

Semantic Perspicuity and the Locative Hypothesis

Author(s): James Paul Gee and Judy Anne Kegl

Proceedings of the Eighth Annual Meeting of the Berkeley Linguistics Society (1982), pp. 335-353

Please see “How to cite” in the online sidebar for full citation information.

Please contact BLS regarding any further use of this work. BLS retains copyright for both print and screen forms of the publication. BLS may be contacted via <http://linguistics.berkeley.edu/bls/>.

The Annual Proceedings of the Berkeley Linguistics Society is published online via [eLanguage](#), the Linguistic Society of America's digital publishing platform.

Semantic Perspicuity and The Locative Hypothesis*

James Paul Gee
Hampshire College

Judy Anne Kegl
Northeastern University & M.I.T.

The "locative hypothesis" is one of the longest standing hypotheses in linguistics: it states that spatial expressions are more basic, grammatically and semantically, than various kinds of non-spatial expressions. They are more basic in the sense that they serve as "structural templates" for the construction of other grammatical systems and semantic structures (Lyons (1977), Anderson (1972), Traugott (1974, 1975, 1977, 1978), Gruber (1965), Jackendoff (1972, 1978)). Such grammatical systems as tense and aspect, as well as various grammatical and semantic cases, and such semantic domains as possession, state, quality/property, existence, quantification and modality have been shown, in language after language, to be founded on the basic notions of location and change of location. In its strongest versions the locative hypothesis constitutes a profound conjecture about the fundamental nature of human language and, by extension, human cognition.

American Sign Language (ASL), a language made in space, turns out to express the locative base of language in a particularly perspicuous manner, as well as the way other grammatical and semantic systems are built upon it. Given the assumption that the lexical resources of all human languages are built up from a locative base, ASL may also have a crucial contribution to make to our understanding of lexical semantics.

In this paper, we will first present a detailed study of the morphological (and morphophonological) structure of the ASL verbal system, and then turn to a discussion of our claim that this morphological structure is particularly "semantically perspicuous."

1. The ASL Lexicon

The Lexicon of ASL contains six basic locative/directional verb stems (IN, ON, AT, WARD, TO, FROM) and a set of Word Formation rules (WFRs) which produce more complex derived verbs from these six simple stems. The lexicon also contains, undoubtedly, a number of frozen forms--forms originally derived by these WFRs, but now no longer seen as combinations of simple stems. For these frozen forms, the WFRs now function as redundancy rules, rendering their morphological form and aspects of their meaning predictable, and their occurrence in the lexicon "less costly" than forms altogether unrelated to the WFRs. This is essentially the conception of the lexicon delineated by Jackendoff (1975) and Aronoff (1976). Further expansion of the ASL lexicon occurs by means of a recursive rule of theme incorporation ("theme" in the Jackendoff/Gruber sense) which inserts a nominal element (a classifier, noun, or nominalization, into the verb stem and by a process of metaphorical extension in which the literal meaning associated with locative/directional verb stems is extended to more abstract domains forming semantically extended verb classes

such as emotion, perception or cognition verbs. It is our contention that locative/directional verb stems form the basis of the entire verbal, in fact, the entire grammatical system of ASL.

2. Structural and Functional Properties of Stems

Each simple verb stem is intransitive (having one argument position) and is listed in the lexicon with information as to where it takes its argument, either on the right or left. Where a stem takes its argument corresponds to where its agreement marker (LOC) will show up. (We use the term LOC here because the agreement process in ASL involves location. Nouns, pronouns and agreement markers are co-indexed with each other by articulating them at or associating them with a shared location in space.) Right position or left position corresponds to whether the LOC is realized prior to the physical realization of the verb (left) or after it (right). Only FROM takes its argument on the left. It is this property that ultimately allows FROM to serve in one of the WFRs as a transitivizer. Furthermore, each simple stem serves a particular semantic function in one of the WFRs. For convenience, we list below the stems under names for the functions they serve:

Simple Verb Stems (and their functions)			
TERMINATORS	MOVER	ORIENTER	NEGATOR
IN__	TO__	WARD__	__FROM
ON__			
AT__			
WARD__			

Terminators entail pure location or terminal perspective on movement. The Mover entails movement or attraction to a goal. The Negator can be either static or moving. The moving form gives us the opposite of attraction to a goal, i.e., "repulsion from a source." The static form gives us the negative of location, i.e., "not at." The Orienter has the unique property of turning the LOC of its verb into an anchor point defining a direction rather than functioning as a location, source or goal. Note that WARD__ occurs twice. Like IN, ON, AT it is a terminator, but it also serves as the static counterpart of TO (pure attraction without movement) and plays a role fully analogous to TO in one of our WFRs (concatenation). In addition, it is the central element of its own WFR--the Orienter Rule. It is the most versatile basic stem.

3. WFRs Involving Combinations of Stems

There are two processes by which complex derived verbs are formed--conjoining and concatenating. Conjoining combines two simple stems in such a way that they share one argument position (e.g. V+V__). Thus, it creates complex intransitives. Concatenating combines two verbs in such a way that they each contribute an independent argument position (__V#V__). This process creates transitive verbs (all transitive verbs, unless frozen forms, are

derived). It is a consequence of our theory that ASL verbs have at most two arguments. This is in fact true. There are, for example, no three argument verbs in ASL comparable to the English verb give. This limitation in argument structure is fully made up for by the theme incorporation process mentioned above.

3.1 Conjoining

The WFRs of ASL are close to being maximally simple. Each WFR contains a quite simple morphological operation and a semantic specification. The semantic specification indicates the function of the rule.

The most basic combinatory process is a process of "conjoining" simple verb stems to create derived intransitives. There are three conjoining rules, all of which have the same structural morphological operation, but which are differentiated by their semantic function. While these rules can be collapsed as one rule, for expository convenience we will treat them separately for the moment. In any complex intransitive of the form $[V+V]_V$, we call the rightmost V the "head." All complex intransitives take their argument on the same side (right or left) as the head is specified for in the lexicon (thus, on the left if the head is FROM ($_V$ +FROM), on the right if it is anything else (e.g. V +ON $_$)). We call this "The Head Argument Determination Principle" (HADP).

The first conjoining rule we will look at is the "Terminator Rule," a rule that creates complex intransitives that entail a specific terminal perspective on movement:

The Terminator Rule

V

TO, TERMINATOR $\Rightarrow [TO+V]_V$

Semantics: V is the terminus of the movement TO

Examples: TO, IN $\rightarrow [TO+IN]_V \rightarrow [TO+IN] _$

'into' $_$

TO, ON $\rightarrow [TO+ON]_V \rightarrow [TO+ON] _$

'onto' $_$

TO, WARD $\rightarrow [TO+WARD]_V \rightarrow [TO+WARD] _$

'orient to' $_$

(TR)

(HADP)

Such combinations as $*[IN+TO]$ and $*[ON+TO]$ or $*[IN+ON]$ are ungrammatical because not derivable by the Terminator Rule or any other WFR. (Notice that ASL $[TO+IN] _$ and $[TO+ON] _$ correspond to English prepositions whose internal ordering is reversed. This is a fairly common correspondence between the two languages.)

A second conjoining rule is the "Negator Rule," which negates some terminal perspective--note that the Negator Rule is, in form, the mirror image of the Terminator Rule:

The Negator Rule

V

TERMINATOR, FROM $\Rightarrow [V+FROM]_V$

Semantics: The terminus V is negated (ceases to hold)

Examples:

IN, FROM \rightarrow [IN+FROM]_V \rightarrow — [IN+FROM]
 'go out, be out of'
 ON, FROM \rightarrow [ON+FROM]_V \rightarrow — [ON+FROM]
 'get off, be off of'
 WARD, FROM \rightarrow [WARD+FROM]_V \rightarrow — [WARD+FROM]
 'turn away from,' or
 'be facing away from'

In the Negator Rule, FROM may be interpreted as either moving or static. In the static form movement exists in the physical articulation of the sign, but is reduced. In the first case the terminus is negated by moving away from that position; in the second case the moving away is realized to a reduced extent and the focus is on the state of being away from the terminus.

Finally, there is the "Orienter Rule," which orients a particular verb in terms of some direction:

The Orienter Rule

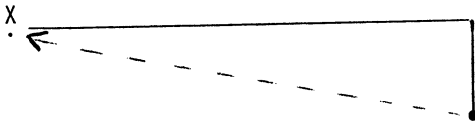
WARD, V \implies [WARD+V]_V

Semantics: Oriented in the direction of the argument of V

Examples:

WARD, TO \rightarrow [WARD+TO]_V \rightarrow [WARD+TO]
 'move toward'
 WARD, IN \rightarrow [WARD+IN]_V \rightarrow [WARD+IN]
 'orient inward'
 WARD, ON \rightarrow [WARD+ON]_V \rightarrow [WARD+ON]
 'onward,' 'facing toward the surface of'
 WARD, FROM \rightarrow [WARD+FROM]_V \rightarrow [WARD+FROM]
 'to move away from or be away from, while orienting toward'

WARD is perhaps the most interesting of the ASL simple verbs. Its LOC or the argument of the verb conjoined with it in a complex intransitive is interpreted as a direction. Thus, the LOCs of WARD LOC_i, [WARD+TO]LOC_i, LOC_i [WARD+FROM], and so forth, are not interpreted as sources, goals, or locations *per se*, but rather as directions. A similar notion is associated with "ward" in English. Consider the following diagram:



Notice that in English 'I went to X' can be interpreted as either following the path indicated by the solid line or the one indicated by the broken line. Yet the sentence: 'I went toward X' picks out only the path indicated by the broken line. Furthermore, the first sentence implies reaching X, the goal, whereas the second sentence implies only orienting toward X and moving in that direction. Consider the difference between the following two sentences:

You go to New York and get off at exit 12.
 You go toward New York and get off at exit 12.

In the first sentence New York functions as a goal whereas in the second New York is simply a reference point used to define a direction.

WARD in ASL, as in English, occurs most frequently with LOCs which are directions (UP, DOWN, LEFT, RIGHT, etc.) or with locations used as directional reference points. Consider the following ward-type words in English:

inward	sideward	southward
outward	leeward	windward
upward	forward	backward
downward	onward	westward
rightward	eastward	heavenward
leftward	northward	hellward
wayward	homeward	seaward
toward	skyward	landward

Notice that all of the above words used with -ward establish directions. WARD marks the LOC of the verb it is in for direction.

In ASL a verb like WARD LOC_i would mean to orient in the direction up. [WARD+TO] LOC_i would be to orient and move in the direction defined by up. WARD LOC_i would be to orient in the direction of whatever is situated at LOC_i , as in the following examples:

[WARD+TO] LOC_i 'move and orient upward'
 \uparrow
 up

[WARD+TO] LOC_i , 'move in John's direction'
 where i coindexes
 the LOC with John

Notice in the first example above that UP is associated to LOC rather than to the index (subscript i). Evidence for this comes from nominalizations and agreement neutralizations where the index is deleted. In these cases UP would remain marked on the neutralized form of the first example, but association with

'John's direction' would be lost in the second. Furthermore, subscript *i* could be associated with John in the first example yielding an interpretation: 'moving and orienting upward in John's direction.' Therefore, directionals like UP, DOWN, etc. are to be seen as further specifications on the LOC itself.

Before moving on to a discussion of the interaction of the three conjoining rules, notice how both the Negator Rule and the Orienter Rule produce the output [WARD+FROM], but with different phonetic forms and different meanings. This distinction occurs as the result of the two different functional properties of WARD. In one case (Negator Rule), WARD functions as a Terminator and the physical form of the verb consists of a pivot away from orientation toward the LOC--i.e., negation of orientation. In the second case (Orienter Rule), WARD functions as an Orienter, adding orientation to the LOC of FROM without changing the movement of the verb. Furthermore, we also have the source/direction distinction mentioned earlier.

The three conjoining rules could hardly be simpler. However, they can feed each other to create more complex combinations. Nonetheless, the feeding relations among the rules are quite constrained. Let us say that a complex intransitive [V+V]_v has the same functional properties as its head. Thus, if the head is a Terminator, then [V+V]_v is also; if the head is the Negator FROM, then the complex verb counts as FROM for the Negator Rule also; and if the head is TO, then the complex verb counts as TO for the Terminator Rule.

It should also be pointed out that the Orienter Rule is strictly limited to conjoining simple stems. The Orienter Rule applies at an earlier level in the lexicon than the other conjoining rules. Therefore it has as its input only simple stems, yet provides complex stems to the input of rules at later levels. The Orienter Rule seems to add a specification to its following V rather than combine two stems to conflate two more distinct locative or directional notions as do the later rules--the Terminator Rule and the Negator Rule. For both semantic and phonetic reasons the three conjoining rules appear to be divided between two levels: level 1 - Orienter Rule, level 2 - Terminator and Negator Rule. No rule is able to feed itself (*[WARD+[WARD+ON]](OR), *[TO+[TO+ON]](TR), *[ON+[ON+FROM]](NR)) and, furthermore no two rules occurring on the same level may feed each other (e.g., the output of the Negator Rule cannot feed the Terminator Rule and vice versa-- *[TO+ON]+FROM](TR,NR), and *(NR,TR) because NR destroys the structural description for TR). We can account for all of this by putting a constraint on feeding as follows:

Feeding Constraint (FC)

The output of a morphological rule may not serve as the input for any morphological rule at the same level.

There is another possibility and that is to recognize the two levels within the lexicon which determine the ordering of the

Orienter Rule, but then to allow the rules to freely feed themselves and each other subject to an output filter which would throw out all complex verbs which had more than one element from a single functional category. TO and FROM, although opposites of one another would have to be seen as sharing a single category (i.e., Movers) or be excluded as opposites.¹ The filter can be stated as follows:

Conjoining Output Filter (COF)

Only one element from each functional category (Orienter, Terminator, Mover, Negator) can appear in a complex intransitive verb. TO and FROM, being opposites cannot occur in any complex intransitive. (Note that these two principles have a consequence that complex intransitive verbs are limited to at most three simple verb stems.)

Whatever means we choose to reduce the output of the conjoining rules, in conjunction with the limitation of the Orienter Rule to simple stems, will prevent interaction of the Terminator Rule (including TO) and the Negator Rule (including FROM) and will allow only the following ordering: OR may feed either NR or TR.

Examples of Interactions between TR, NR and OR

WARD,ON	→	[WARD+ON] _V	→	[TO+[WARD+ON]] _V	
		(OR)(TERMINATOR)(TR)			'move to the state of orienting to the surface of'
WARD,TO	→	[WARD+TO] _V	→	[[WARD+TO]+IN] _V	
		(OR) (TO-type verb)(TR)			'orient to and move to the inside'
WARD,IN	→	[WARD+IN] _V	→	[[WARD+IN]+FROM]	
		(OR) (TERMINATOR)(NR)			'turn from or be away from orienting to the inside of'

ASL can get only a finite number of intransitives from the conjoining process (its true recursiveness occurs in the incorporating process). It is only an expository convenience to treat the process as three separate rules. We have in reality only a single process creating complex intransitives. These complex intransitives are interpreted by three separate semantic specifications. If no semantic interpretation can be given to a particular pair, the whole string is out because uninterpretable.

The Conjoining Rule

$V, V \rightarrow [V+V]_V$

Semantics: For any $[V+V]_V$, where V may itself be complex, interpret any pair of verbs $[V_1+V_2]_V$ in $[V+V]_V$ by one of the following semantic specifications (all such pairs must receive an interpretation):

- a) V_1 is TO (or a TO-type verb) and V_2 is a terminal perspective on V_1 .
- b) V_2 is FROM (or a FROM-type verb) and negates the terminal perspective on V_1 .
- c) V_1 is WARD and forces the LOC of V_2 , a simple verb, to be interpreted as a directional orientation.

Notice that as a consequence of this system FROM has wide scope, and WARD narrow scope.

3.2 Concatenating

A second WFR in the lexicon of ASL, a process which we call "concatenating," forms transitive verbs from intransitives. The concatenation rule applies not to verb stems, but to verbs, simple or complex, plus their agreement slots. Each intransitive verb contributes its own agreement slot. The rule has the following form:

$$\underline{\quad [X+FROM], \left[\begin{array}{c} \{ TO \\ \} \\ WARD \end{array} \right] +X] \quad \underline{\quad} \implies \underline{\quad} [[X+FROM]\# \left[\begin{array}{c} \{ TO \\ \} \\ WARD \end{array} \right] +X] \quad \underline{\quad}$$

Note: We use the symbol "#" to distinguish verbs formed by concatenation from those formed by conjoining ("+"). We chose "#" since concatenation appears to combine independent lexical items (analogous to compounding).

Clearly, concatenating is to be seen as occurring at a level of the lexicon separate from and following the conjoining rules, since it uses their output but never serves as input to a conjoining rule.

Examples of verbs formed by concatenation:

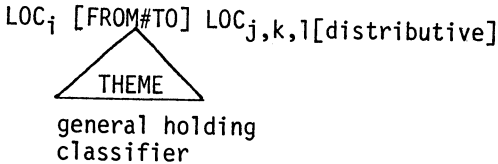
- a. $LOC_i [FROM\#TO] LOC_j$
- b. $LOC_i [FROM\#WARD] LOC_j$
- c. $LOC_i [[ON+FROM]\#[TO+IN]] LOC_j$
- d. $LOC_i [FROM\#[WARD+TO]] LOC_j$
- e. $LOC_i [[WARD+FROM]\#[TO+[WARD+ON]]] LOC_j$

(e.g. (e) would correspond to a verb like "to go from looking toward a picture to looking on the table")

The semantic specification of the concatenation rule would be stated as a combination of the semantics of the FROM verb and the [TO+X] verb, in the following form: first, the state of affairs

of the FROM verb obtains, then the state of affairs of the [TO (or WARD) + X] verb obtains, with a connected transition between them (which they must have phonetically also, i.e. they form one event, phonetically and semantically). It seems as if the FROM which combines with WARD is interpreted as static, which hopefully would be a result of the specifications of the complex meanings of concatenations. Note that transitives are simply combinations of two verbs, whose first argument, contributed by a FROM verb, and thus on the left, is an anti-goal or source and whose second argument, contributed by some verb containing TO (or WARD), and thus on the right, is a goal or a terminal perspective on movement to a goal (or orientational/directional interpretation of a location or goal).

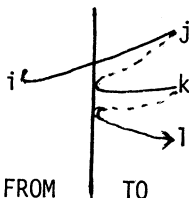
There is some interesting evidence that transitive verbs are indeed made up in ASL of FROM followed by TO, and are not morphologically unitary simple forms (e.g. GIVE). The evidence comes from verbs with plural agreement as in the distributive plural "give to each of many":



"x gives to each of many"

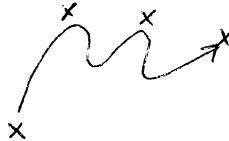
In signing a form like that in the example above, the FROM portion is articulated only once, but the TO portion distributes to three different points in space (the marking for plural agreement). A morphological and phonological analysis following an analysis of the realization of discontinuous morphemes similar to an auto-segmental analysis of vowel infixing in consonantal roots done by McCarthy (1981) for Arabic appears in Kegl (1981), Fowler (to appear), and Barss (1981). In these forms it is clear that both aspect and number marking apply to the separate morphemes within a complex transitive verb. This is because the assignment of locative agreement markers precedes the concatenation rule. Consider the following schema illustrating the distributive plural form of the verb meaning "give":

"to give to each of many"



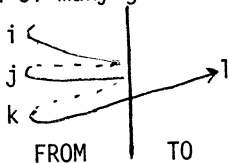
Phonetic evidence of the lack of participation of FROM in the plural agreement for Goal in [FROM#TO] comes from studies of point light displays used to study movement in morphologically complex signs (Poizner, Bellugi and Lutes-Driscoll (to appear), Bellman, Poizner, and Bellugi (to appear), Poizner (to appear) and Poizner, Newkirk and Bellugi (1980)), studies using electrogoniometers (elgons) to study pronation and supination of the hand and wrist (Battison, Green and Stungis (1979), studies using accelerometers as well as simple observation and videotape analysis (research in progress, Northeastern Univ.). These data show that the gestalt pattern for these verb forms appears to be of the following shape:

Pattern of Movement in Distributive Plural forms of verbs



Notice the longer movement corresponding to LOC_i FROM and the short repetitions corresponding to TO LOC_{j,k,l} [distributive]. Just the reverse phenomenon occurs when there is plural agreement on the Source:

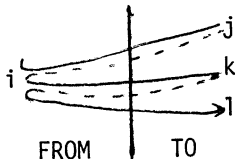
"each of many give to x"



LOC_{i,j,k}[dist][FROM#TO] LOC₁
 general holding classifier

An analysis that treated a transitive verb like "give" as morphologically simple would predict that a form meaning "give to each of many" would have the following form, which it does not:

*"give to each of many" (three separate unitary motions)



Thus, we conclude that transitive verbs (not counting their bimorphemic LOCs--LOC + the index) are themselves bimorphemic.

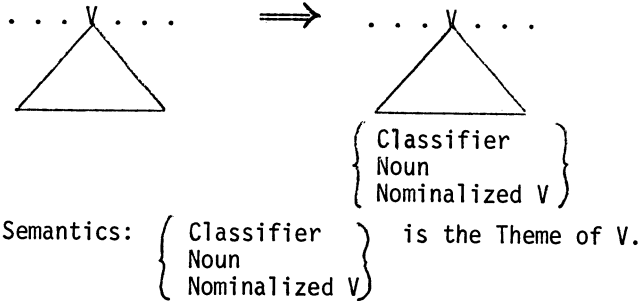
4. Further Expansions of the Lexicon

Conjoining and concatenating are processes that create only a finite number of lexical resources. Actually, the ASL lexicon can

be seen as a structurally defined set of verb classes consisting of simple motion and location verbs, and those complex forms derivable by concatenation and conjoining.² The classes are internally expanded by a recursive rule of Theme Incorporation--incorporating a simple nominal, or nominalized verb which itself must have an incorporated theme. Furthermore, the classes are proliferated by a systematic metaphorical extension of each of the basic verb classes to handle more abstract domains.

Theme incorporation involves an incorporation into the movement component of a verb, either simple or complex, of a noun, classifier or nominalized verb with its arguments--these arguments have, however, lost their indexes and are therefore not tied to locations in space which would make them coindexed with some noun. This incorporated nominal plays the role of Theme with respect to the verb. The rule is maximally simple. However, since it is recursive, it will allow for an infinite number of lexical items:

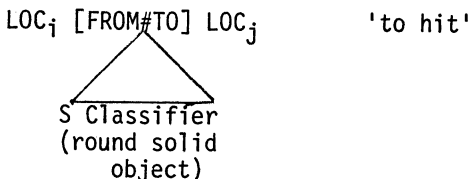
The Theme Incorporation Rule



The Theme is realized concurrent with the phonetic realization of the verb. Since the Theme is generally realized as either a hand shape or a projected area of space, whereas the verb is realized as motion or location in space, these two morphemes, though simultaneous can be separately recognized. In Themes which are nominalized there is some internal movement, but again it can be distinguished from the movement of the main verb into which it is incorporated.

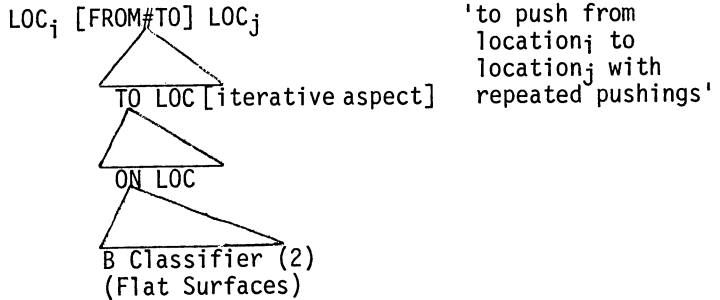
Examples of Verbs with Theme Incorporation

a. single embedding





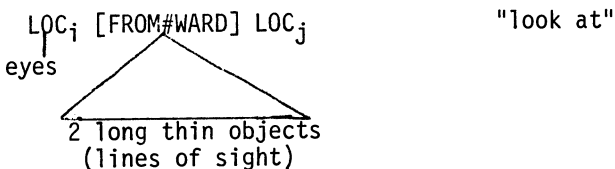
b. multiple embedding



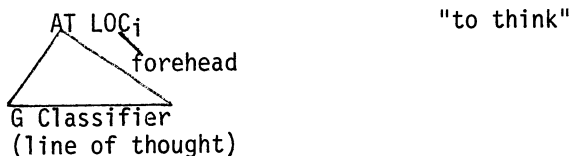
(to go from one location_i to another location_j while repeatedly moving to a location while being on the surface of a location realized as some volume of space by means of flat surfaces--in this case the hands)

Most of our examples have, for purposes of clarity, concerned the literal use of locational and directional verbs. However, it is our contention that these locative/directional verb stems form the basis of the entire verbal, in fact the entire grammatical system of ASL. We must address the issue of how more abstract verbs (e.g. emotion, perception, cognition or any other class of verbs) can be derived from the more basic locative system. The means by which this occurs is metaphorical extension, a notion which stands at the heart of arguments in favor of the locative hypothesis.

In ASL for example, thought, sight and sound are represented by the G Classifier (long thin object). They are lines of thought, lines of sight, and lines of sound which project outward from or inward to the body part associated with them. To "look at" something is "to FROM the eyes and orient toward (ward) an object using lines of sight":



To "think" is for "a line of thought to be located at the forehead":

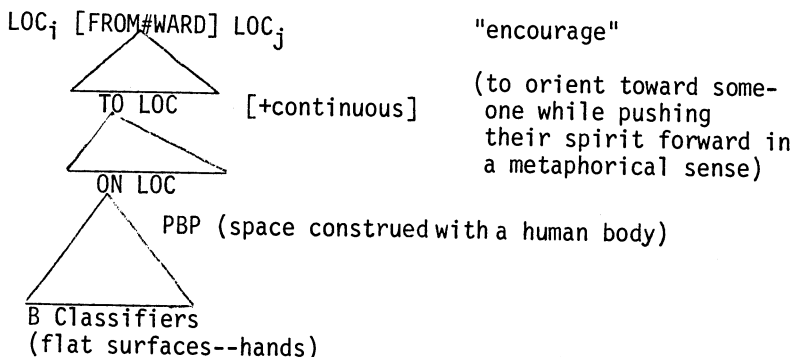


To "know" is the same verb as above except that it has a plural classifier--many lines of thought.

Interestingly, perception (to perceive sound, sight or thought) involves a vehicle as Theme. This is a metaphorical extension of the same vehicle classifier used to represent vehicles like cars, trucks or trains embedded in a [FROM#TO] verb whose right most LOC, the goal, is associated with the appropriate body part.

These metaphorical extensions become far more complicated. For example, in the same way that one can press a stamp onto the flat surface (of a letter), one can press a thought onto the same classifier, now representing a mental surface (IMPRESS).

And in the same way that one can continually push a rock in order to get it from one place to another, one can continually "push" a person to get them to do something as in the verb ENCOURAGE:



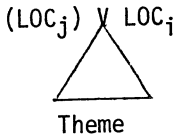
Compare this example with the verb for "push" given in the examples of Theme Incorporation.

The notion of metaphorical extension of spatial notions within the semantics of natural languages is by no means a new idea. However, because of the isomorphism between ASL's formational (phonetic) component, its morphology and its semantics we have a visually inspectable body of data. This isomorphism in ASL gives us a window onto the semantics of a natural language which affords us insights into the structure of language and meaning previously limited to the realm of speculation.

We argue that ASL is "semantically perspicuous": by this we mean that the morphological representation of ASL (basically also a morphophonological representation, since for our purposes each phoneme is also a morpheme) mediates a virtually isomorphic relationship (one-to-one mapping) between ASL's phonetics (physical realization in space) and its semantics (really an isomorphism between its phonetic and semantic representations). This fact gives us as it were a way to actually inspect the semantic structures of the language by looking at its phonetics and morphophonemics. The basis of the semantic structure of ASL, as is apparent from our

discussion above, turns out to be locative through and through. Assuming that all languages share an important core of lexical semantic representation, the semantic perspicuity of ASL may well throw important light on the nature of lexical semantic representation generally.

As we have seen, the basic structure of the ASL verb is as follows:



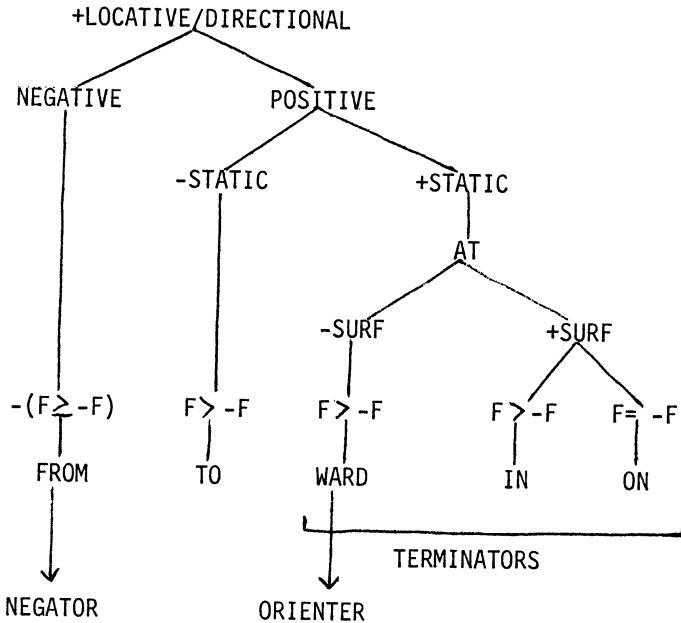
LOC_i is composed of two morphemes, LOC and INDEX. Phonetically, LOC_i is established by designating (through a pointing gesture) an arbitrary point in space (INDEX) to identify the region around it as a designated place or location, i.e. a LOC. Semantically, LOC refers to locations (e.g. here, there, New York, the center of the field) or entities viewed as occupying or themselves constituting locations (e.g. the boy, Mary). LOC picks up this reference by having its INDEX referentially co-indexed with the INDEX of some NP in the sentence or discourse (this is done by signing the INDEX of LOC_i at the same point in space where the INDEX of the NP was previously established). Thus the locative nature of nominals ("arguments") is clearly demonstrated, and referential indexes actually show up phonetically in ASL.

V in the structure above stands for a small set of locative/directional verbs (or combinations of such verbs) whose phonetics and semantics are a virtual map of each other. TO is phonetically realized by movement to a location (end point), and semantically means movement to a location (goal). Similarly, IN, ON, WARD have phonetic realizations that are isomorphic with their semantic representations. In order to indicate some of the possibilities of formalizing this isomorphism, let us use "F" to designate a force of attraction, a propulsion, or a movement to the location LOC_i (that is, the location phonetically realized as/semantically designated by LOC_i, since we want to be neutral as between phonetics and semantics; we might think of F as a force of attraction, propulsion, or movement to the center or INDEX of LOC_i). Let us use "-F" to designate some form of resistance to F (a contrary force, an opposed movement). We purposely leave the values of F and -F vague, so as to abstract away from details of physical relationships in the world, on the one hand, and properties of human movement in the articulation of ASL, on the other. Then TO can be represented by F > -F and FROM as the negative of this, -(F > -F) (if the force attracting an object to LOC_i is stronger than any force opposing or resisting F, then the object will move to LOC_i). We can also take a static perspective on this relationship: F > -F/static perspective. This names a relationship of being WARD LOC_i, i.e. oriented in the direction of, attracted toward, but not moving to LOC_i. If we consider the resistance to F to be some surface

(a surface of LOC_j , so that in this case LOC_j is taken as 2 or 3 dimensional), then an equilibrium of F and $-F$ (i.e. $F = -F$) at that surface names the relationship of being ON LOC_j . If the resistance of the surface of LOC_j were weaker than F (i.e. $F > -F$) then the object would (given the laws of physics) move into LOC_j . If we view this relationship from a static perspective, we get the relationship IN LOC_j (made in ASL with one hand thrust inside the spatial volume or enclosure realizing LOC_j). All of these relations can also be negated.

This view of these locative/directional relations yields the following "feature hierarchy," which encapsulates the phonetics and the semantics of these verbs depending upon how we interpret F and $-F$.

Feature Hierarchy



Notice that AT has a special place in the system. AT is simply static location (pure location), and represents a neutralization of WARD, IN, and ON. And note also that AT functions like an identity element in the system: $AT+ON=ON$, $AT+IN=IN$, $AT+FROM=FROM$, $AT+WARD=WARD$. There are also interesting complications with FROM. Semantically, there is controversy concerning whether the fact that FROM can designate a static or a dynamic relationship (in English for instance) is a matter of ambiguity, vagueness, or neutralization. Interestingly, this same complication appears in the phonetics of FROM in ASL, as we might expect given our claim of a near-isomorphism between ASL's semantics and phonetics. In ASL,

moving FROM is made with a hooked movement away from LOC_i (as if cancelling that location). Static FROM is made similarly, save that the movement is shorter and the end position is emphasized. It is not yet clear whether these are two verbs or alternations of one. Note, finally, that the whole system in our feature hierarchy is generated, in a sense, from TO by restricting or negating $F > -F$ in some way. This does not imply that TO is the unmarked or earliest locative/directional notation (it is not), only that it is the most or prototypical verbal notion (the entrance of TO makes the system a truly verbal system).

We assume that as our morphological rules combine and concatenate various simple verb stems together to form complex verbs, phonetic and semantic rules perform analogous combinations using the sorts of notions encoded in the feature hierarchy above. For example, $[TO+IN]LOC_i$ would be represented phonetically and semantically by

$F_1(F_2 > -F_2 / \text{static perspective vis-a-vis the surface of } LOC_i) > -F_1$

i.e. "attraction, propulsion, or movement to a state of being inside the surface(s) of LOC_i ." Of course, the details remain to be worked out, and our discussion here is meant merely to be suggestive.

In our grammar of ASL there is only one basic case for a verb argument, namely $LOC(ative)$. The semantic specification of the basic verb stem already specifies any further elaboration of this basic case. The semantic specification of AT specifies that the argument of AT is simple location, while the semantic specifications for IN and ON specify their arguments as "locations" in a more elaborated sense (including surfaces). The semantic specification of TO specifies that its argument is a Goal in the sense that TO represents motion attracted or propelled to LOC_i . The argument of FROM is still more elaborate. It is the negation (or cancelling) of a location, a non-goal, an anti-goal or, by extension, a Source when in concatenation with TO. The case notions Agent and Theme are also derivative in ASL, though in importantly different ways. Agent is not overtly marked and arises by construing (an interpretive rule) some argument, very often (but not always) the Source LOC (if it rates high on an agency hierarchy) as the Agent. In other cases, a semantically suitable NP not yet holding an argument relation to the verb or some unspecified but implied NP is taken as the Agent. Notice that the Agent is then often a double-order abstraction from a LOC (i.e. a Source LOC) whose own case relation is itself an extension of the simple notion location. Agency is construed in all cases where a plausible Agent can be construed, though Agency construal can be blocked by the use of a special marker consisting of a turning of the head and a quick breaking of eye gaze. Theme involves a process of morphologically incorporating a nominal element into the verb, as well as a set of semantic interpretive rules. ASL literally (phonetically) treats the Theme as "nominal accompaniment of movement or location," extending this notion figuratively to cover a full range of lexical meanings. Accompani-

ment is itself obviously a spatial-locative notion.

Thus, our approach remedies a recurrent redundancy in case theories: if the meaning of the verb already specifies the specific nature of its argument(s), there is no need to specify any "deep" cases but LOC(ative). Even this in fact is not really necessary. Since all our verbs are locative/directional, the notion "argument (of the verb)" is all that need really be specified, all the rest is supplied by the semantic specification of the verb. And so we establish the fundamental equation, for ASL, "argument of verb" = "location (LOC)." In fact, given our earlier remarks on TO (and AT as the identity element), we can say that the basic logical core of the verbal system is $[TO+AT]LOC_i$ = "movement to a location". The basis of the language, phonetically and semantically, is location and change of location, i.e. movement, just as the locative hypothesis would lead us to expect.

*The authors are co-equal and simply listed in alphabetical order. Part of the research for this paper was carried out while James Paul Gee was a visiting Research Associate in the Department of Psychology at Northeastern University. The authors would like to gratefully acknowledge that this research was supported in part by a grant from the U. S. Department of Health, Education, and Welfare (NS14923) to the Department of Psychology at Northeastern University. We would also like to thank Ed Klima and the ASL Laboratory at the Salk Institute for Biological Studies for feedback in the formative stages of this work; Elizabeth Closs Traugott, whose work helped inspire our approach (though she may regret this); Andy Barss, Kerry Green, and Mark Mandel for helpful discussion and criticism that, whatever its remaining flaws, have much improved this version of the paper; and Emily Dexter, Janie Simmons de Garcia, and Jane Wozniak for being very constructive readers of various drafts of this paper. Finally, we would like to thank the Language and Cognition Group in the Department of Psychology at Northeastern University for their continued support and encouragement. We must concede that the people who helped us aren't responsible for our errors, and probably don't agree with everything we've said.

This paper, which has its roots in work begun by Judy Kegl in 1976, is part of an on-going research project by the authors on the theoretical grammar of ASL. Subsequent papers will discuss Theme Incorporation and construal, Indexing, and a modular approach to the grammar of ASL.

Footnotes

¹There is much question concerning the nature of moving and static FROM. Is FROM to be treated as two separate lexical items or should its moving vs. static quality be considered ambiguous and sensitive to the verb stems with which it combines? FROM and TO are opposites and cannot co-occur in a complex derived intransitive, but the static counterpart does not conflict with the AT-type stems (AT, IN, ON). Furthermore, even when static phonetically,

there is some movement associated with FROM. This supports the non-separate nature of these two forms.

²For additional sources on verbs of motion and location in ASL see Supalla (1978), Newport and Supalla (1980) and Bernstein (1980). The sources, however, do not extend the locative/directional analysis to the language as a whole. They do contain interesting acquisitional evidence.

Bibliography

- Anderson, John M. (1972). The Grammar of Case. London & New York: Cambridge University Press.
- Aronoff, Mark (1976). Word Formation in Generative Grammar. Linguistic Inquiry Monograph 1, Cambridge, Mass: M.I.T. Press.
- Barss, Andy (1981). "Sequential Analysis of Modulated Verbs in ASL," manuscript, Hampshire College.
- Battison, Robin, Green, Kerry, and James Stungis (1979). "Instrumental Measurements of Signs," presented at Nato Advanced Study Institute Seminar on Recent Developments in Language and Cognition: Sign Language Research, University of Copenhagen.
- Bellman, Kristie, Poizner, Howard, and Ursula Bellugi (to appear). "Invariant Characteristics of Some American Sign Language Morphological Processes." In Robert Hoffmeister & James Paul Gee, eds. Special Issue of Discourse Processes devoted to ASL, Vol. 6, 1983.
- Bernstein, Mark (1980). Acquisition of Locative Expressions by Deaf Children Learning American Sign Language. Unpublished Doctoral Dissertation, Boston University.
- Fowler, Carol and Brad Rakerd (to appear). "Speech and Sign: Some Comments from the Event Perspective. Report for the Language Work Group." In William Warren & R. Shaw, eds. Proceedings from the First International Conference on Event Perception.
- Gruber, Jeffrey S. (1965). Studies in Lexical Relations. Doctoral Dissertation, M.I.T. Bloomington: Indiana University Linguistics Club.
- Hjelmslev, Louis (1935-7). "La Catagorie de Cas," Acta Jutlandia 7.1 (i-xii, 1-184), 9.2 (i=vii, 1-78).
- Jackendoff, Ray S. (1972). Semantic Interpretation in Generative Grammar. Cambridge, Mass.: M.I.T. Press.
- Jackendoff, Ray S. (1975). "Morphological and Semantic Regularities in the Lexicon," Language 51. 639-71.
- Jackendoff, Ray S. (1978). "Grammar as Evidence for Conceptual Structure." In Morris Halle, Joan Bresnan, and George A. Miller, eds. Linguistic Theory and Psychological Reality. Cambridge, Mass." M.I.T. Press.

- Kegl, Judy A. (1981). "ASL Phonology and Morphology: Questions from an Event Perspective," presentation to the Language Work Group, First International Conference on Event Perception (manuscript, Northeastern University).
- Lyons, John (1977). Semantics: 2. London & New York: Cambridge University Press.
- McCarthy, John (1981). "A Prosodic Theory of Nonconcatenative Morphology," Linguistic Inquiry 12. 373-418.
- Newport, Elisa and Ted Supalla (1980). "Clues from the Acquisition of Signed and Spoken Language." In Ursula Bellugi & Michael Studdert-Kennedy, eds. Signed and Spoken Language: Biological Constraints on Linguistic Form. Weinheim/Deerfield Beach, Florida/ Basel: Verlag Chemie.
- Poizner, Howard (to appear). "Visual and 'Phonetic' Coding of Movement: Evidence from American Sign Language," Science.
- Poizner, Howard, Newkirk, Don, and Ursula Bellugi (1980). "Processes Controlling Human Movement: Evidence from American Sign Language," Working Paper, Salk Institute for Biological Studies.
- Poizner, Howard, Bellugi, Ursula, and Ventia Lutes-Driscoll (to appear). "Perception of American Sign Language in Dynamic Point-Light Displays," Journal of Experimental Psychology: Human Perception and Performance.
- Supalla, Ted (1978). "Morphology of Verbs of Motion and Location in American Sign Language." In Frank Caccamise & Doin Hicks, eds. American Sign Language in a Bilingual, Bicultural Context: Proceedings of the Second National Symposium on Sign Language Research and Teaching.
- Traugott, Elizabeth C. (1974). "Explorations in Linguistic Elaboration: Language Change, Language Acquisition, and the Genesis of Spatio-Temporal Terms." In J.M. Anderson & C. Jones, eds. Historical Linguistics I: Syntax, Morphology, Internal and Comparative Reconstruction. Amsterdam: North-Holland.
- Traugott, Elizabeth C. (1975). "Spatial Expressions of Tense and Temporal Sequencing," Semiotica 15. 207-30.
- Traugott, Elizabeth C. (1977). "Natural Semantax: Its Role in the Study of Second Language Acquisition." In S. Pit Corder & E. Roulet, eds. The Notions of Simplification, Interlanguages and Pidgins and their Relation to Second Language Pedagogy. Geneva: Librairie Droz.
- Traugott, Elizabeth C. (1978). "On the Expressions of Spatio-Temporal Relations in Language." In Joseph H. Greenberg, ed. Universals of Human Language, Vol. 3: Word Structure.