presented below.¹¹

- (15) Activity
- walk*
- :



- (16) Accomplishment
- walk*
- :



The constant *WALK*, then, can be associated with more than one lexical semantic template in English. This multiple association is not a property of the verb *walk*; rather, it is a property of the English lexicon that all verbs of manner of motion permit activity and accomplishment uses.¹²

Hebrew, which has a richer system of verbal derivational morphology than English, has the same two meanings available to verbs of manner of motion, and allows the association of a single name with both. That is, in Hebrew, as in English, the relationship between these two meanings is not signaled morphologically, as shown by the examples in (17) and (18).

- (17) (a) Hu rakad ba-xeder.
he danced in.the-room
 'He danced in the room.'
- (b) Ha-saxyan saxa ba-nahar.
the-swimmer swam in.the-river
 'The swimmer swam in the river.'
- (18) (a) Hu rakad el mixuts la-xeder.
he danced to outside to.the-room
 'He danced out of the room.'
- (b) Ha-saxyan saxa la-gada ha-šniya šel ha-nahar.
the-swimmer swam to.the-side the-second of the-river
 'The swimmer swam to the other side of the river.'

In the languages in which the relation between the names associated with such pairs of LCSS is morphologically encoded, there seems to be a generalization concerning the morphological device used to signal the relationship. As mentioned in section 1, certain combinations of predicates and constants found in LCSS define lexical aspectual classes of verbs, and most languages have pairs of verbs with different lexical semantic templates but shared constants that belong to distinct aspectual classes, as in the verb of manner of motion examples discussed here. This aspectual relation is reflected in the names associated with the members of these pairs: the members tend to have names

with a common base, and one, if not both, members of such pairs have morphologically complex names that involve the morphological devices employed to signal classification with respect to lexical aspect. In fact, the existence of morphemes in some languages that indicate the lexical aspectual classification of verbs can be taken as support for lexical semantic representations such as those in (5). For example, in Russian, an atelic verb is typically morphologically simple, while a telic verb is morphologically complex, consisting of a base (which is often a morphologically simple activity verb with a related meaning) and one of a set of prefixes (Brecht 1985).¹³ Thus, compare Russian *pit'* 'drink' with *vypit'* 'drink up'. This suggests that, as a general pattern in Russian, morphological complexity is a reflection of template complexity.

The naming of manner of motion events in Russian also illustrates this point. Manner of motion events that qualify as activities are named by morphologically simple verbs (see (13)), while manner of motion events that qualify as accomplishments have morphologically complex names consisting of the same morphologically simple base as the related activity verb together with a directional prefix, chosen from a set of prefixes which are also used to signal aspectual classification (see (14)). Russian is not the only language to show this pattern; as reported by Harrison (1976) (see also Chung and Timberlake 1985), the Micronesian language Mokilese also distinguishes the accomplishment sense of verbs of manner of motion from the activity sense through the use of a set of suffixes that also serve as aspectual markers. For manner of motion verbs, the generalization seems to be that some languages do not allow a single verb name to be associated with lexical semantic templates differing in lexical aspectual classification. The names of such templates are distinguished morphologically in Russian and Mokilese, while one of the templates simply seems to be lacking in French. It is a matter for further research to see whether this generalization may hold more generally in these and other languages.¹⁴

Another phenomenon that can be characterized as involving different lexical semantic templates with a shared constant is the locative alternation. This term refers to the two expressions of arguments characteristic of verbs such as *spray*, *load*, *cram*, and *spread*.¹⁵

- (19) (a) The farmer loaded hay on the truck. (locative variant)
 (b) The farmer loaded the truck with hay. (*with* variant)
- (20) (a) I spread butter on my toast.
 (b) I spread my toast with butter.

The pairs of sentences that typify the locative alternation were originally thought to be derived by syntactic transformations from a common deep structure (Hall 1965). This analysis was abandoned because the alternation does not bear what Wasow (1977) identifies as the hallmarks of syntactic operations (see e.g. Baker, in press). Subsequent accounts took as their starting point the subtle differences in meaning between the variants, as we refer to the alternate expressions of

arguments associated with locative alternation verbs. For example, (19b), the *with* variant, implies that the truck is full, while (19a), the locative variant, need not. (See Anderson 1977a, Jeffries and Willis 1984, Schwartz-Norman 1976, among others, for a discussion of this effect.) Pinker (1989) and Rappaport and Levin (1988) note that the verbs in the two variants can be assigned to two independently established semantic classes. Once the two variants are given the appropriate LCSS, the expression of arguments characteristic of each follows from general principles governing argument expression. Possible representations for the two variants of the verb *load* are given in (21):¹⁶

- (21) (a) [[X ACT] CAUSE [y BECOME P_{loc} z] [LOAD]_{MANNER}]
 (b) [[X ACT] CAUSE [z BECOME []_{STATE} WITH-RESPECT-TO y]
 [LOAD]_{MANNER}]

On this approach, the locative alternation involves two distinct LCSS related by a shared constant. As in the *walk* example, these LCSS are associated with the same name in English; and again, English is not unique in having the locative alternation or in associating the same name with the verb in both variants, as the following examples show:

(22) French:

- (a) On a chargé beaucoup de colis sur le cargo.
 'One loaded many packages on the cargo ship.'
 (b) On a chargé le cargo avec des colis.
 'One loaded the cargo ship with packages.'
 (Postal 1982: 381, ex. 74a–b)

(23) Japanese:

- (a) kabe ni penki o nuru
wall on paint ACC smear
 'smear paint on the wall'
 (b) kabe o penki de nuru
wall ACC paint with smear
 'smear the wall with paint'
 (Fukui et al. 1985: 7, ex. 7a–b)

(24) Kannada:

- (a) ra:ju ʃrakkanu pustakagaḷinda tumbisida.
Raju (NOM) truck-ACC books-INST filled
 'Raju filled the truck with books.'
 (b) ra:ju pustakagaḷannu ʃrakkinalli tumbisida.
Raju (NOM) books-ACC truck-LOC filled
 'Raju filled the books in the truck.'
 (Bhat 1977: 368, ex. 5a–b)

(25) Hebrew:

- (a) Hu he'emis xatzir al ha-agala.
he loaded hay on the-wagon
'He loaded hay on the wagon.'
- (b) Hu he'emis et ha-agala be-xatzir.
he loaded ACC the-wagon with-hay
'He loaded the wagon with hay.'

These examples further support the proposal that the relation between LCSS with distinct lexical semantic templates but a shared constant is often not reflected in the morphological shape of the names associated with these LCSS.

It is perhaps less obvious that the two variants of the locative alternation, although both classified as accomplishments,¹⁷ can nevertheless be distinguished aspectually, as shown by Dowty (1991). The variants differ with respect to the argument said to be the "incremental theme," a term Dowty employs to refer to the argument of a telic verb which determines the aspectual properties of the sentence that verb is found in. Thus, as suggested above, each such verb is associated with two lexical semantic templates. It is not surprising, then, that in many languages, for a particular choice of constant the pair of lexical semantic representations associated with the locative alternation is associated not with the same name, but rather with morphologically related names, where the affixes used to establish this morphological relation are chosen from those signaling aspectual classification, as suggested above. In fact, there are languages in which the locative alternation involves morphologically related verbs, and in each of the languages illustrated, the morphemes involved have an aspectual function.

(26) German:

- (a) Adam schmierte Farbe an die Wand.
Adam (NOM) smeared paint-ACC at the wall-ACC
'Adam smeared paint on the wall.'
- (b) Adam be-schmierte die Wand mit Farbe.
Adam (NOM) be-smeared the wall-ACC with paint-DAT
'Adam smeared the wall with paint.'
(Pusch 1972: 130, ex. 27a, c)

(27) Russian:

- (a) Krest'jany na-gruzili seno na telegu.
peasants (NOM) na-loaded hay (ACC) on cart-ACC
'The peasants loaded hay on the cart.'
- (b) Krest'jany za-gruzili telegu senom.
peasants (NOM) za-loaded cart-ACC hay-INST
'The peasants loaded the cart with hay.'

(28) Hungarian:

- (a) János rá-mázolta a festéket a falra.
John onto-smearred.he.it the paint-ACC the wall-onto
 'John smeared paint on the wall.'
- (b) János be-mázolta a falat festékkal.
John in-smearred.he.it the wall-ACC paint-with
 'John smeared the wall with paint.'
 (Moravcsik 1978b: 257)

Let us consider the locative alternation in each of these languages in turn. The prefixes in the Russian examples are found on the perfective forms of the locative alternation verbs; the imperfective forms are typically unprefixated.¹⁸ More generally, the same prefixes are used to signal telicity elsewhere in Russian; they also overlap with the prefixes signaling the accomplishment sense of verbs of manner of motion. In German, *be-* is often used to signal the affectedness of the object of the verb to which it is attached (Pusch 1972); thus, as a prefix tied to the determination of telicity, it can be viewed as an aspectual morpheme. In fact, Becker (1971) presents other uses of this prefix that support this view. Furthermore, Dutch, like German, uses the prefix *be-* in the locative alternation, and Hoekstra and Mulder (1990) propose that the Dutch morpheme signals total affectedness. De Groot, in a discussion of the Hungarian locative alternation, points out that although the prefixes found in this alternation are sometimes used in Hungarian to contribute independent meaning in the way that the directional prefixes of Russian can, they also function "as indicators of perfectivity and termination of an action" (De Groot 1984: 138).

3.1.2 Verbs with shared lexical semantic templates Although LCSS that involve different lexical semantic templates but share the same constant can have the same name, we are not aware of any instances in which a single name is associated with multiple instantiations of a certain combination of predicates that differ simply in which constant fills a particular position.

Interestingly, it is verbs that share a lexical semantic template but differ in the associated constant that form classes whose members show the same expression of arguments. For example, all verbs of manner of motion in their activity sense share the same lexical semantic template and expression of arguments. Specifically, such verbs are unergative (Hoekstra 1984, Levin and Rappaport Hovav 1995, Zaenen 1993, L. Levin 1986, C. Rosen 1984). By contrast, when a single verb name is associated with several LCSS that are based on different combinations of predicates but share the same constant, each pairing of the name with a LCS is associated with a distinct argument expression. For instance, *walk* is unergative when it is an activity verb, but unaccusative when it is an accomplishment verb (Hoekstra 1984, Levin and Rappaport Hovav 1995, L. Levin 1986, Zaenen 1993, among others).

In this context it is appropriate to mention one additional relationship between verb meanings that, to our knowledge, is never morphologically

signaled. Morphology is not involved in the cross-field generalizations discussed by Jackendoff (1972, 1978, 1983), building on the work of Gruber (1965). Jackendoff points out that certain parallels are found across apparently unrelated semantic fields, such as the fields of location and possession. For instance, the verb *keep* can be used in a variety of semantic fields, as in (29).

- (29) (a) Tracy kept the bicycle in the shed.
(b) Tracy kept the bicycle.
(c) Tracy kept the dog quiet.

This verb is used to describe physical location in (a), possession in (b), and a state in (c), being used in what Jackendoff terms the positional, possessional, and identification fields, respectively. According to Jackendoff, these uses arise because motion and location organize a variety of semantic fields, as articulated in his Thematic Relations Hypothesis (1983: 188). Thus, possession can be conceived of as location or motion within an abstract possessional field, with possessors playing the role of locations in this field, and possessed objects playing the part of physical objects. Similarly, states can be conceived of as locations within an abstract identificational field. When a verb is used in more than one semantic field, Jackendoff associates the same LCS with that verb independent of the field. We know of no language in which the morphological shape of a verb reflects the semantic field it is being used in. More generally, we know of no morphological indication that verbs – or words from other lexical categories for that matter – are being used figuratively or metaphorically.

3.2 Verbs with a shared LCS but distinct argument structures

Having looked at the morphological expression of the relation between verbs with distinct but related LCSS, we turn to the morphological expression of the relation between verbs that have the same LCS but differ in their argument structures. Our contention is that the morphological devices which languages use to signal this kind of relationship are different from those mentioned in the previous section. First, across languages, relationships between argument structures are almost always given morphological expression (in this respect, English is rather unusual). Second, the morphemes used to signal these relationships are not the same as those that signal the relationship between words with distinct, but related, LCSS. We begin by sketching the relations we have in mind.

As mentioned in section 1, the LCS contains variables corresponding to the participants in the event described by the verb. The LCS is not projected directly onto the syntax, however; rather, this mapping is mediated by the argument structure. The argument structure is a lexical representation of

the syntactic expression of a verb's arguments. This representation, in effect, specifies which participants will be syntactically expressed and how. In the (morphologically) unmarked case, each variable in the LCS corresponds to a grammatically interpreted variable in argument structure. However, there are operations on argument structure that usually result in a change in the number of grammatically interpreted arguments or in the position of an argument in the hierarchical organization of argument structure.

Two examples of operations which result in a change – specifically, a decrease – in the number of arguments are reflexivization and middle formation, which may be called “valence-reducing operations.” Reflexivization essentially identifies two of the variables in a verb's argument structure, indicating that they have the same referent (Grimshaw 1982), thus reducing by one the number of syntactic arguments of a verb. We illustrate reflexivization using French. The (a) sentences in (30) and (31) show nonreflexive uses of the verbs *voir* ‘see’ and *parler* ‘speak’; the (b) sentences show reflexive uses, which are signaled by the reflexive clitic *se*.

- (30) (a) Jean voit l'homme.
Jean sees the man
 'John sees the man.'
- (b) Jean se voit.
Jean REFL sees
 'John sees himself.'
- (31) (a) Il parle à l'homme.
he talks to the man
 'He is talking to the man.'
- (b) Il se parle.
he REFL talks
 'He is talking to himself.'

Although in terms of meaning reflexive verbs take two arguments, from the perspective of the syntax they are monadic. The examples in (30) and (31) suggest that reflexivization is not sensitive to the semantic roles of a verb's arguments, since the verbs *voir* ‘see’ and *parler* ‘talk’ do not take arguments bearing the same semantic roles. This insensitivity would be expected of an operation on argument structure (Grimshaw 1990, Rappaport and Levin 1988, Zubizarreta 1987).

Middle formation also relates a transitive verb to an intransitive one, as illustrated once again using French data:

- (32) (a) Il a nettoyé ces lunettes.
he has cleaned those glasses
 'He cleaned those glasses.'

- (b) Ces lunettes se nettoient facilement.
those glasses REFL clean easily
'Those glasses clean easily.'
(Ruwet 1972: 95, ex. 35a)

The exact nature of this operation is a matter of debate (see Condoravdi 1989; Fagan 1988, 1992; Hoekstra and Roberts 1993; Keyser and Roeper 1984; among others), but it is clear that the external argument of the unmarked transitive verb cannot be expressed in the middle form, as discussed with respect to French by Ruwet (1972).

- (33) *Cela se dit par le peuple.
that REFL says by the people
(Ruwet 1972: 110, ex. 100)

Thus, middle formation is also valence-reducing. In fact, in French this process is accompanied by the same reflexive clitic that signals reflexivization.

Valence-reducing operations operate on argument structure.¹⁹ They do not create new LCSS, nor do they relate two different LCSS.²⁰ It is striking that languages which do not mark the locative alternation and, if they have them, manner of motion pairs morphologically may nevertheless mark operations on argument structure morphologically (e.g. Italian, French, Hebrew). Moreover, as far as we know, none of these languages uses aspectual morphology for this purpose. For example, Russian does not use aspectual prefixes to mark changes in valence. It is also striking that a number of languages use a single morpheme for many, if not all, of the valence-reducing operations (Comrie 1985, Langacker 1976, Langacker and Munro 1975, Marantz 1984a, Nedjalkov and Silnitsky 1973, Shibatani 1985, among others). Thus, as already mentioned, the same morpheme is associated with reflexivization and middle formation in French. Furthermore, the morpheme used in valence-reducing operations may be synchronically or diachronically related to a reflexive pronoun, as in the Romance and Slavic languages.

Additional support for the differentiation of argument-structure-related morphology from LCS-related morphology is provided by Haspelmath (1990), who investigates the multiple functions of the passive morpheme – another valence-reducing morpheme – cross-linguistically, and finds that there is a range of uses for this morpheme that are repeatedly attested across languages. Again, these uses resemble passivization in involving valence-reducing operations; they do not signal relations between LCSS.²¹ Moving beyond valence-reducing operations, which have been the focus of this section, there are other morphological operations that are good candidates for being considered operations on argument structure. These include the formation of light verb constructions (Grimshaw and Mester 1988) and causative constructions (Marantz 1984a, S. T. Rosen 1989a, among others).²²

4 Conclusion

Recent work in lexical semantics provides a framework for investigating the relationship between lexical semantics and morphology, which is clearly a rich, though underexplored, area of study. The morphology of languages provides further support for the existence of two levels of lexical representation, LCS and argument structure, as independently argued in studies of the lexicon. Specifically, the morphemes that signal the relation between verbs with related LCSS are different from those that signal the relation between verbs with common LCSS but distinct argument structures. This morphological division of labor is particularly noteworthy, since in the case-studies we have presented, it is maintained even by affixes with multiple functions. Thus, a particular affix consistently derives either new LCSS or new argument structures. Furthermore, when verbs with different LCSS but the same constant are morphologically related, the morphological devices used to signal such relations are associated with grammatically relevant components of meaning, such as aspectual classification. We hope that the ideas sketched here will serve as a starting point for continued exploration of the relationship between lexical semantics and morphology.

ACKNOWLEDGEMENTS

We thank Mark Baker, Jane Grimshaw, Ken Hale, Boris Katz, Mary Laughren, Mari Olsen, and Maria Polinsky for helpful discussion of issues raised here. Andrew Spencer provided invaluable comments on an earlier draft. We thank the members of the Department of Linguistics at Rutgers University for their hospitality during the writing. We are grateful to Olivia Chang for help with the preparation. The work was supported in part by NSF grant SBR-9221993 to Levin.

NOTES

1 One researcher who has paid attention to the relation between lexical semantics and morphology is Joan Bybee, who asks questions that are similar in spirit to those we address here. In her work, Bybee (1985) attempts to predict the kinds of meanings that are likely to find expression as inflectional

morphemes and the degree of fusion between two morphemes based on the meaning relation that obtains between them. A second researcher who has investigated the relation between lexical semantics and morphology is Robert Beard, whose recent book (1995) came to our attention after this was completed.

- 2 The idea that the argument structure is projected from the LCS reflects the assumption that the syntactic expression of arguments of verbs is predictable from their meaning. This idea is incorporated in varying ways in the work of Bresnan and Kanerva (1989), Dowty (1991), Foley and Van Valin (1984), Hale and Keyser (1993, 1997), among others.
- 3 The LCSS that we give throughout this paper are chosen to illustrate particular points, and are not intended to present a unified system of lexical semantic representation.
- 4 See Croft 1991 for an alternative approach to the mapping between lexical semantics and syntax that makes reference to the causal structure of events, as elaborated in the work of Talmy (1976, 1988).
- 5 In this respect, Foley and Van Valin (1984) and Van Valin (1990, 1993) depart from Dowty (1979), who builds the decompositions of all four lexical aspectual classes on state predicates. See also McClure (1994) for a further elaboration of Dowty's idea that all classes are derived from basic state predicates.
- 6 We use *ACT* as the predicate, indicating an unspecified activity; some other work uses the predicate *DO*. The predicate *ACT* (or *DO*) is often used as the activity predicate in the LCS of an accomplishment verb, since accomplishment verbs have a complex LCS that consists of an activity and an achievement (Dowty 1979, Grimshaw and Vikner 1993, Levin and Rappaport Hovav 1995; Pustejovsky 1991b, 1995; among others), but many accomplishments are vague as to the nature of the activity. Thus, the meaning of causative *dry* includes a specification of a particular result state, but is vague as to which of a number of activities brings this state about.
- 7 For a different lexical semantic analysis of verbs like *butter* that preserves the distinction between the primitive predicates and constants see Hale and Keyser (1993, 1997) and Kiparsky (1997).
- 8 A word of clarification is in order concerning the use of the term "constant" to refer to an element that fills a certain argument or modifier position in a verb's lexical semantic template and thus is lexically associated with that position. This term is chosen to contrast with the term "variable," used to refer to those argument positions that are not filled in the LCS, but whose interpretation is determined in the syntax via the association of these positions with overt XPs in the syntax. However, the use of the term "constant" may not be altogether felicitous: there is some variability in the meaning of certain verbs that might be said to involve the same constant within the same lexical semantic template. We suspect that this variability arises because the constant itself may actually be a prototype or a cluster concept. The precise representation of constants is an important question for further study. Jackendoff (1990: 33–4), e.g., proposes that all constants take the form of the "3-D model structures" of Marr and Vaina (1982); these structures provide an interface between visual and linguistic representations. Since this issue is outside the scope of this chapter, we simply adopt the convention of representing a constant by the name of the associated verb in capital italics.

- 9 We distinguish between the “name” of a verb, which is just a phonological stretch of sound, and two uses of the word *verb*. The first corresponds to Aronoff’s notion “lexeme”: i.e. all forms of a verb associated with a single LCS; thus, *walk, walks, walking, walked* are all instances of the lexeme *walk*. The second corresponds to what Aronoff (1994) calls the “grammatical word”: i.e. a verb with a particular set of morphosyntactic features (e.g. the third-person singular present *walks*). It should be clear in any given context which use of *verb* is intended.
- 10 There is one other possibility, which is not often observed and which is most easily introduced with an example. Consider the verb *string*. This verb can be used as in *to string beans* (to remove the strings from beans), where the constant is a thing, or as in *to string beads* (to put beads on a string), where the constant is a place. *STRING* is one of a handful of constants that qualify for membership in more than one ontological category, and hence can fill more than one constant position in a combination of predicates; see Kiparsky (1997) for additional examples.
- 11 The predicate *go* in (16) is not meant to be equivalent to the predicate *BECOME* found in the decomposition of achievements in (5b); specifically, unlike *BECOME*, it is not meant merely to indicate a transition from one state to another. We introduce this predicate to account for sentences such as *The ball rolled out of the room* and *The car rumbled into the driveway*. It seems inappropriate to use *BECOME* for these sentences, since there is then no appropriate predicate for the manner constant to modify.
- Current analyses give a causative representation to all accomplishments, and analyze sentences such as *Tracy walked out of the room* as having a representation along the lines of “Tracy did something that caused Tracy to become at a place out of the room.” Whether or not these examples should receive a causative analysis, it seems fairly clear that the just-cited *roll* and *rumble* examples should not. If there are noncausative accomplishments, then the accomplishment use of a verb like *walk* cannot simply be derived by adding a goal to the representation of the verb in its activity use, as is assumed for example in Pustejovsky (1991b). See Jackendoff 1990: 93–5 for a similar suggestion that a predicate like *go* is needed.
- 12 Due to the unavailability of the accomplishment sense of verbs of manner of motion in some languages and to the existence of morphologically complex names for this sense in others, we suggest that manner of motion constants are basically associated with the activity lexical semantic template. We take the association of the constant with the accomplishment lexical semantic template to be effected by rule. We do not formulate such a rule here, but see Levin and Rappaport Hovav 1995 for further discussion.
- 13 Due to space considerations we cannot provide a fuller discussion of the Russian aspectual system; for further discussion see Brecht 1985, Chung and Timberlake 1985; C. S. Smith 1991, as well as the papers in Flier and Timberlake (eds) 1985.
- 14 There is reason to believe that this generalization holds more generally in Russian (see e.g. Brecht 1985), but it remains to be seen to what

- extent it holds true of French. As we go on to discuss, French does allow the locative alternation, although the two variants differ aspectually, but it is perhaps significant that both variants still describe accomplishments. Further investigation is needed to determine whether other lexical aspectual shifts which are attested in English are attested in French as well, and if so, whether these shifts are accompanied by any changes in the form of the verb.
- 15 See Anderson 1971, Dowty 1991, Hoekstra and Mulder 1990, Jackendoff 1990, Pinker 1989, Rappaport and Levin 1988, among others, for discussions of the locative alternation, and B. Levin 1993 and Pinker 1989 for a list of English locative alternation verbs. The locative alternation should be distinguished from what might be called "locative advancement," a process by which a locative adjunct or oblique argument becomes a syntactic object of a verb. Such processes, which are found in some Bantu languages, typically involve a different type of morphology than the locative alternation. See also n. 22.
- 16 In these representations we have not associated the constant with a specific predicate, because it has proved difficult to determine the exact representation for locative alternation verbs. (See Pinker 1989 and Rappaport and Levin 1988 for two suggestions.) It is likely that what is special about these verbs is that the constant restricts facets of the causing activity, the result state, and the theme argument (i.e. *hay* in (19)).
- 17 We are simplifying somewhat here. As pointed out by Dowty (1991: 591), some of these verbs do permit an activity interpretation.
- 18 Due to the complexity of aspectual morphology, a full discussion of these examples cannot be offered here.
- 19 English does have apparent analogues to the two valence-reducing rules discussed in this section – reflexivization and middle formation – as illustrated by *I dressed quickly this morning* and *The can opened easily*; but again there is no morphology associated with such examples. What is interesting is that these processes are much more restricted in English than they are, say, in French. Reflexivization is found only with verbs of grooming and bodily care (see B. Levin 1993 for a list), while middle formation is subject to a much-discussed affectedness condition (Jaeggli 1986a, Roberts 1987, among others). We suspect that the lack of morphology is responsible for these semantic constraints, although we do not understand precisely why this should be.
- 20 A word of caution is needed here. A sentence with a middle verb does not report an event in the same way that the corresponding sentence with the nonmiddle form does. In this respect, the semantic representations of the two sentences differ significantly. The middle operator is most likely a sentential operator with modal force (Condoravdi 1989; Doron and Rappaport Hovav 1991), and thus embeds the LCS of the corresponding nonderived verb unchanged. However, see Ackema and Schoorlemmer 1994 for an account of middles that uses an operation on LCS and Sadler and Spencer, MORPHOLOGY AND

ARGUMENT STRUCTURE, for some discussion of the issue of whether middle formation involves an operation on argument structure or LCS.

- 21 The fact that the passive morpheme is homophonous with the perfect morpheme in some languages does not present a problem for our discussion, as the perfect morpheme is different from the perfective morpheme. It is the perfective morpheme which has the lexical aspectual function, and, as far as

we know, languages do not tend to use this morpheme to mark the passive.

- 22 Applied affixes may be additional candidates, though their status requires further investigation. We believe that they are likely to be associated with operations on argument structure, and that, unlike the Russian directional prefixes found with verbs of manner of motion, they are not indicators of an LCS that shares a constant with another LCS.