pre-final draft of paper to appear in :
From perception to meaning:
Image Schemas in Cognitive Linguistics
ed. by Beate Hamp. Mouton de Gruyter

The Fundamental System of Spatial Schemas in Language

Leonard Talmy

Department of Linguistics and Center for Cognitive Science
University at Buffalo, State University of New York

1. Introduction[1]

1.1 Overview of the system of spatial schemas

Linguistic research to date has determined many of the principles that govern the structure of the spatial schemas represented by closed-class forms across the world's languages. contributing to this cumulative understanding have, for example, been Gruber 1965, Fillmore 1968, Leech 1969, Clark 1973, Bennett 1975, Herskovits 1982, Jackendoff 1983, Zubin and Svorou 1984, as well as myself, Talmy 1983, 2000a, 2000b). It is now feasible to integrate these principles and to determine the comprehensive system they belong to for spatial structuring in spoken language. The finding here is that this system has three main parts: the componential, the compositional, and the augmentive.

In the componential part of the system, there is a relatively closed inventory of fundamental spatial elements that in combination form whole schemas. Further, these elements fall into a relatively closed set of categories. Accordingly, there is a relatively closed number of particular elements in each category -- hence, of spatial distinctions that each category can ever mark -- and this number is generally small. The inventory is universally available. That is, any language can draw on the elements and categories of the inventory for its spatial schemas.

[1] This paper is an expanded and more detailed version of that portion of Talmy (2003) that deals with spoken language.

In the compositional part of the system, selected elements of the inventory are combined in specific arrangements to make up the whole schemas represented by individual closed-class spatial forms. Each such whole schema that a closed-class form represents is thus a "pre-packaged" bundling together of certain elements in a particular arrangement. Each language has in its lexicon a relatively closed set of such pre-packaged schemas (larger than that of spatial closed-class forms, due to polysemy) that a speaker must select among in depicting a spatial scene.

Finally, the augmentive part of the overall system pertains to single whole schemas. Such already-formed individual schemas can exhibit various forms of generalization. Thus, a schema can either include a property that lets it cover a full family of schemas, or it can undergo a process that extends or deforms its basic form to yield certain nonbasic forms. Such generalizations of schemas are a necessary part of the overall system so that the relatively closed set of spatial schemas in any given language can represent a greater range of spatial situations.

1.2 The Target of Analysis

The analysis to be undertaken here rests on a universal linguistic property. All languages exhibit two different subsystems of meaning-bearing forms. One is the "open-class" or "lexical" subsystem that, in any given language, comprises all of its open classes. An open class has relatively many forms that are readily augmented -- for example, commonly, the roots of nouns, verbs, or adjectives. The other is the "closed-class" or "grammatical" subsystem. A closed class has relatively few forms that are difficult to augment -- for example, bound forms like the case inflections on a noun, or free forms like conjunctions or prepositions. As argued in Talmy (2000a, ch. 1), these subsystems basically perform two different functions: open-class forms largely contribute conceptual content, while closed-class forms determine conceptual structure. Since our concern is with systematic spatial structuring in language, our examination focuses on the spatial schemas represented by closed-class forms. Thus, we do not examine the spatial configurations represented by open-class forms like the English noun *spiroal*, the adjective *square*, or the verb *(to) zigzag*, which can be idiosyncratic without conforming to some organized framework. We instead examine only the spatial schemas represented by closed-class forms, as described next.

The spatial schemas represented by closed-class forms[2] fall into two main groups. The schemas of one group pertain to paths or sites. The closed-class forms for this group are of different types, as shown in (1).

[2] Closed-class forms can of course represent other conceptual domains than space, e.g., tense, aspect, gender, and causation.

(1)
a. forms in construction with a nominal, e.g.,
   i. prepositions like English *across* (as in *across the field*)
   ii. noun affixes like the Finnish illative suffix *-:n*‘into’
   iii. prepositional complexes like English *in front of*
   iv. constructions with a "locative noun" like Japanese *ue* ‘top surface’, (
      (as in *teeburu no ue ni* ‘table GEN top at’ = "on the table")
b. forms in construction with a verb, e.g.,
   i. free verb satellites like English *out, back, apart*
      (as in *They ran out / back / apart*)
   ii. bound verb satellites like Atsugewi *-ic’t* ‘into liquid’
c. deictic determiners and adverbs like English *this* and *here*
d. indefinites, interrogatives, relatives, etc.,
   like English *everywhere / whither / wherever*
e. qualifiers like English *way* and *right*
   (as in *It’s way / right up there*)
f. adverbials like English *home*
   (as in *She isn’t home*).

The schemas of the second group pertain to the shape or disposition of objects. closed-class forms for this group include types like those in (2).

(2)
a. markers for plexity or state of boundedness,
   like English *-s* for multiplexing (as in *birds*)
   or *-ery* for debounding (as in *shrubbery*)
b. numeral classifiers like Korean *chang* ‘planar object’
c. forms in construction with the verb like some Atsugewi Cause prefixes,
   e.g., *cu-* ‘as the result of a linear object moving axially into the Figure’

2. The Basic Spatial Elements and their Categories

2.1 Methodology for Determining the Elements and Categories

A particular methodology is here used to determine fundamental spatial elements in language. We start with any closed-class spatial morpheme in any language, considering the full schema that it expresses and a spatial scene that it can apply to. We then determine any factor that can be changed in the scene so that

the morpheme no longer applies to it. Each such factor must accordingly correspond to an essential element in the morpheme's schema.

To illustrate, consider the English preposition *across* and the scene it refers to in *The board lay across the road*. Let us here grant the first two elements in the *across* schema (demonstrated elsewhere). The first element, shown in (3a), is that a Figure object (here, the board) is spatially related to a Ground object (here, the road). The second element, shown in (3b), is that the Ground is ribbonal -- that is, a plane with two roughly parallel line edges that are as long as or longer than the distance between them (what Herskovits (1982) terms a "strip"). The remaining elements can then be readily demonstrated by the methodology. Thus, a third element is that the Figure is linear, generally bounded at both ends. If the board were instead replaced by a planar object, say, some wall siding, one could no longer use the original *across* preposition but would have to switch to the schematic domain of another preposition, that of *over*, as in (3c). A fourth element is that the axes of the Figure and of the Ground are roughly perpendicular. If the board were instead aligned with the road, one could no longer use the original *across* preposition but would again have to switch to another preposition, *along*, as in (3d). Additionally, a fifth element of the *across* schema is that the Figure is parallel to the plane of the Ground. In the referent scene, if the board were tilted away from parallel, one would have to switch to some other locution such as those in (3e). A sixth element is that the Figure is adjacent to the plane of the Ground. If the board were lowered or raised away from adjacency, even while retaining the remaining spatial relations, one would need to switch to locutions like those in (3f). A seventh element is that the Figure's length is at least as great as the Ground's width. If the board were replaced by something shorter, for example, a baguette, while leaving the remaining spatial relations intact, one would have to switch from *across* to *on*, as in (3g). An eighth element is that the Figure touches both edges of the Ground. If the board in the example retained all its preceding spatial properties but were shifted axially, one would have to switch to some locution like that in (3h). Finally, a ninth element is that the axis of the Figure is horizontal (the plane of the Ground is typically, but not necessarily, horizontal). Thus, if one changes the original scene to that of a spear hanging on a wall, one can use *across* if the spear is horizontal, but not if it is vertical, as in (3i).

(3) target sentence: The board lay across the road.
(F = Figure; G = Ground)
a. F is spatially related to G
b. G is ribbonal
c. F is linear (and generally bounded at both ends)
-- vs. The wall siding lay over the road.
d. the axes of F and G are roughly perpendicular
-- vs. The board lay along the road.
e. F is parallel to the plane of G
-- vs. The board is sticking out of / into the road.
f. F is adjacent to the plane of G
-- vs. The board lay (buried) in the road. / The board was suspended above the road.
g. F's length is at least as great as G's width
-- vs. The baguette lay on the road.
h. F touches both of G's edges
-- vs. The board lay over one edge of the road.
i. the axis of F is horizontal
(the plane of G is typically, but not necessarily, horizontal)
The spear hung across the wall.
-- vs. The spear hung up and down on the wall.

Thus, from this single example, the methodology shows that at least the following elements figure in closed-class spatial schemas: a Figure and a Ground, a point, a line, a plane, a boundary (a point as boundary to a line, a line as boundary to a plane), parallelness, perpendicularity, horizontality, adjacency (contact), and relative magnitude.

In the procedure of systematically testing candidate factors for their relevance, the elements just listed have proved to be essential to the selected schema and hence, to be in the inventory of fundamental spatial elements. But it is equally necessary to note candidates that do not prove out, so as to know which potential spatial elements do not serve a structuring function in language. In the case of *across*, for example, one can probe whether the Figure, like the board in the referent scene, must itself be planar -- rather than simply linear -- and coplanar with the plane of the Ground. It can be seen, though, that this is not an essential element to the *across* schema, since this factor can be altered in the scene by standing the board on edge without any need to alter the preposition, as in (4).

(4) The board lay flat / stood on edge across the road.

Thus, coplanarity is not shown by *across* to be a fundamental spatial element. However, it does prove to be so in other schemas, and so in the end must be included in the inventory. This is seen, for example, for one of the schemas

represented by English *over*, as in (5a). Here, both the Figure and Ground must be planes and coplanar with each other. If the tapestry here were changed to something linear, say, a string of beads, it is no longer appropriate to use *over* but only something like *against*, as in (5b).

(5) a. The tapestry hung over the wall.
b. The string of beads hung *over / against the wall.

Now, another candidate element -- that the Figure must be rigid, like the board in the scene -- can be tested and again found to be inessential to the *across* schema, since a flexible linear object can be substituted for the board without any need to change the preposition, as seen in (6).

(6) The board / The cable lay across the road.

Here, however, checking this candidate factor across numerous spatial schemas in many languages might well never yield a case in which it does figure as an essential element and so would be kept off the inventory.

This methodology affords a kind of existence proof: it can demonstrate that some element does occur in the universally available inventory of structural spatial elements since it can be seen to occur in at least one closed-class spatial schema in at least one language. The procedure is repeated numerous times across many languages to build up a sizable inventory of elements essential to spatial schemas.

The next step is to discern whether the uncovered elements comprise particular structural categories and, if so, to determine what these categories are. It can be observed that for certain sets of elements, the elements in a set are mutually incompatible -- only one of them can apply at a time at some point in a schema. Such sets are here taken to be basic spatial categories. Along with their members, such categories are also part of language's fundamental conceptual structuring system for space. A representative sample of these categories is presented in the next section.

It will be seen that these categories generally have a relatively small membership. This finding rests in part on the following methodological principles. An element proposed for the inventory should be as coarse-grained as possible -- that is, no more specific than is warranted by cross-schema analysis. Correlatively, in establishing a category, care must be taken that it include only the most generic elements that have actually been determined -- that is, that its membership have no finer granularity than is warranted by the element-abstraction procedure. the said but no: it

To illustrate, the principle of mutual incompatibility yields a spatial category of "relative orientation" between two lines or planes, a category with perhaps only two member elements (both already seen in the *across* schema): approximately parallel and approximately perpendicular. Some evidence additionally suggests an intermediary "oblique" element as a third member of the category. Thus, some English speakers may distinguish a more perpendicular sense from a more oblique sense, respectively, for the two verb satellites *out and off*, as in (7). In any case, though, the category would have no more than these two or three members. Although finer degrees of relative orientation can be distinguished by other cognitive systems, say, in visual perception and in motor control, the conceptual structuring subsystem of language does not include anything finer than the two- or three-way distinction. The procedures of schema analysis and cross-schema comparison, together with the methodological principles of maximum granularity for elements and for category membership, can thus lead to a determination of the number of structurally distinguished elements ever used in language for a spatial category.

(7) A secondary pipe branches out / off from the main sewer line.

2.2 Sample Categories and Their Member Elements

The fundamental categories of spatial structure in the closed-class subsystem of language fall into three classes according to the aspect of a spatial scene they pertain to: the segmentation of the scene into individual components, the properties of an individual component, and the relations of one such component to another. In a fourth class are categories of nongeometric elements frequently found in association with spatial schemas. A sampling of categories and their member elements from each of these four classes is presented next. The examples provided here are primarily drawn from English but can be readily multiplied across a diverse range of languages (see Talmy 2000a, ch. 3).

2.2.1 Categories Pertaining to Scene Segmentation

The class designated as scene segmentation may include only one category, that of "major components of a scene", and this category may contain only three member elements: the Figure, the Ground, and a Secondary Reference Object. Figure and Ground were already seen for the *across* schema. But schema comparison shows the need to recognize a third scene component, the Secondary Reference Object -- in fact, two forms of it: one that is encompassive of the Figure and Ground and one that is external to them. The English preposition *near*, as in (8a), specifies the location of the Figure (the lamp) only with respect to the Ground (the TV) -- it could be anywhere roughly within a sphere centered on the TV provided the distance between them is relatively small. But localizing the Figure with the preposition *above*, as in (8b), requires knowledge not only of where the Ground

object is, but also of the encompassive earth-based spatial grid, in particular, of its vertical orientation. Thus, *above* requires recognizing three components within a spatial scene, a Figure, a Ground, and a Secondary Reference Object of the encompassive type.

(8) a. The lamp is near the TV. b. The lamp is above the TV.

Comparably, the schema of *past*, as in (9a), only relates John as Figure to the border as Ground. An observer could felicitously say this sentence on viewing the event through binoculars from either side of the border. But (9b) with the preposition *beyond* could be said only by an observer on the initial side of the border, the side now opposite John. Hence, the *beyond* schema establishes a perspective point at that location as a Secondary Reference Object -- in this case, one of the external type -- in addition to its specifications for Figure and Ground.

(9) a. John is past the border. b. John is beyond the border.

Closed-class schemas do not seem to require any further major scene components beyond the three just cited -- Figure, Ground, and Secondary Reference Object -- for example, something like a Tertiary reference Object. However, several scene components that are minor, or specialized, or derivatively dependent on the presence of certain other spatial phenomena, do occur in schemas. Examples of these -- all illustrated below -- are the path line formed by a moving point Figure, the spin axis defined by a rotating object, and a "meta-Figure" such as an object that rotates or exhibits expansion or contraction. The main reason for recognizing such cases as kinds of scene components in their own right is that many of the same categories of basic spatial properties that belong to the remaining two classes, treated in the following sections, and that can apply to the three major scene components described above, can also apply to these newly proposed scene components. It is not clear how to treat such further scene components within our proposed framework. On the one hand, they could be added to the present category, which would then drop the term "major" from its label, or they could be placed in a new category, "minor components of a scene". Alternatively, the processes at work in the compositional part of the schema system in language -- the ones that select and arrange the basic elements in the componential part of the system -- can be considered capable of operating at least in part sequentially. Then one of the so-called minor scene components, such as the path of a moving Figure, can first be formed through the assembling of one set of basic components and then, as a new higher-level entity, be amenable to the addition of a further set of basic components.

2.2.2 Categories Pertaining to an Individual Scene Component

The second class of spatial categories comprises a number of categories that pertain to the characteristics of an individual spatial scene component. As just discussed, such a scene component can either be one of the three within the "major components of a scene" category, or one of the minor scene components, however these are assumed to arise. Several categories in this class are presented next. In addition to this sampling, some ten or so further categories pertaining to properties of an individual scene component, each category with a small number of fixed contrasts, can be readily identified.

Dimension.

One category in this class is that of "dimension". It has four member elements: zero dimensions for a point, one for a line, two for a plane, and three for a volume. Some English prepositions require a Ground object schematizable for only one of the four dimensional possibilities. Thus, the schema of the preposition *near* as in *near the dot* requires only that the Ground object be schematizable as a point. The preposition *along*, as in *along the trail*, requires that the Ground object be linear. *Over* as in *a tapestry over a wall* requires a planar Ground. And *throughout*, as in *cherries throughout the jello*, requires a volumetric Ground. it might at first be thought unfair to use this category as evidence of constrained membership since, after all, there are only four dimensions that could be members. But the noteworthy observation does emerge that each of these four dimensions can singly play a role in a spatial schema, so that all four -- not some lesser number -- must be included in the inventory. In any case, all the remaining spatial categories will have selective memberships.

Number.

A second category is that of "number". It seems to have only the following four members: one, two, several, and many. Some English prepositions require a Ground comprising objects in one or another of these numbers. Thus, *near* requires a Ground consisting of just one object, *between* of two objects, *among* of several objects, and *amidst* of numerous objects, as in (10). The category of number appears to lack any further members -- that is, closed-class spatial schemas in languages around the world seem never to incorporate any other number specifications -- such as ‘three’ or ‘even-numbered’ or ‘too many’.

(10) The basketball lay near the boulder / between the boulders /
among the boulders / amidst the cornstalks.

Motive State.

A third category is that of "motive state". It has only two members: motion and stationariness. Several English prepositions mark this distinction for the Figure. Thus, in one of its senses, *at* requires a stationary Figure, as in (11a). But *into* requires a moving Figure, as in (11b).

(11) a. I stayed / *went at the library. b. I went / *stayed into the library.

Other prepositions mark this same distinction, but for the Ground object (in conjunction with a Figure that is moving). Thus, *up to* requires a stationary Ground (here, the deer), as in (12a). But *after* requires a moving Ground, as in (12b). The issue of whether a Ground is stationary or moving itself can be understood in either of two ways. One way is to regard the terrain around the Ground as a Secondary Reference Object with respect to which the Ground is either fixed or moving. The other is to explain the moving Ground notion in terms of a nesting of one Figure-Ground situation within another -- the solution adopted in Talmy (2000a, ch. 5). By this interpretation, for example, in the sentence *The lion caught up with the deer*, the lion as Figure reaches the deer as Ground, at the same time that both lion and deer together as a distinct composite type of Figure move relative to the terrain as a distinct Ground. This nested arrangement holds as well for (12b) except that in the first Figure-Ground relationship, the lion as Figure remains fixed relative to the deer as Ground, since they retain the same distance from each other as they both run along.

(12) a. The lion ran up to the deer. b. The lion ran after the deer.

The motive state category seems to be limited to the two cited members, stationariness and motion. Apparently no spatial schemas mark such additional distinctions as motion at a fast vs. slow rate, or being located at rest vs. remaining located fixedly.

State of Boundedness

A fourth category is that of "state of boundedness". It too has only two members: bounded and unbounded. The English preposition *along* requires that the path of a moving Figure be unbounded, as shown by its compatibility with a temporal phrase in *for* but not *in*, as in (13a). But the spatial locution *the length of* requires a bounded path, as shown by its reverse compatibility with the two temporal constructions, as seen in (13b).

(13) a. I walked along the pier for 10 minutes / *in 20 minutes.
b. I walked the length of the pier in 20 Minutes / *for 10 minutes.

As it happens, most motion prepositions in English have a polysemous range that covers both the unbounded and the bounded sense. Thus, *through* as in (14a) refers to traversing an unbounded portion of the tunnel's length. But in (14b), it refers to traversing the entire bounded length.

(14) a. I walked through the tunnel for 10 minutes.
b. I walked through the tunnel in 10 minutes.

While some spatial schemas have the bounded element at one end of a line and the unbounded element at the other end, apparently no spatial schema marks any distinctions other than the two cited states of boundedness. For example, there is no cline of gradually increasing boundedness, nor a gradient transition. This is the case even though just such a "clinal boundary" appears elsewhere in our cognition, as in geographic perception or conception, e.g., in the gradient demarcation between full forest and full meadowland (Mark and Smith, 2004).

Type of Geometry.

Continuing the sampling of this class, a fi fth category is "type of geometry" with two members: rectilinear and radial. The radial member in turn is of two main kinds, motion or location either along a radious -- **coradial** -- or about a center -- **circumcentric**. The category as a whole can apply to a range of different scene components. For example, it can apply to an encompassive Secondary Reference Object to yield reference frames of the two geometric types. Thus, in a subtle effect, the English verb satellite *away*, as in (15a), tends to suggest a rectilinear reference frame in which one might picture the boat moving rightward along a corridor or sea lane with the island on the left (as if along the x-axis of a Cartesian grid). But *out*, as in (15b), tends to suggest a radial reference frame in which the boat is conceptualized as moving from a center point along a radius through a continuum of concentric circles.

(15) a. The boat drifted further and further away from the island.
b. The boat drifted further and further out from the island.

The radial geometry in the preceding example sentence was of the coradial kind, that is, the kind involving motion or location along a radius. As noted, radial geometry can also be of the circumcentric kind, with motion or location about a center. In turn, this kind has two main forms: **revolutional**, that is, motion or location along a typically linear orbit curved around a center, and **rotational**, that is, the spinning of an object about a point within itself, typically its

center. Note that what is here termed "center" can range, according to the situation, over a point, an axis, an interior area, etc.

To illustrate the revolution form, the example in (16) represents a moving point Figure describing a line itself curved about a central point as Ground.

(16) I walked around the maypole.

Note that certain related usages of *around* can be explained either in terms of the nesting of one Figure-Ground situation within another, as described earlier in the section on "motive state", or in terms of a notion of a Figure concurrently relating in different ways to two distinct Grounds -- the solution adopted here. Thus, the sentence in (17a) can be understood as a conflation of an underlying form with two paths and Grounds -- where one of the Grounds is implicit in the situation -- something like: *I ran around [a central area] along the track*. Similarly, the sentence in (17b) can be understood to refer when unpacked to something like: *I walked around [the castle] alongside the castle wall*. These additional *around* usages are part of a more extensive pattern in English. The same pattern holds for the prepositions in *I drove across / over the bridge*, which can be taken to represent *I drove across / over [a terrain concavity] along the bridge*. Comparably, *I climbed out the window*, can be taken to represent *I climbed out of [an enclosure] through the window*. And *I crawled up the chimney* can be taken to represent *I crawled up through the chimney*.

(17) a. I ran around the track. b. I walked around the castle wall.

Continuing with the circumcentric kind of radial geometry, its second form, rotation, pertains to an object rotating about a point within itself, prototypically its center, as in (18). In the analysis of rotation of this sort in Talmy (2000a, ch. 5), what is truly Figural in the situation is a set of multiple Figures: the points or parts of the rotating object. Each of these executes a circular path around a center -- that is, exhibits the revolving form of circumcentric motion --
as treated in the preceding example. The object as a whole, then, is not a Figure, but what I term a *meta-Figure*. This can in turn serve as a further type of scene component to which spatial categories and their member concepts might apply. Here, the relevant senses of the satellite *around* and the preposition *about* pertain to this meta-Figure.

(18) The top spun around. / The top spun about its central axis.

State of Consolidation

A sixth category is that of "state of consolidation" with apparently two members: compact and diffuse. This category applies to 1-, 2-, or 3-dimensional regions of space. The compact member concept indicates that such a region is of relatively smaller ambit, and is typically associated with the further concepts that the region is bounded and that the speaker's measurement of it is relatively precisional. The diffuse member concept indicates that a region is of relatively larger ambit, and is typically associated with the further concepts that the region is unbounded and that the measurement of it is approximative. If an object is located in such a region, the two member concepts often have the further associations that the object's specific location within the region is relatively certain or uncertain, respectively.

To illustrate, the English preposition *at*, as in (19a), suggests a relatively compact 2-dimensional region surrounding a Ground object (the landmark) in which a Figure object (the hiker) is located and hence can be found with some certainty. By contrast, the preposition *around* in (19b) indicates that the region is relatively diffuse and hence that the Figure's specific location within it is relatively uncertain. Consistent with this distinction, the word *somewhere* can be readily added before the preposition in (19b) but not before the preposition in (19a).

(19) a. The other hiker will be waiting for you at the landmark.
b. The other hiker will be waiting for you around the landmark.

While the anaphoric locative pronoun *there* as in (20a) might be best considered neutral to the distinctions of the present category, its counterpart *thereabouts* as in (20b) surely includes the diffuse concept in its schema.

(20) a. Go to the market; you'll find her there.
b. Go to the market; you'll find her thereabouts.

For an example outside English, the distinctions of the present category can be seen marked in Malagasy (Imai, 2003), by two demonstrative locative adverbs. They are distance-neutral, but to gloss them for proximal usage, *eto* means 'here within this bounded region', typically indicated with a pointing finger, while *ety* means 'here spread over this unbounded region', typically indicated with a sweep of the hand.

Phase of Matter

A final category in this sampled series is "phase of matter", which mainly pertains to a volume of space. It has three main members, vacancy (empty space / air), solid, and liquid, and perhaps a fourth member, fire. By another

interpretation, this category could instead be placed in the class of nongeometric categories discussed in section 2.2.4. I place it here in a geometric class, though, on the grounds that the main distinction among the category members is between whether a volume of space is filled or not -- a geometric property -- and that, in the filled case, the category members differ on the basis of how the filling moves internally: largely immobile, readily movable, or actively moving -- properties that are at least akin to those of the state of motion category.

This category can be readily illustrated in Atsugewi (Talmy, 2000b, ch. 1). The directional verb suffixes of Atsugewi, each of which represents a specific path followed with respect to a certain kind of Ground object, include a number of forms that are specific to a particular phase of matter. For example, among those that subdivide the English 'into' path concept, the suffix *-ipsnu* specifies motion into the empty space of a volumetric enclosure. The suffix *-ik's* specifies motion horizontally into solid matter (as in chopping an ax into a tree trunk). The suffix *-ic't* specifies motion into liquid. And *-caw* specifies motion into a fire.

The phase of matter category figures even in English in some of its prepositions, albeit covertly. Thus, *in* can apply to a Ground object of any phase of matter, whereas *inside* can apply only to one with empty space as in (21a), but not to one of any other phase of matter, as seen in (21b).

(21) a. The rock is in / inside the box.
b. i. The rock is in / *inside the ground.
ii. The rock is in / *inside the puddle of water.
iii. The rock is in / *inside the fire.

Other than the ones listed above, the present category apparently need not include as members any further phases or consistencies of matter, such as powder or viscous material or ooze (like mud).

2.2.3 Categories Pertaining to the Relation of One Scene Component to Another

A third class of categories pertains to the relations that one scene component can bear to another. In addition to the five categories presented below, some further ten categories of the same class can be readily identified, each with a relatively small number of members.

Relative Orientation

One such category was described earlier, that of "relative orientation", that is, the angle between two lines, two planes, or a line and a plane. This category

appears to have two or three members: (roughly) parallel, (roughly) perpendicular, and perhaps oblique. For example, the linear path of the Figure (the caterpillar) in (22a) is represented as parallel to the linear Ground (the crack) by *along*, and as perpendicular to it by *across*. And, repeating an earlier example, the *out* of (22b) seems to contrast with the *off* in depicting a more perpendicular as against a more oblique angle, respectively.

(22) a. The caterpillar crawled along / across the crack in the sidewalk.
b. A secondary pipe branches out / off from the main sewer line.

Further evidence of a need to include a perpendicular/oblique distinction in the present category comes from the contrast between two "Cause prefixes" in Atsugewi (see Talmy 2000b, ch. 2). Both refer to a linear object impinging axially on a Figure in a way that causes it to move or remain located. But *cu-* refers to the linear instrument impinging on the Figure perpendicularly, as in such causal actions as 'by poking' or 'by prodding'. On the other hand, *ra-* refers to such an instrument impinging obliquely on the Figure, as in such actions as 'by poling a canoe', 'by piercing a needle through cloth as in sewing', or 'by propping something up with a stick leaned against it'.

The earth-based spatial grid incorporates a member of the present category in that its vertical axis is perpendicular to its horizontal plane. Further, spatial schemas often represent an element as being parallel to one or the other of these two earth-grid components. Thus, with the earth-grid functioning as the Ground, the satellites or adverbs in (23a) indicate that the path of the moving Figure (the balloon) is parallel to the earth's vertical axis. And with the earth-grid functioning as the Secondary Reference Object, the satellites in (23b) represent the path of the Figure (the bat) as parallel to the earth's vertical axis, while that in (23c) represents the path as parallel to the earth's horizontal plane. Finally, to repreise an earlier locative example, the preposition in (23d) indicates that the line connecting the Figure and the Ground (the lamp and the TV, respectively) is parallel to the earth's vertical axis.

(23) a. The balloon floated up(wards). / down(wards).
b. The bat flew up to the ceiling of the cavern. / down to the floor of the cavern.
c. The bat flew over to a ledge in the cavern.
d. The lamp is above the TV.

A further application of orientation relative to the earth grid is seen for schemas involving the rotation of an object about its center, discussed above under the "type of geometry" category. Such rotation defines a "spin axis". Specifically, the rotating object is a meta-Figure, as defined above; points in this

object move in concentric circles that lie on a plane (or on a set of parallel planes); and the spin axis is a line through the center of those circles perpendicular to the plane(s). Now, the present category of relative orientation can be considered to include a subcategory, that of "orientation of spin-axis", which then has two members, vertical and horizontal. That is, the spin-axis is either parallel to the earth grid's vertical axis or to its horizontal plane. And English has two verb satellites that distinguish rotation about such differently oriented axes. These are *around* and *over*, respectively, as seen in (24). Thus, the pail in (24a) is understood to rotate about a vertical axis when *around* is used, but about a horizontal axis in (24b) when *over* is used.

(24) a. I turned the pail around. b. I turned the pail over.

Degree of Remove.

A second category in the present class is that of "degree of remove" that one scene component has relative to another. This category appears to have four or five members, two with contact between the components -- coincidence and adjacency -- and two or three without contact -- proximal, perhaps medial, and distal remove. Some pairwise contrasts in English reveal one or another of these member elements for a Figure relating to a Ground. Thus, the locution *in the front of*, as in (25a), expresses coincidence, since the carousel as Figure is represented as being located in a *part* of the fairground as Ground. But *in front of* (without a *the*) as in (25b) indicates proximality, since the carousel is now located outside the fairground and near it but not touching it.

(25) a. The carousel is in the front of the fairground.
b. The carousel is in front of the fairground.

The distinction between proximal and distal can in turn be teased out by noting that *in front of* can only represent a proximal but not a distal degree of remove, as seen in the fact that one can say (26a) but not (26b). On the other hand, *above* allows both proximal and distal degrees of remove, as seen in (26c), and so does not serve to show the need for the distinction.

(26) a. The carousel is twenty feet in front of the fairground.
b. *The carousel is twenty miles in front of the fairground.
c. The hawk is one foot / one mile above the table.

The distinction between adjacency and proximality is shown by the sense distinction between the prepositions *on* and *over*. Thus, the *on* in (27a) requires that the Figure be in adjacent contact with the Ground, whereas the *over* in (27b) requires that the Figure in fact not be in contact with the Ground but proximal to

it.

(27) a. The fly is on the table. b. The fly is over the table.

A need to include a fifth category member of 'medial degree of remove' -- midway between the proximal and distal degrees of remove -- might come from languages with a 'here / there / yonder' kind of distinction in their deictic adverbs or demonstratives. English might covertly retain something of this three-way distinction in that the locative adverbial *away*, as used in an expression like that in (28) seems to indicate a distance greater than any proximal or medial distance that an adverbial or demonstrative uttered at that same location might ordinarily represent.

(28) Mary is away.
<said to someone asking for her at the door of her home>

Degree of dispersion

A third category in this series is that of "degree of dispersion" with two members: sparse and dense. To begin with, English can represent a set of multiple Figures as being located adjacent to or coincident with a Ground object in a way that is neutral to the presence or absence of dispersion. This is seen, for example, in the sentences in (29) showing a set of 0-demensional peas in relation to a 1-dimensional knife, a 2-dimensional tabletop, and a 3-dimensional portion of aspic.

(29) There are peas on the knife. / on the table. / in the aspic.

But in representing dispersion as present, English can (or must) also indicate its degree. Thus, a sparse degree of dispersion is indicated by the addition of the locution *here and there*, optionally together with certain preposition shifts, as seen in (30).

(30) a. There are peas here and there on / along the knife.
b. There are peas here and there on / over the table.
c. There are peas here and there in the aspic.

To indicate a dense degree of dispersion, English has the three specialized forms *all along, all over* and *throughout*, as seen in (31).

(31) There are peas all along the knife. / all over the table. /
throughout the aspic.

Note that such representation of dense dispersion -- despite the occurrence of the word *all* in some of the English forms -- does not require an exhaustive covering or filling of the Ground object, but rather only a certain representative distribution relative to the Ground's total spatial extent. It appears that no closed-class forms across languages distinguish between such exhaustively dense distribution and merely representatively dense distribution, nor between any further distinctions of dispersion beyond the two cited concepts of sparse and dense.

Relation to Directedness

The fourth category to be presented here rests on a prior category, "state of directedness" that has two members: nondirected and directed. This prior category could have been included under the preceding class of categories pertaining to an individual scene component, except that possibly no closed-class forms directly mark its two-way distinction, and it may come into play only for the present category. The prior "state of directedness" category is here considered only for a scene component with spatial extent, that is, with dimension above zero (though certain schemas might in fact involve a point). When an extended entity moves along its axis, plane, or radii, the property of directedness simply reduces to the direction of motion. but a stationary entity can also be conceptualized as having an intrinsic directedness or orientation throughout its extent. Returning to the present category, it can apply where a schema already includes an extended entity that is directed. The present category, then, is here termed "relation to directedness" and has two main members, co-directional and anti-directional, corresponding to whether the path of a moving object, or the locations of successive stationary objects, are in the same direction as the directed entity or in the reverse direction.

To illustrate a stationary directed entity first, such an entity can, as in (32), function as the Ground (the chemical gradient). Then the preposition *along* can indicate that the path of a moving Figure (the axon) is co-directional with the directedness of the Ground, while *against* indicates that it is anti-directional.

(32) The axon grew along / against the chemical gradient.

A stationary directed entity can also function as a Secondary Reference Object, in particular, one of the encompassive type. In (33), this is the line (queue) which here inherits its directedness from the direction in which the people making it up are largely facing and intend to move. Here, Mary is the Figure while John is the Ground. The prepositional complex *ahead of* indicates Mary's location as being co-directionally further than John's location relative to the line's directedness. In its use here, this prepositional complex requires a directed Secondary Reference Object, and can occur in this sentence only because one is

present. If both Mary and john retained their relative positions but were standing alone in a fi eld, one could not say that Mary was "ahead of" John but only that she was "in front of" him. And this latter form can be used only in the case where he in fact faces toward her -- a condition that *ahead of* did not require.

(33) Mary is ahead of John in line.

The vertical axis of the earth grid is the most prominent case of a stationary directed extended entity. It is not clear whether the basic direction of the vertical axis should be the direction away from the earth or the one toward it -- and metaphoric motivation could be argued either way. Nor is it clear whether a directed line must in fact have one direction as its basic direction, as long as a schema somehow establishes how, say, the motion of an external object relates to that directed line. for convenience here, though, it will be said that the direction away from the earth is the basic one. This directed vertical axis, then, can function either as a Ground or as a Secondary Reference Object. When it is the Ground, the English satellite *up* indicates that the path of a moving Figure is (prototypically parallel to and) co-directional with the vertical axis, while *down* indicates that it is anti-directional, as illustrated in (34a). When it is a Secondary Reference Object, among other prepositional options, English *above indicates that a stationary Figure is at a location co-directionally greater than that of the Ground, while below* indicates that it is anti-directionally greater, as illustrated in (34b).

(34) a. The eagle swooped up / down.
b. The lamp is above the TV. / The TV is below the lamp.

The sentence in (35) illustrates the case where the directionality of an entity is determined by the direction of its motion. Here, the entity (the current), which functions as the Ground, is of linear extent and moves along its axis. The preposition *(with* indicates that the path of the moving Figure (the bear) is co-directional with the moving Ground's directedness, while *against* indicates that it is anti-directional.

(35) The bear swam with / against the current.

It is possible to maintain that the present category, "relation to directedness", has a third member, cross-directional, given that there do exist closed-class forms -- like the English preposition *across*, as in (36) -- that can be used to indicate a path transverse to a linearly directed entity. The conclusion here, though, is that such a transverse path does not hinge on the linear entity's being directed, but only on the fact that the path is perpendicular to the linear entity's orientation, whether directed or not, and this is a relationship already covered under the category of "relative orientation".

(36) The axon grew across the chemical gradient. / The bear swam across the current.

Contour.

A fifth category is that of "contour", which most prominently applies to the path of a moving objecte, but can apply as well to a static line or plane. It is treated here in the class of categories for one scene element relating to another because, at least in the case of a moving entity, its path is generally cognized in terms of its relation to other objects external to it. A schema that includes a path or static element can be neutral to its contour, as the schema for *through* is in sentences like *I made a bee-line / zig-zagged / circled through the woods*. But if the schema is contour-specific, there may be only four member concepts, that is, four available contour types for it to draw on: straight, arced, circular, and meandering. To illustrate, some English prepositions require one or another of these contour types for the path of a Figure moving relative to a Ground. Thus, *across* requires that the Figure's path be a straight line relative to the vertical axis (and, for that matter, the stationary Ground object must itself be a flat plane, that is, have a straight contour), as seen in (37a). by contrast, *over* -- in its usage referring to a single path line -- requires a contour arced relative to the vertical axis (and the stationary Ground must be comparably arced), as in (37b). In one of its senses, *around* indicates a roughly circular path, as seen in (37c). And *about* indicates a meandering contour in sentences like (37d).

(37) a. I drove across the plateau / *hill.
b. I drove over the hill / *plateau.
c. I walked around the maypole.
d. I walked about the town.

2.2.4 Nongeometric Categories

All the preceding categories and their member elements have broadly involved geometric characteristics of spatial scenes or of the objects within them -- that is, they have been genuinely spatial. But a certain number of nongeometric categories and elements are recurrently found in association with otherwise geometric schemas. Although definitionally outside the scope of a spatial analysis, their frequency of association calls for a treatment of them, and several of the most recurrent are described next. It remains to examine what it is about our cognitive structure that regularly associates such nongeometric concepts with the geometric ones.

Force Dynamics

One category of such elements is that of "force dynamics" (see Talmy 2000a, ch. 7) with two members: present and absent. Thus, geometrically, the English prepositions *on* and *against* both represent a Figure in adjacent contact with a Ground. But in addition, *on* indicates that the Figure is supported against the pull of gravity through that contact, as is the case in (38a), while *against* indicates that it is not so supported, as in (38b).

(38) a. The poster is on / *against the wall.
b. The fbating helium balloon is against / *on the wall.

As in the preceding example, the two Dutch prepositions *op* and *aan* both indicate spatial contact between a Figure and a Ground, and both involve force dynamics in distinct ways (Melissa Bowerman, personal communication). But this distinction between them cuts force dynamics in a slightly different place. The form *op* indicates a Figure supported comfortably in what is conceptualized as a natural rest state through its contact with a Ground, whereas *aan* indicates that the Figure is being actively maintained against gravity through its contact with the Ground. Accordingly, flesh is said to be "op" the bones of a live person but "aan" the bones of a dead person.

Cognitive / Affective State

A second nongeometric category that can occur in association with a geometric schema is that of "cognitive/affective state". Its extent of membership is not clear. But one recurrent member is the attitude toward a schematic feature that it is unknown, mysterious, or risky. This category member is associated with the English preposition *beyond*, perhaps in combination with the further concepts of inaccessibility or nonvisibility -- themselves seeming to have part geometric and part nongeometric aspects. More specifically, these cognitive/affective concepts occur in association with the distal region of space specified by the *beyond* schema and with the locatedness of the Figure in that region, as seen in (39a). However, these concepts are absent from the otherwise parallel spatial locution *on the other side of*, as in (39b). Thus, a speaker using *beyond* as in (39a) -- in addition to specifying roughly the same spatial schema as that of *on the other side of* -- also indicates that she in some way regards that region of space as being unfamiliar and the Figure located within it as accordingly being in potential jeopardy.[3]

(39) a. John is beyond the border. b. John is on the other side of the border.

[3] Earlier, the schema for *beyond* was contrasted with that of *past* as including an external Secondary Reference Object, namely, an observer's point of view on the side opposite that of the Figure. Here, the schema for the locution *on the other side of* shares the same viewpoint requirement with the *beyond* schema, but now these two schemas contrast with respect to the additional cognitive/affective state.

Relative Priority

A third nongeometric category -- in the class that relates one scene component to another -- is that of "relative priority". It has two members: coequal and main/ancillary. To illustrate, the English verb satellites *together* and *along* can both indicate joint participation and, when applied to motion through space, can both indicate that a moving Figure's path is executed coextensively with and parallel to a moving Ground's path. But *together*, as in (40a), indicates in addition to this spatial relation that the Figure and the Ground are coequal participants in the activity. On the other hand, *along*, as in (40b), indicates that the Figure entity is ancillary to the Ground entity, while the Ground entity is the main or determinative entity, one who would be assumed to engage in the activity even if alone (see Talmy 2000b, ch. 3).

(40) a. I jog together with him. b. I jog along with him.

2.3 Properties of the Inventory

By the methodology adopted here, the universally available inventory of structural spatial elements includes all elements that appear in at least one closed-class spatial schema in at least one language. All such elements may indeed be equivalent in their sheer availability for use in schemas. Nevertheless, they appear to differ in their frequency of occurrence across schemas and languages, ranging from very common to very rare. Accordingly, the inventory of elements -- and perhaps also that of categories -- may have the property of being hierarchical, with entries running from the most to the least frequent.

Given such a hierarchy, the question arises whether the elements in the inventory, the categories in the inventory, and the elements in each category form fully closed memberships. That is, does the hierarchy end at a sharp lower boundary or does it trail off indefi nitely? With many schemas and languages already examined, our sampling method may have yielded all the commoner elements and categories. But as the process slows down in the discovery of the rarer forms, will it asymptotically approach some limit of distinctions and maximum of constituents in the inventory? Or will it be able to go on uncovering sporadic novel forms?

The latter alternative seems likelier. Exotic elements with perhaps unique occurrence in just one schema in one language -- or minimal occurrence in just a few such -- can be expected. In fact, at least one such case can be observed in as close a language as English. Thus, both the prepositions *in* and *on* can refer to a Figure's location at the interior of a wholly or mostly enclosed vehicle. But, by one analysis, these two prepositions distinguish whether the vehicle respectively

lacks or possesses a walkway. Thus, one is in a car but on a bus, in a helicopter but on a plane, in a grain car but on a train, and in a rowboat but on a ship. Further, Fillmore has observed that this *on* also requires that the vehicle be currently in use as transport. Accordingly, *in* becomes the preferred preposition for use with a nonfunctional bus, as in *The children were playing in / *on the abandoned bus in the junkyard*. Thus, schema analysis in English reveals the element '(mostly) enclosed vehicle with a walkway currently in use as transport". This is surely one of the rarer elements in schemas around the world. But its existence, along with that of various others that can be found, suggests that indefinitely many more of them can sporadically arise. The theory that accounts for this arrangement cannot be of a type that requires a domain with well-defined boundaries and uniformaly applicable principles, but rather of a type that can include gradients and fuzzy boundaries.

In addition to being only relatively closed at its hierarchically lower end, the inventory may include some categories whose membership seems not to settle down to a small fixed set. One such category may be that of "intrinsic parts", which could have been included under section 2.2.2 as another case of a category pertaining to an individual scene component, but which has been relocated here to help make the present point. Frequently encountered in this category are the five member elements 'front', 'side', 'back', 'top', and 'bottom , as found in the English prepositions in (41).

(41) The cat lay before / beside / behind / atop / beneath the TV.

But Mixtec, for one language, seems to distinguish a rather different set of intrinsic parts in their spatial schemas, ones dependent on the overall geometric shape of an object, e.g., one that might be glossed as 'at a main vertex of' (Brugmann and Macaulay, 1986). And Makah distinguishes many more and finer parts than the five cited above for English, such as with its verb suffixes for 'at the ankle of' and 'at the groin of' (Matthew Davidson, personal communication).

Apart from any such fuzzy lower boundary or noncoalescing categories, though, there does appear to exist a graduated inventory of basic spatial elements and categories that is universally available and that is relatively closed. This notion, however, has been challenged, with the main challenge raised by Bowerman (e.g. 1989). She notes, for example, that at the same time that children acquiring English learn its *in/on* distinction, children acquiring Korean learn its distinction between *kkita* 'put [Figure] in a snug fit with [Ground]' and *nehta* 'put [Figure] in a loose fit with [Ground]' she argues that since the elements 'snug fit' and 'loose fit' are presumably rare among spatial schemas across languages, they do not come from any preset inventory, one that might plausibly be innate, but rather are learned from the open-ended semantics of the adult language. My reply is that the spatial schemas of genuinely closed-class forms in Korean may

well still be built from the inventory elements, I propose and that the forms she cites are actually open-class verbs. Open-class semantics -- whether for space or other domains -- seems to involve a different linguistic subsystem, one that draws from finer cognitive discriminations within our overall processes of perception and conception. The Korean verbs are perhaps learned at the same age as English space-related open-class verbs like *hug* or *squeeze*. Thus, English-acquiring children probably understand that *squeeze*involves centripetal pressure from encircling or bi-/multi-laterally placed Antagonists (typically the arm(s) or hand(s)) against an Agonist that resists the pressure but yields down to some smaller compass where it blocks further pressure, and hence that one can squeeze a teddy bear, a tube of toothpaste, or a rubber ball, but not a piece of string or sheet of paper, juice or sugar or the air, a tabletop or the corner of a building. Thus, Bowerman's challenge may be directed at the wrong target, leaving intact the proposal for a roughly preset inventory of basic spatial building blocks.

3. Basic Elements Assembled into Whole Schemas

The last section was devoted to mapping out the componential part of the overall system of spatial schemas in language. The procedure was analytic, starting with the whole spatial schemas expressed by closed-class forms and abstracting from them an inventory of fundamental spatial elements. We turn now to the compositional part of the overall schema system. The procedure will now be one of synthesis, and will examine the ways in which individual spatial elements are assembled to constitute whole schemas.

The schemas represented by closed-class forms can range in complexity from the rather simple to the truly elaborate. Perhaps some few schemas consist of a single basic spatial element by itself. A possible candidate for this status is the schema of the English form *way* as in *The eagle flew way up*. This schema might consist solely of the (presumably) basic element 'of relatively great magnitude' -- though an additional complexity might already be introduced if this schema is constrained to apply only to a linear extent. But most closed-class schemas are more complex than this -- even ones that at first seem simple in form and usage. Thus, the schema of the seemingly simple *up* in the example sentence just cited was seen above under the "relation to directedness" category to consist of a fair-sized and fairly intricate assembly of elementary components. Moreover, the upper end of the schema complexity scale is quite well populated. Again, even common and seemingly innocuous forms can represent schemas of great complexity. This was already seen in the initial *across* example. We now go through another such example, but this time with specific focus on the assembly and arrangement of the schema components, while using only the categories and components already treated.

Consider the schema represented by the English preposition *past* as in (42).

(42) The ball sailed past my head at exactly 3 PM.

Loosely characterized, this schema represents the ball as moving horizontally through a point near the side of my head. But its precise characterization is quite elaborate, and involves all the elements cited in (42) arranged with respect to each other exactly as indicated. Still, every one of the elements and of the relations among the elements that is presented in (42) is a member of one of the categories treated above -- and here named within brackets. Thus, even though it is still rather partial, the inventory of basic spatial elements and categories proposed so far can already serve as an exhaustive source for some spatial schemas.

a. There are a Figure object and a Ground object (here, the ball and my head, respectively)
[members of the "major scene components" category].
b. The Figure is schematizable as a 0-dimensional point
[a member of the "dimension" category].
c. This Figure point is moving
[a member of the "motive state" category].
d. Hence it forms a one-dimensional line, its path
[a member of the "dimension" category"].
e. The Ground is also schematizable as a 0-dimensional point
[a member of the "dimension" category].
f. There is a certain point P at a proximal remove
[a member of the "degree of remove" category] from the Ground point.
g. Point P forms a 1-dimensional line
[a member of the "dimension" category] with the Ground point.
h. This line is parallel
[a member of the "relative orientation" category[to the horizontal plane.
i. In turn, the horizontal plane is a part
[a member of the "intrinsic parts" category] of the earth-based grid.
j. And the earth-based grid is a Secondary Reference Object
[a member of the "major scene components" category].
k. The Figure's path is perpendicular
[a member of the "relative orientation" category]
to the line between point P and the Ground.
l. The Figure's path is also parallel to the horizontal plane of the earth-based grid.
[same as h/i/j above].
m. If the Ground object has a front, side, and back
[members of the "intrinsic parts" category],
then it is the side part to which point P is proximal.
n. There is a certain point Q of the Figure's path that is not one of its boundary points
[a member of the "state of boundedness" category].
o. Point Q becomes coincident
[a member of the "degree of remove" category] with point P at a certain point of time.

The reasons for some of the inclusions in the *past* schema above can be made clearer. Thus, the Figure's path is specifi ed as passing through a point P proximal to the Ground (42 f and o) because if it instead headed directly toward the Ground, one would not say *The ball sailed past my head*, but rather *The ball*

sailed into my head. And if the point through which the Figure passed were distal, one might instead say something like *The ball sailed along some distance away from my head*. The point P is further specified as being on a horizontal level with the Ground in (42 g and h) because if it were instead, say, above the Ground, one would now have to say something like *The ball sailed right over my head*. And point P is specified as located at the side of the Ground in (42m) because if it were instead, say, at the front of the Ground, one would switch to saying something like *The ball sailed (by) in front of my head*. Finally, the Figure's path is specified as horizontal in (42l) because if it instead were vertical, one might rather say something like *The ball sailed down beside my head*.

The least understood aspect of the present investigation is what well-formedness conditions, if any, may govern the legality of the selection and arrangement of basic elements into whole schemas like the one just analyzed. As yet, no obvious principles based, say, on geometric simplicity, symmetry, consistency, or the like are seen to constrain the patterns of assembly. On the one hand, some seemingly byzantine combinations -- like the schemas seen above for *across* and *past* -- occur with some regularity across languages. On the other hand, much simpler combinations seem never to occur as closed-class schemas. For example, one could imagine assembling elements into the following schema: down into a surround that is radially proximal to a center point. One could even invent a preposition *apit* to represent this schema. This could then be used, say, in a sentence like (43) to refer to my pouring water down into a nearby hole dug in the field around my house. But schemas like this one are not found.

(43) *I poured water apit my house.

Similarly, a number of additional schematic distinctions in, for example, the domain of rotation are regularly marked by signed languages, as discussed in Talmy (2003), and could readily be represented with the inventory elements available to spoken languages, yet they largely do not occur. It could be argued that the spoken language schemas are simply the spatial structures most often encountered in everyday activity. But that would not explain why the additional sign-language schemas -- presumably also reflective of everyday experience -- do not show up in spoken languages. Besides, the different sets of spatial schemas found in different individual spoken languages are diverse enough from each other that arguing on the basis of the determinative force of everyday experience is problematic. Something else is at work, but it is not yet clear what that is.

4. Properties and Processes Applying to Whole Spatial Schemas

Dealing with the second "compositional" part of the overall system of spatial schemas in language, we just saw that selected elements of the universally

available inventory are combined in specific arrangements to make up the whole schemas represented by individual closed-class spatial forms. Each such whole schema is thus a "pre-packaged" bundling together of certain elements in a particular arrangement. Each particular language has in its lexicon a relatively closed set of such pre-packaged schemas. This set is larger than that of its phonologically distinct spatial closed-class forms, because such forms are largely polysemous. A speaker of the language must in general select among this set of schemas in depicting a spatial scene.

Turning now to the third "augmentive" part of the overall system of spatial schemas in language, we can observe that such schemas, though composite, have a certain unitary status in their own right, and that certain quite general properties and processes can apply to them. In particular, certain properties and processes allow a schema represented by a closed-class form to generalize to a whole family of schemas. The terms "property" and "process" are here distinguished according to the way they perform this generalization. In the case of a generalizing property, all the schemas of a family are of equal priority. On the other hand, a generalizing process acts on a schema that is somehow basic, and either extends or deforms it to yield nonbasic schemas. (see Talmy 2000a ch. 1 and 3, 2000b ch. 5). Such properties and processes are perhaps part of the overall language system so that any given language's relatively closed set of spatial closed-class forms and the schemas that they basically represent can be used to match more spatial configurations in a wider range of scenes.

4.1 Generalizing Properties of Spatial Schemas

Looking first at generalizing properties of spatial schemas, under several such properties a schema exhibits a topological or topology-like neutrality to certain features of Euclidean geometry. Accordingly, a family of different schemas that range over all the variations of the feature that the basic schema is neutral to are equally represented by the same closed-class form. Three properties of this sort are described next.

Magnitude-Neutrality

For a first topological property, schemas are generally magnitude neutral. This property can be seen, for example, in the fact that the *across* schema can apply to a spatial situation of any size, as in (44a). Comparably, the two demonstratives *this* and *that* can contrast the different distances of two distinct objects from a speaker, but these distances can vary indefinitely in length, as seen in (44b).

(44) a. The ant crawled across my palm. / The bus drove across the country.
b. This speck is smaller than that speck. / This planet is smaller than that planet.

Shape-Neutrality

It was seen under the "contour" category in section 2.2.3 that a schema can require a particular contour at a certain locus and with respect to a specific orientation (e.g., an arced contour in the vertical plane). Outside of such constraints, though, schemas largely exhibit a second topological property of being shape-neutral. Thus, to reprise an earlier example, the *through* schema requires that the Figure form a path with linear extent, but it lets that line take any contour, as seen in (45).

(45) I made a bee-line / zig-zagged / circled through the woods.

Bulk-Neutrality

A third topology-like property of spatial schemas is that they are largely bulk-neutral. This property is seen, for example, in the fact that the *past* schema requires a Figure and a Ground idealizable as points, regardless of the degree of spherical radial extension outward from those ideal points (provided only that the Ground does not then block the Figure), as seen in (46a). Comparably, the *along* schema requires that the Ground be idealizable as a linear extent, regardless of the radial extension outward from that ideal line, as in (46b).

(46) a. The ball sailed past my head. / The asteroid sailed past the planet.
b. The caterpillar crawled up along the filament / tree trunk.

Thus, while holding to their specific constraints, schemas can vary freely in other respects and so cover a range of spatial configurations.

4.2 Generalizing Processes that Extend Spatial Schemas

We turn now to generalizing processes, ones of the type that extend a basic form of a schema to nonbasic forms of it. Three such processes are described next.

Extendability in Ungoverned Dimensions

One process of this kind is "extendability in ungoverned dimensions". By this process, a scene component of dimensionality N in the basic form of a

schema can generally be raised in dimensionality to form a line, plane, or volume that is oriented and contoured in a way not conflicting with the schema's other requirements. To illustrate, it was seen earlier under the "type of geometry" category that, in the spatial schema of the English verb satellite *out* (in its radial sense), a Figure point is conceptualized as moving along a radius away from a central Ground point through a continuum of concentric circles, as in (47a). This schema with the Figure idealizable as a point is the basic form. But the same satellite can be used when this Figure point is extended to form a 1-dimensional line along a radius, as in (47b). And the *out* can again be used if the Figure point were instead extended as a 1-dimensional line forming a concentric circle, as in (47c). In turn, such a concentric circle could be extended to fill in the interior plane, as in (47d). Alternatively, the concentric circle could have been extended in the vertical dimension to form a cylinder, as in (47e). Or again, the circle could have been extended to form a spherical shell, as in (47f). And such a shell can be extended to fill in the interior volume, as in (47g). Thus, the same form *out* serves for this series of geometric extensions without any need to switch to some different form.

(47) a. The boat sailed further and further out from the island.
b. The caravan of boats sailed further and further out from the island.
c. A circular ripple spread out from where the pebble fell into the water.
d. The oil spread out over the water from where it spilled.
e. A ring of fire spread out as an advancing wall of flames.
f. The balloon I blew into slowly puffed out.
g. The leavened dough slowly puffed out.

Extendability across Motive States

A second schema-extending process is "extendability across motive states". A schema that is basic for one motive state and Figure geometry can in general be systematically extended to another motive state and Figure geometry. For example, a closed-class form whose most basic schema pertains to a point Figure moving to form a path can generally serve as well to represent a related schema with a stationary linear Figure in the same location as the path. Thus, probably the most basic *across* schema is actually for a point Figure moving along a path, as in (48a). By the present process, this schema can extend to the static linear Figure schema exemplified initially with the sentence in (48b). All the spatial properties earlier uncovered for that static schema hold as well for the present basic dynamic schema, which in fact is the schema in which these properties originally arise.

(48) a. The gopher ran across the road.
b. The board lay across the road.

Extendability from the Prototype

A possible third extensional process, "extendability from the prototype", actually covers no new cases, but is proposed here only as an alternative interpretation for some cases of neutrality, already treated above under generalizing properties. Thus, the *through* schema illustrated above in (45) was there treated as exhibiting shape neutrality. But this schema could alternatively be conceived as prototypically involving a strait path line for the Figure, one that can then be bent to any contour. comparaably, the schemas for *past* and *along* shown above in (46) to illustrate bulk neutrality could alternatively be thought to have as their prototypes a zero-dimensional point and a one-dimensional line, respectively, that can then be radially inflated.

4.3 Generalizing Processes that Deform Spatial Schemas

Continuing with generalizing processes, we turn now to ones of the type that derive nonbasic forms of a schema from the basic form not by extending it but by "deforming" it. That is, such processes alter the basic schema so that the result somehow deviates from its original basic character. Two such processes are described next.

Stretching

One schema-deforming process is that of "stretching". This process allows a modest relaxation of one of the normal constraints otherwise present in a schema. Thus, in the *across* schema, where the Ground plane is either a ribbon with a long and short axis or a square with equal axes, a static linear Figure or the path of a moving point Figure normally must be parallel to the short axis or to one of the equal axes. But it cannot be parallel to the long axis of a ribbonal Ground. Accordingly, across can be used for a Figure's path along the short axis of a ribbonal Ground, as in (49a), or along one of the equal axes of a square, as in (49b), but it cannot be used for a path along the long axis of a ribbonal Ground, as in (49c). However, in this last case, the long axis is of much greater magnitude than the short axis. Consider now instead a Ground that is only slightly oblong in shape, where the Figure's path goes from one of its narrower sides to the other, as in (49d). Perhaps the longer axis here can be conceptualized as having been stretched from an equal-axis square shape. If so, the *across* schema can generally continue to apply to the longer axis if the stretch remains moderate, and becomes progressively less applicable as the stretch increases. But the fact that the schema can be used at all for such a stretched shape, rather than abruptly becoming

inapplicable, is evidence for the existence of a cognitive process of schema deformation.

(49) a. I swam across the canal.
<from one side of the canal to the other>
b. I swam across the pool.
<from one side of a square pool to its opposite>
c. *I swam across the canal.
<from one end of the canal to the other>
d. ?I swam across the pool.
<from one narrower side of a moderately oblong pool to the other>

Feature Cancelation

Another schema deforming process is that of "feature cancellation", in which a particular element or complex of elements in the basic schema is omitted. To illustrate, the basic schema for the dynamic sense of *across* includes as features the fact that the path of a moving Figure point begins at one side of a Ground ribbon and terminates on the other side. (These features are in addition to the path's continuing in coincidence with the plane of the Ground ribbon, as well as to all the other features listed early on in (3). But the preposition *across* can still be used in a sentence like (50) even though, in the spatial scene represented by this sentence, the path of the moving Figure (the shopping cart) does not extend all the way to the distal side of the Ground ribbon (the boulevard). That is, one of the cited features of the schema -- the Figure's path terminating on the distal side of the Ground ribbon -- has been canceled or is left unrealized. Instead of needing to switch to some new preposition or paraphrase, the language here allows an extant preposition to have its schema altered and thus fi t the novel spatial confi guration.

(50) The shopping cart rolled across the boulevard and was hit by an oncoming car.

The schema of this same preposition is seen to undergo an even more extreme case of feature cancelation in (51). Here, the two cited features -- the Figure's path beginning on one edge of a bounded Ground and terminating on the opposite edge -- are both canceled, leaving *across* to refer only to the Figure's path continuing along in coincidence with the plane of the Ground.

(51) The tumbleweed rolled across the prairie for an hour.

5. Relating the System of Spatial Schemas to Other Language Systems

Closed-class forms that represent spatial structure are a subset of all closed-class forms representing conceptual structure generally. As such, they can be expected to exhibit the same properties possessed by the superset, as these were set forth in Talmy (2000a, ch. 1). This in fact they do. For example, the superset has bequeathed to them its properties of having a componential part consisting of basic conceptual elements that fall into basic conceptual categories, which together constitute a relatively closed universally available inventory that individual languages draw from; a compositional part in which certain basic concepts are selected and set in particular relationships within conceptual complexes for representation by individual closed-class forms; and an augmentive part in which such conceptual complexes can be extended or deformed. Nevertheless, the spatial forms distinguish themselves as a subset by exhibiting certain greater constraints as well as certain greater elaborations in comparison with the rest of the superset.

The case of greater constraints can be seen in the componential part of the spatial schema system. In that part, certain conceptual categories are present that correspond to or are identical with conceptual categories in the componential part of the larger closed-class system -- except that they are more constrained in their membership. One prominent example is the category of "number". In the spatial closed-class system, as discussed above, this category is apparently limited to just four member concepts: one, two, several, and many. But in the overall closed-class system, the number category includes additional concepts, including those expressed by such English closed-class determiners as *no, few, more, most, all* as well as such further concepts as ‘three’ in the trial inflections of some languages.

The case of greater elaboration can be seen in the compositional part of the spatial schema system. As just noted, the combining of basic conceptual elements into complexes for representation by single closed-class forms occurs not only in the compositional part of the spatial schema system, but also in the corresponding part of the general closed-class system. We saw earlier that what closed-class spatial schemas consist of can range from perhaps a single basic element, through an arrangement of moderate complexity, to a pattern of extreme intricacy. But while the referents of nonspatial closed-class forms can range over the first two degrees of this scale, they seem not to come up to the elaboration that spatial schemas are capable of.

To illustrate the nonspatial closed-class system first at the low end, consider the conceptual category of "gender" -- say, in a language with just the two member concepts ‘male’ and ‘female’. If we can abstract away from the application of this category to entities without natural gender and from various complications in its application even to entities with natural gender, perhaps we could conclude that the closed-class forms for masculine and feminine largely represent the single basic ‘maile’ or ‘female’ concept alone.

More commonly, a nonspatial closed-class form represents a combination of several basic concepts in a particular relationship. Thus, still at the simpler end, the English plural suffix *-s*, as in *cats*, represents a shift within the conceptual category of "plexity" from one member concept ‘uniplex’ to another member concept ‘multiplex’. But at the same time, it places the new multiplex referent within the sphere of relevance of another conceptual category, that of "state of boundedness", and in particular marks the new referent as unbounded. Thus, adding *-s* to *cat* changes its uniplex referent into an unbounded multiplexity.

For a more elaborate case, the English closed-class form *the*, as in *the cat*, represents a conceptual complex something like ‘the speaker infers that the addressee can readily identify the referent of the adjoined noun’. This conceptual complex draws on the category of "speech participants" for the member concepts of ‘speaker’ and ‘hearer’, on a proposed category of "cognitive process" for the member concepts ‘inferring’ and ‘identifying’, and on the category of "force dynamics" for the member concept ‘against little opposition‘ (for the ‘readily’ notion).

The conceptual complexes just seen represented by nominal *-s* and *the* exhibited integral patterns of basic concepts set into specific relationships with each other. In addition, though, some closed-class forms can represent what seem to be simple aggregations of basic concepts. An example is the English verb suffix *-s*, as in *Sue eats no meat*. This form represents together the concept ‘one’ (singular) from the "number" category, the concept ‘third person’ from the "person" category, the concept ‘present’ from the "tense" category, the concept ‘factual’ (indicative) from the "mood" category, and the concept ‘habitual’ from the "aspect" category. That is, this closed-class form appears to represent a selection of basic concepts that are juxtaposed as a simple set but that are not set into a particular arrangement with respect to each other.

But while nonspatial closed-class forms readily represent some four or five basic concepts combined in a complex -- whether simply as an aggregate or in a structured relationship -- they seem not to reach the extremities of elaboration and organization that occur with some frequency in the schemas represented by spatial closed-class forms.

So far in this section, the closed-class spatial schema subsystem has been compared with the closed-class subsystem for nonspatial conceptual structure. But this same closed-class spatial schema subsystem, as it has been analyzed in this chapter, has been looked at solely as it exists in spoken language. However, signed language has a particular subsystem -- often termed the "classifier" subsystem -- that is specifically dedicated to representing the motion or location of objects relative to each other in space. This is a subsystem within a different

language modality that in turn invites comparison. It turns out that the properties we have found in the spatial schema subsystem of spoken language mostly do not hold for the classifier subsystem of signed language. The arguments and details are presented in Talmy (2003), but some highlights can be sketched here.

In its counterpart to the componential inventory of the closed-class spatial schema system of spoken language, the classifier subsystem of signed language generally has more basic spatial elements and more categories that they fall into. Further, though, these "elements" are often not the discrete concepts of the spoken system, but rather points along a gradient continuum. With regard to composition, where spoken languages have whole pre-packaged schemas constituting specific selections and arrangements of basic elements, signed language largely lacks such preset schemas. Instead, each classifier expression can concurrently represent its own selection from some thirty distinct spatial parameters, and it can independently vary the values of these parameters, so that the whole complex accords in an individually tailored way with the current spatial structure needing representation. Finally, where the spoken language system has augmentive mechanisms that can extend and deform the preset schemas to adapt them to a wider range of spatial structures, the classifier subsystem largely lacks such mechanisms since they are generally not necessary: what would be extensions and distortions for a spoken language representation are simply represented directly in signed language. The cognitive and neural implications of these spoken-signed differences in spatial representation are examined in Talmy (2003), while their implications for the evolution of language are explored in Talmy (2004).

References

Bennett, David C. 1975. *Spatial and temporal uses of English prepositions: An essay in stratificational semantics.* London: Longman.

Bowerman, Melissa. 1989. Learning a semantic system: What role do cognitive predispositions play? In Mabel L. Rice & Richard L. Schiefelbusch (eds.) *The teachability of language*. Baltimore: P.H. Brookes Pub. Co.

Brugmann, Claudia. and Macaulay, Monica. 1986. Interacting Semantic Systems: Mixtec expressions of location. In Proceedings of the Thirteenth Annual Meeting of the Berkeley Linguistics Society. 315-328. Berkeley Linguistics Society.

Clark, Herb. 1973. Space, time, semantics, and the child. In Timothy E. Moore (ed.) *Cognitive development and the acquisition of language*. New York: Academic Press.

Fillmore, Charles. 1968. The case for case. In Emmon Bach & Robert T. Harms (eds.) *Universals in linguistic theory*. New York: Holt, Rinehart and Winston.

Gruber, Jeffrey S. 1965. Studies in lexical relations. PhD dissertation, MIT. Reprinted as part of *Lexical structures in syntax and semantics*, 1976. Amsterdam: North-Holland.

Herskovits, Annette. 1982. Space and the prepositions in English: Regularities and irregularities in a complex domain. PhD dissertation, Stanford University.

Imai, Shingo. 2003. *Spatial Deixis: How Demonstratives Divide Space*. Doctoral dissertation. University at Buffalo, State University of New York.

Jackendoff, Ray. 1983. *Semantics and cognition*. Cambridge, MA: MIT Press.

Leech, Geoffrey. 1969. *Towards a semantic description of English*. New York: Longman Press, 1969.

Mark, David M., and Smith, Barry, 2004 "A Science of Topography: From Qualitative Ontology to Digital Representations", in: Michael P. Bishop and John F. Shroder (eds.), Geographic Information Science and Mountain Geomorphology, Chichester, England: Springer-Praxis, 75-100.

Talmy, Leonard. 1983. How language structures space. In Herbert L. Pick, Jr. & Linda P. Acredolo (eds.) *Spatial orientation: Theory, research, and application*. New York: Plenum Press.

Talmy, leonard. 2000a. *Toward a cognitive semantics*, volume I: *Concept structuring systems*. Cambridge, MA: MIT Press.

Talmy, leonard. 2000b. *Toward a cognitive semantics*, volume II: *Typology and process in concept structuring*. Cambridge, MA: MIT Press.

Talmy, leonard. 2003. The representation of spatial structure in spoken and signed language. *Perspectives on Classifier Constructions in Sign Language*, ed. by Karen Emmorey. 169-195. Mahwah, NJ: Lawrence Erlbaum.

Talmy, Leonard. 2004. Recombinance in the Evolution of Language. in Proceedings of the 39th Annual Meeting of the Chicago Linguistic Society: The

Panels. eds. Jonathon E. Cihlar, David Kaiser, Irene Kimbara, and Amy Franklin. Chicago: Chicago Linguistic Society.

Zubin, David A. and Svorou Soteria. 1984. Orientation and gestalt: Conceptual organizing principles in the lexicalization of space. In Proceedings of the 20th meeting of the Chicago Linguistics Society Parasession on Lexical Semantics, Veena Mishra Testen and Joseph Drogo, with Soonja Choi (eds), 333-345. Chicago: Chicago Linguistic Society.