

On the Locative Alternation*

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0. Introduction

The lexical competence of a native speaker of a language clearly includes knowledge of syntactically relevant and semantically coherent verb classes. This is demonstrated by the existence of regularities in the syntactic behavior of lexical items belonging to semantically defined verb classes.

The locative alternation verbs (so named by Levin and Rappaport, 1988a) have been described as verbs that exhibit an alternation in the expression of their arguments because they occur in two syntactic frames illustrated in (1) and (2) below:

- (1) a. John sprayed paint on the wall.
- b. John sprayed the wall with paint.
- (2) a. Bill loaded hay onto the truck.
- b. Bill loaded the truck with hay.

This paper is concerned with the following questions: (1) what is the property that allows the locative alternation to take place and (2) how can this property best be represented? To answer these questions, we will follow Levin and Rappaport (1988a) in claiming that the alternation at issue is one case of the process of lexical extension. Unlike Levin and Rappaport, however, we will argue that the locative alternation verbs fall into three classes according to the mode of lexical extension they select.

In what follows, we will observe some fundamental facts concerning the locative alternation verbs in Section 1. Section 2 will be devoted to introducing a certain amount of descriptive apparatus to account for the observed facts, basically following Hale and Keyser (1986, 1987), Guerssel et al. (1985), Levin and Rappaport (1988a), and Laughren (1988), which are all undertaken in connection with the Lexicon Project at MIT. In Section 3 we will analyze the locative alternation verbs by

means of the apparatus and determine what the semantic information in the lexical entry can predict about the syntactic behavior of the word. Finally in Section 4 we will discuss the extension of the proposed analysis and the direction which this study could lead to in the future.

1. The Fundamental Observations and the Problems

In this section we will observe syntactic and semantic facts about the locative alternation verbs. First it will be observed that the number of arguments required for participating in the locative alternation is three, one is 'external' argument and the others are 'internal' arguments in the sense of Williams (1981). Second the locative alternation verbs fall into three classes with respect to deletability of 'indirect' internal arguments. (The distinction between 'direct' and 'indirect' internal arguments originates in Marantz, 1984.) Third we will observe the difference in meaning which accompanies the alternation and determine what property should be incorporated in the lexical representation.

1.1. One of the prototypical members of locative alternation verbs is *load*, which displays an alternation shown in (3).

- (3) a. Bill loaded cartons onto the truck. (locative variant)
 b. Bill loaded the truck with cartons. (*with* variant) '

The (a) and (b) sentences seem to describe the same event, as they each involve an entity or substance coming to be at a particular location through the action of *Bill*. Here we are apt to consider the event involving three participants, *Bill*, *cartons*, and *the truck*, but are these three participants all the arguments of the verb *load*? In other words, is the verb *load* a three-place predicate? To answer this question, let us compare it with the most typical three-place predicate *put* in (4).

- (4) John put the book *(on the table).

The phrase *on the table* cannot be elided in (4). This sharply contrasts with the case of *load* in which the prepositional phrases in both variants are optional elements, as illustrated below.

- (5) a. Bill loaded the cartons.
 b. Bill loaded the truck.

This fact tempts us to regard the phrases *onto the truck* in (3a) and *with cartons* in (3b) as optional adjuncts, not the arguments of *load*. However, we may interpret the sentences in (5) as elliptical. That is, if a required argument of the verb is not expressed, there is a clear intuition that something is missing, and it must be filled in by information from context. Therefore, (5a) invites the question, 'where did Bill load the cartons?' and (5b) invites the question, 'what did Bill use to load the truck?' or 'Bill loaded the truck with what?'. A similar observation can be made with the verb *pack*, which also participates in the alternation.

- (6) a. She packed shirts (into the suitcase).
 b. She packed the suitcase (with shirts).

Anyone who hears these sentences, when the bracketed phrases are omitted, will most likely wonder what she packed shirts into, in the case of (a), and what she packed the suitcase with, in (b). This is evidence that the verb *load* and *pack* have three arguments. ²

The claim that the locative alternation verbs are three-place predicates gets indirect support from the fact that the prepositional phrases in the alternation can be distinguished from true adjuncts syntactically in a number of ways. Let us consider the following examples.

- (7) a. Bill loaded cartons on the truck on a baseball ground.
 b. Bill loaded the truck with cartons with a crane.

In (7a), the phrase *on the truck* is the location argument of *load*, but

on a baseball ground is a locative adjunct, not the argument. * This is confirmed by the following examples.

- (8) a. *Bill loaded cartons on the truck and Don did so on the wagon.
 b. Bill loaded cartons on a baseball ground and Don did so on a football ground.

The sentences above show that the location argument behaves like a prepositional phrase inside a verb phrase, while an adjunct *on* phrase behaves like a sentential prepositional phrase.

In (7b), on the other hand, the phrase *with cartons* is the locatum argument of *load*, while the phrase *with a crane* is an instrumental adjunct. As observed in Levin and Rappaport (1988b), the locatum *with* phrase falls inside of *do-so*, whereas the instrumental *with* phrase falls outside of *do-so*.

- (9) a. *Bill loaded the truck with cartons and Don did so with trunks.
 b. Bill loaded the truck with a crane and Don did so with a forklift.

(Levin and Rappaport 1988b: 1073)

The further difference between the two *with* phrases is that locatums can never appear as subjects, unlike true instruments, which can, if they are of the appropriate type.

- (10) a. *Hay loaded the truck.
 b. The crane loaded the truck. (ibid: 1073)

Verbs such as *fill*, *stop*, and *block* might appear at first glance to be minimally different from the *spray/load* verbs. They appear to express their arguments in the same way as *spray/load* verbs do in the *with* variant (although they cannot express their arguments as in the locative variant).

- (11) a. Sue filled the pail with water.
 b. *Sue filled water into the pail.

Levin and Rappaport (1988b) point out that verbs like *fill* can also take true instrumentals, although sentences with both instrumental and locatum *with* phrases involving *fill* verbs seem to be more awkward than those involving *spray/load* verbs.

- (12) a. Sue filled the pail with a hose.
 b. ??Sue filled the pail with water with a hose.
 c. Sue filled the pail with water from a hose.
 (ibid: 1081)

They have also observed that the locatum *with* phrase found with *fill* verbs behaves more like an instrumental *with* phrase. The locatum *with* phrase shows the behavior of a sentential prepositional phrase:

- (13) Sue filled the pail with distilled water, and Sam did so with tap water.
 (ibid: 1073)

The verb *fill* permits the locatum to appear as the subject of the verb, a phenomenon that is reminiscent of instrumental subjects, although such sentences receive a slightly different interpretation from sentences with real instrumental subjects.

- (14) Water slowly filled the pail. (ibid: 1074)

These observations suggest that the locatum *with* phrases found with verbs like *fill* do not qualify as internal arguments, thus these verbs are in fact two-place predicates, unlike the *spray/load* verbs.

Levin and Rappaport (1988b) have put forward the claim that what they call non-event - *er* nominals do not refer to internal arguments. If their claim is correct, the following prediction holds: With the *spray/load* verbs, the non-event - *er* nominals derived from them should not refer to an entity denoted by the noun phrase characterized as a

location or locatum. On the other hand, with verbs like *fill*, nonevent - *er* nominals derived from them can refer to the entity that is expressed in the locatum *with* phrase, because it is not an internal argument. The following examples show that this prediction is borne out:

(15) loader, sprayer, spreader, sprinkler, squirter,...

(16) filler, beta-blocker, stopper, liner,...

(ibid: 1073-1074)

Sprayer can refer to a tool such as a spray gun but never to water or some other liquid, nor to some location; and *spreader* can refer to a tool such as a knife or a spatula but never to a substance such as butter or jam. On the other hand, the noun *filler* typically refers to a substance that can be used to fill something, for example, to the stuffing put into a pillow. Their observation of this minimal contrast, therefore, reinforces our present claim that the *spray/load* verbs have two internal arguments, but verbs like *fill* have only one internal argument.

Returning back to our main concern in this section, the fact that the *spray/load* verbs participate in the locative alternation while verbs like *fill* do not, clearly correlates with the above observation. One of the lexical properties which are relevant to the alternation in question is the number of arguments required by the verb. That is, only verbs which take three arguments, one external, and the other two internal, can qualify as those participating in the locative alternation.

However, this is not sufficient for distinguishing the *spray/load* verbs from other verbs that do not allow the alternation but nevertheless require three arguments such as *put*. We will return to this problem later.

1.2. The second observation concerns the deletability of internal indirect arguments expressed in prepositional phrases. With respect to this deletability, the *spray/load* verbs fall into three subclasses; those which allow the deletion both in the locative variant and in the

with variant, those which allow it only in the locative variant, and those which permit it only in the *with* variant. The first class includes verbs such as *load* and *pack*.

- (17) a. We loaded hay (onto the truck).
 b. We loaded the truck (with hay).
 (18) a. She packed shirts (into the suitcase).
 b. She packed the suitcase (with shirts).

Verbs like *pile*, *stack*, and *spread* belong to the second class.

- (19) a. I piled books (onto the shelf).
 b. I piled the shelf *(with books).
 (20) a. We stacked dishes (on the rack).
 b. We stacked the rack *(with dishes).

The third class includes verbs such as *stuff*, *cram*, and *wrap*.

- (21) a. We stuffed feathers *(into the pillow).
 b. We stuffed the pillow (with feathers).
 (22) a. We crammed food *(into the freezer).
 b. We crammed the freezer (with food).

According to Levin and Rappaport's (1986) observation, which in turn draws much from the work by Wasow (1977), the rule of Adjectival Passive Formation (APF) is sensitive to which argument can stand as sole NP complement: With verbs that allow either argument to be the sole NP complement, such as *load*, either argument may be external to the adjectival passive. ⁴ For verbs that allow only the locatum argument to be the sole NP complement, such as *pile*, only the locatum argument may be external to the adjectival passive. And for verbs that permit the location argument to be the sole complement, such as *stuff*, only the location argument may be external to the adjectival passive. This is exemplified by the following examples.

- (23) a. the recently loaded hay
 b. the recently loaded truck
- (24) a. carefully piled books
 b. *carefully piled shelf
- (25) a. *The feathers remained stuffed.
 b. The pillow remained stuffed.

(Levin and Rappaport 1986: 634)

Given the process sensitive to the optionality of indirect argument, such as APF, the lexical representation for the locative alternation verbs must include the information to account for the contrast above.

As has frequently been noted, verbs of 'removing', such as *clear*, *rid*, and *wipe*, which denote actions that are the reverse of those denoted by the *spray/load* verbs, also exhibit the locative alternation in realizing their arguments, as illustrated in (26)-(28):

- (26) a. clear dishes (from the table)
 b. clear the table (of dishes)
- (27) a. rid insects (from the room)
 b. rid the room *(of insects)
- (28) a. wipe crumbs *(from the counter)
 b. wipe the counter (of crumbs)

Note that verbs of removing, as well as the *spray/load* verbs, can be classified into three classes in regard to the optionality of indirect arguments, as indicated in the above examples. This parallelism clearly shows that there is a systematic correspondence between the lexical representations of the *spray/load* verbs and those of verbs of removing, both of which should incorporate the property triggering the locative alternation.

1.3. So far we have observed the syntactic properties of the locative alternation verbs. And now let us consider the differences in meaning which accompany the alternation.

Various researchers have made the claim that the pair of sentences

in (29) are only near-paraphrases, and cannot be regarded as fully synonymous:

- (29) a. John sprayed paint on the wall.
 b. John sprayed the wall with paint.

A change in interpretation accompanies the alternation in the expression of the arguments; when the location argument is realized as direct object, it is understood to be wholly affected by the action denoted by the verb, while a partially affected interpretation is also possible when the location argument is realized as the object of a preposition. In (29a) *the wall* may have a 'partitive' interpretation (i.e. only part of the wall is covered with paint), while in (29b) *the wall* will have only a 'holistic' interpretation (i.e. the whole wall is covered). This difference in meaning, it may be recalled, was the evidence in Anderson (1971) and Chomsky (1972) against using a syntactic movement strategy to account for the alternation.

One of the arguments put forward by Mellema (1974) in favor of the holistic interpretation of *the wall* in (29b), is that the following sentence is compatible with the situation described by (29a), but not with the one described by (29b):

- (30) Most of the wall didn't get any paint on it.
 (Mellema 1974: 50)

Another argument for the difference in interpretation between the two variants comes from the observation made in Jackendoff (1989) that the object of *with* displays the determiner constraint, as shown in (31b).

- (31) a. Felix loaded $\left\{ \begin{array}{l} \text{books} \\ \text{some books} \\ \text{the books} \end{array} \right\}$ onto the truck.
 b. Felix loaded the truck with $\left\{ \begin{array}{l} \text{books} \\ \text{?*some books} \\ \text{the books} \end{array} \right\}$.

(Jackendoff 1989: Ch. 5, p. 14)

However, the holistic/partitive contrast can be readily neutralized simply by the choice of lexical items to fill the NP slots. Let us consider the examples taken from Jeffries and Willis (1984).

- (32) a. The caretaker sprinkled the floor with sawdust.
 b. The caretaker sprinkled sawdust on the floor.
 (33) a. The English boy sprinkled the hot water with tea.
 b. The Japanese boy sprinkled tea on the hot water.

(Jeffries and Willis 1984: 717)

In examples (32a-b) and (33a-b) above, *the floor*, as a location argument, tends to have a holistic reading in (32a) but not in (32b), whereas there seems to be no such distinction between the two in (33). They argue that our world knowledge of tea making causes us to envisage a restricted surface area of hot water which would most likely be covered by tea in both instances. A similar argument may hold in the examples below:

- (34) a. The fireman sprayed the fire with water.
 b. The fireman sprayed water on the fire.
 c. Most of the fire didn't get any water on it.

(ibid: 718)

They observe that (34c) is perfectly compatible with both sentences (34a-b). This is partly because fire does not have well defined edges and the question of whether the whole fire is affected is difficult to answer.

Although Jackendoff (1989) claims that the determiner constraint exists in the *with* variant, it becomes unclear whether such constraint really exists or not, when we consider the following sentence:

- (35) They loaded the truck with a box.

(Jeffries and Willis 1984: 718)

Indeed, it is possible to give the sentence (35) an interpretation in which the box is so large that it fills the truck. However another interpretation is possible in which the box and the truck are of an ordinary size, but there is involved some agreed notion of a completed 'load' which makes the sentence acceptable. A similar notion can be found in the meaning of the verb *stock*, where the contextually determined idea of a complete 'stock' is most important:

(36) John stocked the shop with notebooks.

Thus the sentence (36) does not mean that the shop was full of notebooks, but only that the shopkeeper *John* acquired the amount required by his own notion of a complete stock.

Furthermore, the *with* variant of *stick* does not at all entail that the whole part of the location argument is affected, as shown in the (b) sentence below.

- (37) a. He stuck his fork into the potato.
 b. He stuck the potato with his fork.

What emerges from this discussion is that the holistic/partitive difference in meaning, which, at first glance, appears to accompany the locative alternation, is in fact pragmatic in nature and depends on a wide variety of extra-linguistic factors. Yet the above argument is not intended to deny a meaning difference between the two variants of locative alternation. What, then, is the exact nature of the difference?

We would like to suggest, essentially following Levin and Rappaport (1988a), that there is a clear difference in 'entailment' between the two variants. Let us consider the examples below:

- (38) a. Henry loaded hay onto the wagon.
 b. Henry loaded the wagon with hay.
 (39) a. Hay was loaded on the wagon.
 b. The wagon was loaded with hay.

(Levin and Rappaport 1988a: 26)

While both variants in (38) entail (39a), only the *with* variant, (38b), entails (39b).⁵ This entailment suggests that the verb in the *with* variant, but not in the locative variant, denotes the bringing about of a change in the state of the location argument. The so-called 'affected' interpretation of the location argument can be attributed to the change of state that is entailed. Furthermore, note that (38b) entails (38a) but not vice versa. This observation indicates that the meaning of the locative variant is properly included in that of the *with* variant.

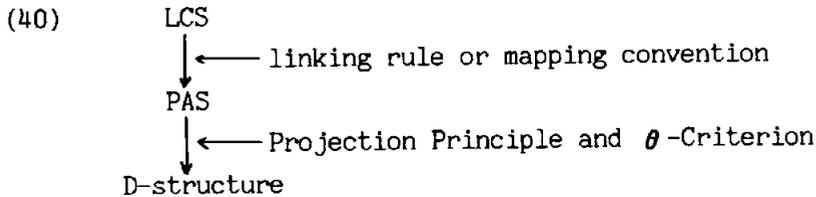
The upshot, then, is that the meaning difference between the two variants cannot be attributed to the holistic/partitive distinction, but to an entailment relation holding between them; and therefore an adequate lexical semantic representation of the locative alternation verbs ought to capture this entailment relation.

2. The Theoretical Framework of the Present Analysis

2.1. Before kicking off a detailed analysis of the observed behavior of the locative alternation verbs, let us introduce a certain amount of apparatus, which has been developed in current works in connection with the Lexicon Project of the Center for Cognitive Science at MIT (eg. Hale and Keyser, 1986, 1987, Guerssel et al., 1985, Levin and Rappaport, 1988a, Laughren, 1988, Fukui et al., 1985).

In our attempt to develop appropriate lexical entries for verbs, we posit two levels of representation in the lexicon: the Predicate Argument Structure (PAS), which is relevant to a lexical-syntactic representation, and the Lexical Conceptual Structure (LCS), which is relevant to a lexical-semantic representation. These two representations are related by a set of linking rules or mapping conventions such as the one proposed in Levin and Rappaport (1988a). Thus the LCSs of verbs do not interact directly with the syntax. The PAS, by encoding the compositional relations between the verb and its arguments, determines the basic syntax of a sentence, in conjunction with the Projection Principle and the θ -Criterion (Chomsky, 1981).⁶ This relation will

be schematized in (40) below:



What is important is the assumption behind the LCS approach that at some level of representation the meanings of verbs have internal structures. Similarities in the meanings of verbs can be captured by attributing shared elements to their decompositions. Verbs fall into classes and are therefore expected to have shared properties by virtue of these common elements. But a discussion of the exact nature of LCS is beyond the scope of this paper. Presumably, a limited set of predicates is found in the meaning decompositions, though; see Jackendoff (1983, 1989) and Nakau (1985).

In order to illustrate the essential elements of the two levels of lexical representation and the linking rules relating them, let us consider the verb *put*, basically along the line proposed in Levin and Rappaport (1988a), slightly different from the others cited above. This verb is a prototypical triadic transitive verb. It denotes an action in which an active participant brings about a change in the location of an entity. The LCS and the PAS take the forms illustrated in (41).

- (41) *put* LCS: [x cause [y to come to be at z]]
 PAS: x < y, P_{loc} z >

In the LCS, the x variable represents an agent, who brings about a change in the location of an entity (the y variable); the z variable indicates the goal of this change of location. The three distinct variables in the LCS indicate that *put* is a triadic predicate. In the PAS for *put*, on the other hand, the three variables also indicate that *put* is a triadic verb. Moreover, the structure also encodes how the NP arguments in the syntax that correspond to variables will be assigned

their θ -roles. The variable x outside the brackets represents the external argument, and it is associated with an NP in the syntax external to the maximal projection of the verb and assigned its θ -role by the VP via predication. The variables inside the brackets represent the internal arguments and are associated with NPs internal to the verb's maximal projection. One internal argument, which is represented by the y variable, is a direct argument and the other is an indirect argument, which is represented by the z variable, assigned its role by a locative preposition (represented in 41 as P_{loc}). We refer to the variables in the PAS as direct, indirect, internal, or external argument variables according to how the NP corresponding to the variable in the syntax is assigned its θ -role, following the current assumption within the framework of GB syntax.

Turning to the linking rule from LCS to PAS, we tentatively assume the one which is also proposed in Levin and Rappaport (1988a), given in (42) and (43).

(42) When the LCS of a verb includes one of the substructures in (43), link the variable represented by x in either substructure to the direct argument variable in the verb's PAS.

(43) a. ...[x come to be at LOCATION]...

b. ...[x come to be in STATE]...

(ibid: 25)

This linking rule would apply to the verb *put*, since its LCS subsumes the structure in (43a), so that the y variable in its LCS is linked to the y variable in its PAS.

2.2. Having set out the basic framework within which this paper addresses the problems on the locative alternation verbs, let us turn to the relations holding between two clauses in an LCS, which will play a crucial role in the present analysis.

There seem to exist at least two types of relations. One is the MEANS relation, in which an event or process serves as the means of bringing about a second state, event, or process. The other is the

PURPOSE relation, in which an event or process serves as the purpose for bringing about a second state, event, or process. These two relations frequently license extended uses of verbs in English and in other languages. And they can be considered as 'two sides of the same coin,' as illustrated in (44) and (45):

(44) *the MEANS relation*

(result) BY MEANS OF (means)

(45) *the PURPOSE relation*

(means) IN ORDER THAT (result)

We assume with Guerssel et al. (1985), Levin and Rappaport (1988a), and Laughren (1988), that the MEANS relation allows the primary meaning of a verb *V* to become a subordinate clause in a new LCS associated with an extended use of the verb. Furthermore, we would like to propose that the PURPOSE relation allows the core meaning of a verb *V* to become a subordinate clause in a new LCS in much the same way as the MEANS relation does. The assumption and our proposal are to be examined in the following section in the course of discussion of the locative alternation verbs.

3. The Analysis of the Locative Alternation

The key idea of the the present analysis is that the locative alternation is one case of the process of lexical extension, the ability of a predicate in one semantic class to take on an extended use as a predicate in a second existing class, generally sharing a common semantic core with the first.

It will be shown in this section that the locative alternation verbs fall into three classes according to the mode of lexical extension they select, which is explicitly correlated with the optionality of indirect arguments observed in 1.2. In other words, the locative alternation verbs may vary in which variant of the alternation is the semantic or conceptual core. Taking this idea as a guide, we will propose three different LCSs for the three classes in terms of the apparatus set out in the previous section, on the basic assumption that

the variant in which an argument can stand as sole NP complement is the conceptual core.

For the convenience of exposition, we will restrict ourselves to 'material-adding verbs', which are included in a larger class of locative alternation verbs. The three groups with respect to the optionality of indirect arguments are repeated as follows:

- (46) a. I piled books (onto the shelf).
- b. I piled the shelf *(with books).
- (47) a. We stuffed feathers *(into the pillow).
- b. We stuffed the pillow (with feathers).
- (48) a. We loaded hay (onto the truck).
- b. We loaded the truck (with hay).

In the remainder of this section we will examine in turn these three classes in detail.

3.1. Let us start with ones which allow the deletion of indirect arguments only in the locative variant, such as *pile*, *stack*, and *spread*. For example, the core meaning of *pile* amounts to 'to make a pile of something', as in (49).

- (49) He piled the boxes one on top of the other.

This meaning will be modified to denote an event which involves 'a change of location' expressed in the locative variant such as (50).

- (50) He piled the boxes onto the shelf.

The sentence (50) roughly means 'He caused the boxes to come to be on the shelf while making a pile of the boxes'. We can take the use of the path preposition *onto* as strong evidence that the locative variant denotes an event which involves a change of location.

Furthermore, *pile* can name an event in which 'a change of state' is brought about (the *with* variant), as follows.

(51) He piled the shelf with boxes.

This sentence can be paraphrased as 'He caused the shelf to come to be piled with boxes by piling boxes onto the shelf'.

It is not unreasonable to assume that the locative variant of *pile* represents the more central reading and the *with* variant is an elaboration. Thus we propose the following LCSs for the two variants of *pile*, which are essentially the same as the ones proposed for *load* by Levin and Rappaport (1988a).

- (52) a. *PILE* : [x cause [y to come to be at z]/PILE]
 b. *PILE* : [[x cause [z to come to be in STATE]]
 BY MEANS OF [x cause [y to come to be at z]/PILE]

Some remarks on these representations should be made. First note that the LCS in (52b) includes that in (52a). This accounts for the entailment relation between the two variants, which was pointed out earlier. The *with* variant entails the locative variant, but not vice versa.

Second, the /PILE in the representation in (52) is intended to indicate the manner in which the action came about. The presence of this component of meaning distinguishes the locative alternation verbs from verbs of pure change of state, such as *break*, or verbs of pure change of location, such as *put*.⁷ Lacking this component, the verb *put* does not participate in the locative alternation, as exemplified below:

- (53) a. John put books on the table.
 b. *John put the table with books.

Third, the use of the same set of variables (x, y, z) in both the main and the subordinate MEANS clauses in (52b) is meant to indicate that participants of the embedded clause are to be identified with those of the main clause. In this way, the analysis is able to capture the fact that the entity denoted by the z variable both undergoes a change

of state and serves as the goal of the change of location of the entity denoted by the *y* variable.

To summarize, verbs such as *pile* take on an extended meaning as a change-of-state verb in the *with* variant as a result of the MEANS extension, since a change of location could be the means of bringing about a change of state in the goal of the change of location.

A question that remains to be addressed is how the core meaning of *pile*, 'to make a pile of' extends to the meaning as a change-of-location verb including the manner of the change.⁸ Our analysis implicitly says that the core meaning of *pile* is incorporated into the manner component in the meaning of the extended use. This issue awaits more extensive study, which is beyond the scope of this paper. But we can suggest that the same relation appears to hold in the following examples:

- (54) a. John pushed the cart.
 b. John pushed the cart into the corner.

3.2. Let us turn to the second class of the relevant verbs, which permit the deletion of indirect arguments only in the *with* variant. The verb *stuff* belongs to this class, as shown in (55).

- (55) a. We stuffed the pillow (with feathers).
 b. We stuffed feathers *(into the pillow).

Regarding *stuff* as basically a change-of-state verb, we propose the following LCSs for the two variants of *stuff*.

- (56) a. *STUFF* : [x cause [y to come to be STUFFED with z]]⁹
 b. *STUFF* : [[x cause [z to come to be at y]/STUFF]
 IN ORDER THAT [x cause [y to come to be STUFFED
 with z]]]

The representation in (56a) indicates that *stuff* names an event which involves a change of state (the *with* variant). The representation (56b)

indicates that *stuff* names an event in which a change of location is brought about in order to cause a change of state (the locative variant). The present analysis means that verbs such as *stuff*, *cram*, and *wrap* take on an extended meaning as a change-of-location verb by the PURPOSE extension, since a change of state could be the purpose for bringinig about a change of location. This sharply contrasts with the case of *pile*, in which the *with* variant follows from the locative variant by way of the MEANS extension.

Our claim that these verbs, such as *stuff*, *cram*, and *wrap*, are basically change-of-state verbs will get support from the following facts. The verb *wrap* participates in the locative alternation, as exemplified in (b) and (c) below:

- (57) a. She wrapped the baby in a towel.
 b. She wrapped the baby with a towel.
 c. She wrapped a towel around the baby.

(Nakau 1986: 624)

Notice that the (a) sentence does not entail the change of location of *a towel*, as pointed out in Nakau (1986). If we considered *wrap* as basically a change-of-location verb and extended to a change-of-state verb by the MEANS extension, the LCS for *wrap* in (a) would also include the component of change of location. This is clearly undesirable.^{10, 11}

The difference in meaning between the two variants of this class of the locative alternation verbs can be characterized in terms of a difference in entailment of a change of state. (55a) entails that the pillow is stuffed with feathers, whereas (55b) does not entail that the pillow is stuffed with feathers. This difference in meaning is captured in the LCSs we have proposed in (56a) and (56b).¹²

As observed in Section 1, verbs such as *fill* and *cover* do not participate in the locative alternation, illustrated as follows:

- (58) a. Sue filled the pail with water.
 b. *Sue filled water into the pail.
 (59) a. Bill covered the ground with a tarpaulin.

- b. *Bill covered a tarpaulin onto the ground.

What, then, prevents these verbs from participating in the alternation? Put differently, why does the PURPOSE extension not apply to these verbs? As was suggested in Section 1, the LCSs and PASs of these verbs are considered to have only two arguments, and therefore these verbs cannot participate in the alternation. On this view, we might get the following representation for *fill*.

- (60) LCS for *fill* : [x cause [y come to be FILLED]]

We have claimed that the two variants of verbs like *stuff*, *cram*, and *wrap* are related by the PURPOSE extension. Our analysis would get much support if there existed other examples of the PURPOSE extension. One of such examples comes from another alternation called 'the conative alternation', which is cross-linguistically studied by Guerssel et al. (1985) and Laughren (1988). The case of the alternation in English is illustrated as follows:

- (61) a. Margaret cut the bread.
 b. Margaret cut at the bread.
 (62) a. John shot the kangaroo.
 b. John shot at the kangaroo.

According to their analyses, this alternation can be characterized as one case of PURPOSE extension, and the two uses of *cut* in (61) might get something like the following representations.

- (63) a. *cut* : [x produce CUT on y]
 b. *cut* : [[x causes sharp edge to move along path toward y]
 IN ORDER THAT [x produce CUT on y]]

Notice that the difference in meaning between the two sentences in (61) can be characterized in terms of a difference in truth condition with respect to the clause [x produce CUT on y]; (61a) is true iff Margaret

made a cut on the bread, whereas (61b) is true irrespective of whether Margaret made a cut. This difference in logical entailments is clearly of the same type as the one found in the case of locative alternation of *stuff*. Therefore the use of PURPOSE extension to characterize the locative alternation is independently motivated. (For more discussion on the conative alternation, see Guerssel et al. 1985 and Laughren, 1988.)

In sum, what we have just seen is that the change of state constitutes the core meaning of verbs like *stuff*, and these verbs take on an extended meaning as a change-of-location verb through the PURPOSE extension.

3.3. More complicated are the cases of verbs such as *load* and *pack*, where either argument can stand as sole NP complement, as in (64) and (65):

- (64) a. Bill loaded hay (onto the truck).
- b. Bill loaded the truck (with hay).
- (65) a. She packed shirts (into the suitcase).
- b. She packed the suitcase (with shirts).

This fact concerning the optionality of indirect arguments is the source of difficulty in determining which variant is the conceptual core. In other words, it is unclear whether these verbs are originally change-of-location verbs or change-of-state verbs. Although we will leave this question open, let us see how well the present formalization works in either case.

First, let us assume that the primary meaning of *pack* is change of location as represented in the following LCS.

- (66) *PACK* : [x cause [y to come to be at z]/PACK]

This representation corresponds to the sentence (65a) without the bracketed phrase, *She packed shirts*. In this instance, the z variable in (66) becomes an implicit argument. This seems to us to be a reasonable

analysis, because it is entirely consistent with the observation that verbs like *pack* have three arguments, as was noted in Section 1.

Since the representation in (66) includes the manner component /PACK, this verb takes on an extended meaning as a change-of-state verb by virtue of the MEANS extension, in exactly the same way as in the case of *pile*. Then the verb *pack* gets the following LCS.

- (67) **PACK** : [[x cause [z to come to be in STATE]]
BY MEANS OF [x cause [y to come to be at z]]/PACK]

This representation corresponds to the *with* variant of *pack* in (65b), which denotes an event in which a change of state is brought about by means of a change of location.

Furthermore, let us suppose that *pack* is basically a change-of-state verb, whose meaning can be represented in the LCS as below.

- (68) **PACK** : [x cause [y to come to be PACKED with z]]

This LCS corresponds to the meaning of the sentence *She packed the suitcase*. In this case, the z variable in the LCS in (68) also qualifies as an implicit argument.

There is nothing in principle to prevent this LCS from entering into the PURPOSE extension. Consequently, *pack* takes on an extended meaning as a change-of-location verb, in the same way as *stuff*. So the following representation results.

- (69) **PACK** : [x cause [z to come to be at y]/PACK]
IN ORDER THAT [x cause [y to come to be PACKED with z]]]

This LCS represents the meaning of the locative variant of *pack* in (65a), which roughly means 'She put shirts into the suitcase in order to pack the suitcase with shirts.'

In this way, the four variants of *pack*, two of which are those of locative alternation, have the precise representations.

This analysis of *pack* implies that its locatum argument and

location argument bear inherent relations to the verb in the same degree. It is precisely in this respect that we have distinguished this verb from other two types of locative alternation verbs, which were dealt with in the previous subsections: In the case of verbs such as *pile*, the locatum argument has a closer relation to the verb than the location argument does. Conversely, in the case of *stuff*, the location argument has a closer relation than the locatum argument. It is difficult to measure the closeness of arguments to their verbs by some means. Nevertheless, we would like to regard the optionality of the arguments as a reflex of their closeness to their verbs.

3.4. On the basic assumption that the locative alternation is one case of lexical extension, we have shown that material-adding verbs fall into three classes with respect to the mode of lexical extension. This was explicitly correlated with the optionality of indirect arguments, which in turn was related to the closeness of arguments to their verbs.

In the case of verbs such as *pile*, *stack*, and *smear*, the locative alternation has been characterized as an extension from change-of-location verbs to change-of-state verbs, which is mediated by the MEANS extension. In the case of verbs such as *stuff*, *cram*, and *wrap*, we have regarded it as an extension from change-of-state verbs to change-of-location verbs, which is mediated by the PURPOSE extension. Finally in the case of verbs such as *load* and *cram*, the distinction between change-of-location verbs and change-of-state verbs seems to become blurred, but our apparatus has captured the relationship between the two variants of locative alternation in which these verbs participate.

Now let us consider some consequences which our analysis would bring about, especially in view of language acquisition. On our account, the locative alternation is not the result of an alternation in the syntactic expression of the arguments of a verb with a single lexical-semantic representation. Rather it reflects the existence of two or more distinct but related LCSs named by a single verb. More a language learner should learn, more systematic and regular process must be acquired by him to lighten the task. In fact, it is unquestionable that the lexicon contains the bulk of the linguistic knowledge. So the best

representation of lexical knowledge should reflect the regularities and principles that govern the organization of the lexicon. The MEANS extension and the PURPOSE extension, which we have proposed in the present analysis, are exactly of the sort, we are convinced.

Other members of the locative alternation verbs, such as verbs of removing mentioned earlier, are expected to be characterized in the same way, but we will leave this issue open, hoping to do this in future research.

4. Conclusion

We have examined the locative alternation, especially focusing on verbs of material-adding. And we have shown that the locative alternation is one case of the process of lexical extension. At the same time, it has been argued that the locative alternation verbs fall into three classes according to the way of lexical extension they select. At this point, we depart from Levin and Rappaport's analysis of the relevant alternation, in which the alternation is unidirectional, i.e. the *with* variants follow from the locative variants, but not vice versa.

Other alternations in the expression of the arguments are possible. These include the alternations illustrated in (70)-(73).

- (70) a. Hannah embossed her name on the book.
- b. Hannah embossed the book with her name.
- (71) a. Julie presented the cup to the winner.
- b. Julie presented the winner with the cup.
- (72) a. Kevin hit the stick against the wall.
- b. Kevin hit the wall with the stick.
- (73) a. Margaret carved the wood into a toy.
- b. Margaret carved a toy out of wood.

The possible alternations point to the existence of regularities reflecting the organization of the lexicon. First, the verbs participating in each alternation seem to belong to semantically coherent classes, even though not every member of the class participates in the alternation. ¹³ And, second, verbs with similar

meaning participate in comparable alternations cross-linguistically, as reported by many researchers. A theory of lexical competence should be able to characterize the factors conditioning the acceptable alternations.

We believe that these alternations above are essentially of the same type as the locative alternation and can be characterized as lexical extensions. Pursuing the line of investigation which we have followed in this paper, the task is to identify the ways in which the components of LCSs may combine and the constraints on the possible LCSs that may be constructed. However, we must leave this task for future research.

NOTES

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¹ The terms 'locative variant' and '*with* variant' are taken from Levin and Rappaport (1988a).

² A similar observation is reported in Fukui et al. (1985) as for the Japanese counterparts for the *spray/load* verbs. The verb *hari-tsukusu*, which is composed of *haru* ('hang') and the morphological ending - *tsukusu* meaning 'exhaust', participates in the locative alternation, as shown in (i):

- (i) a. kabe-ni postaa-o hari-tsukusu
 wall-on poster-ACC hang-exhaust
 'completely hang posters on the wall'
- b. kabe-o postaa-de hari-tsukusu
 wall-ACC poster-with hang-exhaust
 'completely hang the wall with posters'

They observe that when one of the arguments in (ib) is omitted, the sentences become clearly elliptical.

- (ii) a. kabe-o hari-tsukusu
 wall-ACC hang-exhaust
 b. postaa-de hari-tsukusu
 poster-with hang-exhaust (Fukui et al. 1985: 28)

They suggest that (ia) invites the question, 'what will you use to completely hang the wall?', and (iib) invites the question, 'what will you completely hang with posters?'

In contrast to *hari-tsukusu*, the verb *haru* alone does not allow the alternation, as exemplified below:

- (iii) a. kabe-ni postaa-o haru
 wall-on poster-ACC hang
 'hang posters on the wall'
 b. *kabe-o postaa-de haru
 wall-ACC poster-with hang
 'hang the wall with posters'

They also observe that when one of the arguments in (iiia) is omitted, the difference from *hari-tsukusu* arises.

- (iv) a. ano postaa-o haru
 that poster-ACC hang
 b. kabe-ni haru
 wall-on hang (ibid: 27)

They mention that in (b), clearly something is missing, the thing that is being hung; while in (a), the sentence is semantically complete, and there is no real sense that something is elided.

From this observation, they conclude that verbs that allow the alternation have two internal arguments, whereas verbs that do not allow it have only one internal argument. This is exactly along the argument

which we have put forward in the body.

³ Henceforth, we use the term 'location' as the one denoting a particular location where an entity or substance comes to be through the action of an agent. And we refer to such an entity or substance as a 'locatum'. The term 'location argument' is to be distinguished from 'locative adjunct' in that the former is an element required by a verb, but the latter is not.

⁴ Note that the subject of a predicative adjectival passive and an NP modified by an attributive adjectival passive are found external to (outside the maximal projection of) the AP headed by the adjectival passive participle, as exemplified in (23)-(25) in the body.

⁵ Note that we can say *The wagon was loaded with hay* irrespective of whether the whole space of the wagon is occupied by hay. As pointed out earlier, this is a matter of pragmatics or extra-linguistic factors.

⁶ We are assuming here with Levin and Rappaport (1988a) that the Projection Principle and the θ -Criterion do not refer to the substantive nature of θ -role labels. Some researchers have proposed a thematic hierarchy in which θ -roles are arranged, but this approach appears to face many problems. See Levin and Rappaport (1988a) for an extensive discussion on this point.

⁷ The difference between *put* and *pile* is exemplified by the following pair of sentences.

- (i) a. John put a book on the table.
- b. *John piled a book on the table.

If *pile* were a verb of pure change of location such as *put*, the (b) sentence would be acceptable. This example clearly shows that *pile* incorporates an additional meaning, which we characterize as the manner component here.

⁸ S. Iwata pointed out to me another possibility that the meaning of *pile* in (49) is the same as that in (50), and both of them can be represented in the LCS in (52a). In fact, the difference between them is very subtle, but the following example might suggest the need for distinguishing them.

- (i) sand dunes piled up by the winds

In this example, 'sand dunes' can be interpreted as the thing which was made by the winds, but not as that which was moved somewhere.

⁹ When the NP complement occurs without the *with* phrase, as in *We stuffed the pillow*, the z variable in the LCS in (56a) becomes an implicit argument of the verb *stuff*, we assume. This is slightly different from the treatment of *pile*; we do not assume that there is an implicit argument in the sentence *She piled the books*. A further refinement might be called for, but we will put aside this problem for the time being.

¹⁰ In example (57), we regard the (a) and (b) sentences as basically denoting a change of state, and (c) as denoting a change of location. An objection might be raised here that since (a) entails the change of location of *the baby*, (a) and (c) should be treated as the same kind. This is clearly not true, however. First, the path prepositions do not appear in the sentences like (a), as exemplified below.

- (i) *She wrapped the baby into a towel.

Second, the particle *up* can occur with the sentences (a) and (b), but not with (c).

- (ii) a. She wrapped the baby up in a towel.
 b. She wrapped the baby up with a towel.
 c. ??She wrapped a towel up around the baby.

Thus these examples indicate that the (a) and (b) sentences in (57) basically denote a change of state of *the baby*.

¹¹ One of the Japanese counterparts for *wrap*, *tsutsumu* may give a piece of evidence for our claim that *wrap* is basically a change-of-state verb. The verb *tsutsumu* appears in the following frames.

- (i) a. akanbou-o taoru-ni tsutsumu

- baby-ACC towel-in wrap
 'wrap the baby in a towel'
 b. akanbou-o taoru-de tsutsumu
 baby-ACC towel-with wrap
 'wrap the baby with a towel'
 c. *taoru-o akanbou-no-mawarini tsutsumu
 towel-ACC baby-around wrap
 'wrap a towel around the baby'

Notice that *tsutsumu* does not occur in the locative variant, suggesting that this verb is a change-of-state verb, not a change-of-location verb.

However, another counterpart is *maku*, which can appear in the both variants, as shown below:

- (ii) a. akanbou-o taoru-de maku
 baby-ACC towel-with wrap
 'wrap the baby with a towel'
 b. taoru-o akanbou-no-mawarini maku
 towel-ACC baby-around wrap
 'wrap a towel around the baby'

Furthermore, once we add the morphological ending - *tsukeru* ('attach') to *maku*, it cannot occur in the *with* variant.

- (iii)*a. akanbou-o taoru-de maki-tsukeru
 baby-ACC towel-with wrap-attach
 'wrap the baby with a towel'
 b. taoru-o akanbou-no-mawarini maki-tsukeru
 towel-ACC baby-around wrap-attach
 'wrap a towel around the baby'

This is an interesting issue, but here we do not go into the issue any further.

¹² We have recognized the difference in entailments which our analysis brings about, between the case of *pile* and that of *stuff*. In

our analysis, the *with* variant of *pile* entails its locative variant, but not vice versa. On the other hand, the *with* variant of *stuff* would not entail its locative variant, and the locative variant does not entail its *with* variant, either. However, it is not clear at this point whether the *with* variant of *stuff* entails its locative variant or not, in other words, whether the *with* variant of *stuff* does really entail the change-of-location of its locatum argument. We will leave this problem open.

¹³ The verbs participating in each alternation from (70) to (73) may be characterized as 'verbs of inscribing,' 'verbs of presenting,' 'verbs of forceful contact,' and 'verbs of contact-effect,' respectively. (These terms are borrowed from Levin and Rappaport, 1988a.) The following lists include examples of these verbs.

- (i) emboss, embroider, engrave, imprint, inscribe, mark, stamp,..
- (ii) present, credit, entrust, furnish, supply, trust,...
- (iii) hit, strike,...
- (iv) carve, build, make, grow, whittle, weave, fashion, create,...

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