The Relation of Grammar to Cognition--a Synopsis

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Abstract

A sentence (or other portion of discourse) is taken to evoke in the listener a meaning complex, here called a "cognitive representation". The lexical elements of the sentence, to simplify, by and large specify the content of the cognitive representation, while the grammatical elements specify its structure. Thus, looking systematically at the actual notions specified by grammatical elements can give us a handle for ascertaining the very makeup of (linguistic-) cognitive structuring. We accordingly examine a number of grammatically specified notions, observe the categories and systems in which they pattern, and speculate on broader cognitive connections.

Some provisional findings have already emerged. Grammatical specifications for structure are preponderantly relativistic or topological, and exclude the fixed or metrically Euclidean. The categories in which grammatical notions pattern include:

plexity	perspectival mode
state of boundedness	level of synthesis
state of dividedness	level of exemplarity
degree of extensionality	axial characteristics
pattern of distribution	scene-breakup "

Grammatical specification of structuring appears to be the same, in certain abstract characteristics, as the structuring of visual perception.

0. Introduction

A sentence (or other portion of discourse) is taken to evoke in the listener a particular kind of experiential complex--here to be termed a "cognitive representation" or "CR".[1] There appears to be a significant way in which different portions of the language input specify, or code for, different portions of the CR. The major finding is that--for a first approximation--the lexical fraction of a sentence codes mainly for the content, or substance, of a CR, while the grammatical fraction of a sentence codes mainly for the structure of a CR. Determining the structure within a realm of phenomena has been a central concern for analytic science, including linguistics and psychology. With grammar seen in the above light, it can be used in determining the structure, of the language-related portion of human cognition, with possible connections to further portions. In particular, looking systematically at the actual notions specified by grammatical elements can give us a handle for ascertaining the very nakeup of (linguistic-) cognitive structuring.[2] The beginnings of such an endeavor are the aims of this paper

Several ideas here require some immediate elaboration. The distinction between lexical and grammatical is made entirely formally--i.e., without any reference to meaning--on the basis of the distinction between open-class and closed-class.[3] All open-class elements--i.e., the stems of nouns, verbs, and adjectives[4]--are considered lexical. Everything else is considered grammatical. Included here are all closed-class morphemes and words--inflections, particles, adpositons, conjunctions, demonstratives, etc.--as well as syntactic constructions, grammatical relations, categorial identities, word order, and intonation. Terminologically here, "grammatical element" will be used to refer to any of these.

The nature of content and of structure, and the distinction between them, are not understood well enough to be addressed analytically in this paper and must be left to our intuitive sense of the matter.[5] Taking them for granted, however, we can now more finely characterize the linguistic-cognitive cross-relationships noted earlier. While most of a CR's content is specified by the lexical fraction of a sentence, the lexical items do usually specify some structural notions along with the contentful ones. The grammatical elements of a sentence more unalloyedly specify only structural notions and specify them more determinately in the case of conflict with a lexical item, establishing perhaps the majority of a CR's structure.[6]

In other work in the present direction--notably Fillmore's (e.g., 1975, 1976)--concern has also been with ascertaining structre, but the sentence elements used as starting-points have generally been lexical items with prominently inmixed structural specifications (like buy and sell). The present work, in part a complement to the other, takes advantage of grammar's greater directness and completeness in specifying structure.

This paper is divided into three sections. In the first, a sampling of grammatical elements is examined for the notions that they specify, both as an introduction to out method and for the aim of noticing properties common to such notions as well as properties excluded from them. In the second, we present a number of the categories in which grammatically specified notions have been observed to pattern. In the third, we speculate on broader cognitve connections.

1. The Nature of Grammatically Specified Notions

In this section we examine a small sampling of grammatical elements for the particular component notions that they specify. The sample will give a heuristic indication of the kinds of notions that get grammatically specified as well as of kinds of notions that possibly never do. The excluded kinds will be seen as readily specifiable by lexical elements. A further comparison between the characteristics of grammatically specified notions and of lexically specified ones is then made. To indicate the major finding at the outset, it seems that grammatical specifications for structure are preponderantly relativistic or topological, and exclude the fixed or metrically Euclidean.

For a first simple case, many languages have inflections for the noun (English has -Ø and -s) that specify the uniplex or the multiplex instantiation of the object specified by the noun. By contrast, no languages appear to have inflections that specify the redness or blueness, etc.--i.e., the particular color--of the object specified by a noun. In the preceding, the underlined are instances of "notions". The first set are grammatically specified and can be readily seen to play a structuring role in a CR.[7] The second set are perhaps never found specified by grammatical elements, though they are everywhere found specified by lexical elements (such as (red and blue).

For another case we consider a deictic like the English this or that as in This chair is broken. A grammatical element of this type specifies the location of an indicated object as being, in effect, on the speaker-side or the non-speaker-side of a conceptual partition drawn through space (or time or other qualitative dimension). This integral specification can be analyzed as containing the following component notions (enclosed by quotes):

(1)
- a-b. a 'partition' that divides a space into 'regions'/'sides'
- c-e. the 'locatedness's' (a particular relation) of a 'point' (or object idealizable as a point) 'within' a region
- f-g. (a side that is the) 'same' as or 'different' from
- h-i. a 'currently indicated' object and a 'currently communicating' entity

Notions that might at first be ascribed to such deictics, such as of distance or perhaps size, prove not to be, on the evidence of sentence-pairs like (2):

(2) a. This speck is smaller than that speck.
    b. This planet is smaller than that planet.

The CRs evoked by (2a) and (b) differ greatly, involving tiny objects millimeters apart or huge objects parsecs apart. Yet the sentences differ only lexically, not grammatically. Hence, the CRs' notions as to the magnitude of size or distance cannot be traced to the deictics (or to other grammatical elements) in the sentences. Thus, the notional specifications of a this or a that appear, in part, to be genuinely topological: the establishment of a partition remains a constant, but its position can vary unlimitedly (or, using topology's characterizability as "rubber-sheet geometry", the partition's distance away can be stretched indefinitely) without any constraints imposed by the deictics' specifications per se. This finding about the deictics alerts us to noticing whether any grammatical elements make specifications about magnitude. A spot check through English and various other languages suggests that--while there are apparently grammatical specifications for relative magnitude[8]--there are possibly never any for absolute or quantified magnitude, whether of size, distance, or other parameters.

For a third case, we consider the type of adposition that specifies, for a moving object, certain characteristics of path and of point- or frame-of-reference! An example of this type is English through as used, e.g., in:

(3) a. I walked through the water.
    b. I walked through the timeber (i.e., woods).

In this usage, through specifies, broadly, 'motion along a line that is within a medium'. The component notions contained here include:

4)
- a-e. 'motion'--i.e., 'one-to-one correspondences' between 'adjacent' points of 'space' and adjacent points of 'time'
- f. motion that describes a 'line'
- g. the locatedness of a line within a 'medium'
- h-i. a medium, i.e., a region of three-dimensional space set apart by the locatedness within it of 'material' that is in a pattern of distribution' of a certain range of character (still to be determined)

Again, with (3a) and (b) differing only lexically, any notional differences in their CRs cannot be attributed to through. Thus, not within the specificational purvue of that element are: the 'kind of substance' comprising the medium and the 'sensorimotor characteristics' attendant on executing the motion--as, here, those attendant on wading vs. weaving amidst obstacles. With other sentence pairs like

(5) a/b. I crawled/ran through the timber.
(6) a/b. I zig-zagged/arced throught the timber.

it can be further determined that 'rate of motion' and 'shape/contour of linear path' are also not specified by the grammatical element.

As one step in a program to ascertain any properties common to grammatically specified notions, the notions just found are gathered together in Table 1. For heuristic purposes, the notions are very provisionally divided into three groups on the basis of their relation to topology. In group (a) are the notions that properly belong, or are readily definable, in the actual mathematical system of topology. In group (b), the notions might not be part of topology proper but intuitively seem like those that are--and might be includable in a related mathematical system that could be constructed. In group (c) are the notions that fall outside of any usual conception of a mathematical system. The number of notions in the first two groups combined is 13 while the third has 6--an indication of a preponderant propensity for grammatical elements to specify quasi-topological notions. The ratio in this direction is in fact improved if we consider that even several notions in group (c)--the bottom three--resemble topological ones in the sense of involving relativistic relationships between quantities rather than absolutely fixed quantities.

(7) Table 1: Some notions found to be specified by grammatical elements

a. topological	b. topology-like
partition	same
region/side	different
point	pattern of distribution
line	"adjacency" of points (monotonicity)
locatedness	
within	
uniplexity	c. non-topological
multiplexity	
one-to-one correspondences	matter
	space
	time
	motion
	medium
	currently indicated/ communicating entity

For a complementary program of ascertaining any properties excluded from grammatical specification, the notions found above not to be specified by the elements investigated are listed in Table 2. Rather than topological, topology-like, or relativistic, these notions involve Euclidean-geometric concepts (e.g., set distance, size, contour), quantified measure, and various particularities of a quantity--in sum, characteristics that are absolute or fixed.

(8) Table 2: Some notions seemingly never specified grammatically

absolute/quantified magnitude (of distance, size, etc.)	kind of substance
	speed
shape/contour of line	color
sensorimotor characteristics	

The provisional conclusion to be drawn from these findings is that, if grammatical specifications largely correspond to (linguistic-) cognitive structuring, then the nature of that structuring is largely relativistic or topological rather than fixed or absolute.

In a search for contrasts between grammatical and lexical specification, a difference that presents itself at this point is that the relativism vs. absolutism restrictions do not apply to the latter. Lexical items can specify topological and relativistic concepts, as the very words listed in Table 1 attest to. And they can also specify Euclidean or absolute concepts. Thus, for the notion of color in Table 2, there are such lexical items as red, blue; for contour, there are circle, straight; for quantified magnitude, there are inch, mile; for sensorimotor characteristics, there are wade, nimble, effort.

For a further contrast between the grammatical and the lexical type of specification, we consider the full complement of both element-types in a single whole sentence, viz., that selected in (9):

(9) A rustler lassoed the steers.

We first list the grammatical elements present in the sentence and the notions that they specify:

(10)

a.	-ed:	'occurring at a time before that of the present communication'
b.	the:	'has ready identifiability for the addressee'
c.	a:	'not before in discussion or otherwise readily indentifiable for addressee'
d.	-s:	'multiplex object'
e.	a...-Ø:	'uniplex object'
f.	the grammatical category of "verb" for lasso:	'eventhood'
g/h.	the gram. category of "noun" for rustler/steer:	'objecthood' (one possible spec. of "N")
i/j.	the grammatical relations of "subject"/"object" for rustler/steer:	'agent'/'patient' (among possible specs.)
k.	active voice:	'point-of-view at the agent'
l.	intonation, word-order, state of auxiliaries:	'the speaker "knows" the situation to be true and asserts it'

The lexical items in the sentence can have their specifications characterized as follows:

(11) A complex of concepts involving:

a. rustler:	property ownership, illegality, mode of activity
b. steer:	appearance, physical makeup, relation to animal kingdom
	institution of breeding for intended purposes, esp. human consumption
c. lasso:	certain materials (a body and a lasso) in certain configurations
	movement sequences of materials' parts
	concomitant mental intentions, directings, monitorings, etc.

In surveying the lists, we can see these differences emerge: The grammatical elements are more numerous and their specifications seem simpler and more structural. Together, their specifications seem to determaine the main organizational and communicational delineations of the CR evoked by the sentence. The lexical elements are fewer in number, but their specifications are more complex and seem to comprise most of the content of the CR. The lexical specifications are complex in three ways: compared to a grammatical specification, each has a) more total information, b) greater intricacy of information, and c) more different types of information together.

These grammatical-lexical differences can be set into further relief by in turn varying one element-type while keeping the other constant. Thus, varying only the grammatical elements of (9), as is done in (12), seems to alter the organizational and communicational characteristics of the scene but to leave its basic contents intact:

(12) Will the rustlers lasso a steer?

Varying only (9)'s lexical elements, as in (13), shifts us to a new scene altogether, and yet the essential breakup of the scene and of the communicative setting seem to remain the same:

(13) A machine cancelled the stamps.

2. Categories of Grammatically Specified Notions

The preceding sampling of grammatical elements has yielded a set of notions helpful toward discovering common properties. But the set has been small and haphazardly arrived at. With a broader and more systematic investigation, patterns of organization become evident. Grammatically specified notions can be seen to pattern in categories, and the categories, in turn,

in integrated systems. In this section we look at some of these categories and systems.

The grammatical elements here will not be treated in isolation, but in association with lexical items. That is, the grammatically specified structural notions will be considered in interaction with that portion of lexical specification that is also structural. This interaction entails cognitive processing, and different cases of such processing will be considered along the way.

The note on methodology should be made that our direction of analysis has been from grammatical specification to category, not the reverse. That is, the categories considered below were discovered to be relevant to the specifications of various grammatical elements. They were not part of some a priori conceptual schema which then sought corroborative examples.

2.1 Dimension / Kind of Quantity

The category of "dimension" has two member notions, 'space' and 'time'. The kind of "quantity" that exists in space is--in respectively continuous or discrete form--'matter' or 'objects'. The kind of quantity existing in time is 'action' or 'events' ("action" is meant to refer to any obtaining circumstance not just (willed) motion). In tabular form, these notions relate thus:

(13) space: matter/objects
time: action/events

A number of grammatical and lexical referents are specific with regard to one or the other pole of this category. But since the category cross-cuts the ones treated next, we will not exemplify it here but will endeavor in the following to present both space and time examples side by side.

2.2 Plexity

The category here to be termed "plexity" is a quantity's state of articulation into equivalent elements. Where the quantity consists of only one such element, it is "uniplex", and where it consists of more than one, it is "multiplex". When the quantity involved is matter, plexity is, of course, equivalent to the traditional category of "number" with its component notions "singular" and "plural". But the present notions are intended to capture the generalization from matter over to action, which the traditional ones do not.[9]

Specifications as to plexity are made by both lexical items and grammatical elements, and the interplay between the two when they are both in association must be noted. Example English lexical items that basically specify a uniplex referent are--for matter and action, respectively--bird and (to) sigh. They can occur with grammatical elements that themselves specify a uniplexity, like those underlined in (14a) (many languages have here a more regular, overt system of markers than English). But they can also occur with grammatical elements that specify a multiplexity, as in (14b). In this association, such elements can be thought to trigger a particular cognitive operation--in this case, one of "multiplexing". By this operation, an original solo referent is, in effect, copied onto various points of space or time.

(14)	matter	action
a. uniplex	A bird flew in.	He sighed (once).
b. multiplex	Birds flew in.	He kept sighing.

The reverse of the preceding circumstances is also to be found in language. First, there are lexical items that intrinsically specify a multiplexity. English examples are furniture or timber (i.e., 'standing trees') for matter and breathe for action, as used in (15a). And, too, there are grammatical elements able to appear in association here, as in (15b), that signal an operation the reverse of multiplexing--one that can be called "unit-excerpting". By this operation, a single one of the specified equivalent units is taken and set in the foreground of attention.

(15)	matter	
	action	
a. multiplex	Furniture overturned in the 'quake.	
	She breathed without pain.	
b. uniplex	A piece of furniture overturned...	
	She took a breath/breathed in...	

The grammatical elements that above signaled multiplexing-- -s and keep -ing --have a directly manifested surface form. The ones signaling unit-excerpting are in part abstract in form, as represented in (16):

(16) $\underline{\text{matter}}$ $\underline{\text{action}}$
(a) N_{unit} of + ___ V_{dummy} (a) [___ + X]$_N$

eg: a piece of furniture take a breath

or: ___ + Prtcle (eg: in)

2.3 State of Boundedness

Another category of attributes specified both grammatically and lexically for a quantity is its "state of boundedness" When a quantity is specified as "unbounded", it is conceived as continuing on indefinitely with no necessary characteristic of finiteness intrinsic to it. When a quantity is specified as "bounded", it is conceived as demarcated off as an individuated unit entity.

Among English examples of lexical items, water and (to) sleep seem basically to specify unbounded quantities, whereas sea and (to) dress seem basically to specify bounded ones. These specifications are demonstrated by the words' respectively unacceptable and acceptable occurrence with the grammatical element "in $NP_{\text{extent-of-time}}$", which specifies boundedness:

(17)	matter	
	action	
a. unbounded	*We flew over water in 1 hr.	
	*She slept in 8 hrs.	
b. bounded	We flew over a sea in 1 hr.	
	She dressed in 8 mins.	

Now, there are grammatical elements suitable for co-occurrence with unbounded-type lexical items which therewith, in effect, trigger a cognitive operation of "bounding". By this operation, a portion of the specified unbounded quantity is demarcated and placed in the foreground of attention. Examples of such grammatical elements in English are:

(18) $\underline{\text{matter}}$ (a) $N_{\text{bounded-quantity}}$ of + ___

$\underline{\text{action}}$ for $N_{\text{extent-of-time}}$ + ___

Particular cases of them in use are:

(19) We flew over a body of water in 1 hr.
She slept for 8 hrs.

The question arises whether the reverse of the preceding circumstances is ever to be found in language. Entailed would be the existence of grammatical elements that, when used with lexical items specifying a bounded quantity, Would trigger an operation of "debounding". By this, e.g., the referent of sea would be shifted to 'pelagic water', and that of (a) tear, to take another lexical bounded case, would shift to 'lachrymal fluid'. It seems likely that such grammatical elements exist; the closest candidate known to the author is the French suffix -age, but this has a range of meanings and many occurrence restrictions--and does not, e.g., happen to combine with the French words for "sea" or "tear".[10]

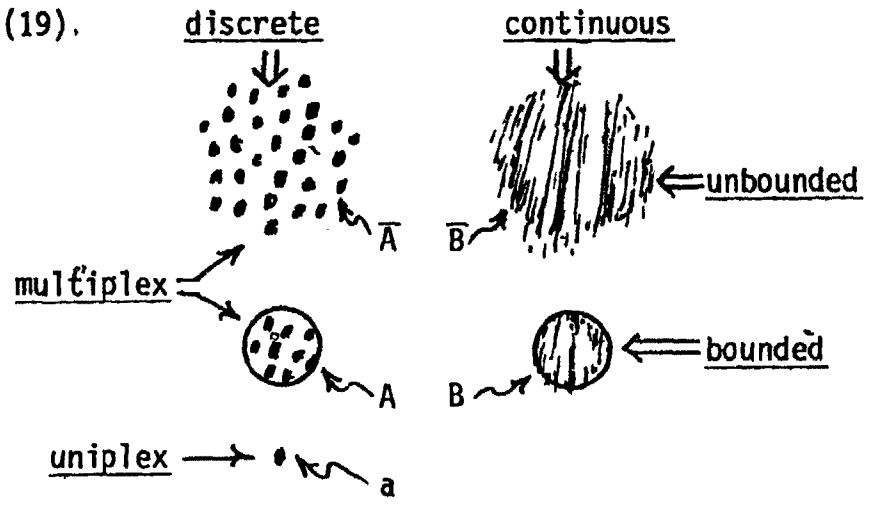
2.4 State of Dividedness

The category of "state of dividedness" refers to a quantity's internal consistency. A quantity is "discrete" (or "particulate") if there are breaks in its continuity. Otherwise, the quantity is "continuous".[11] Both lexical and grammatical elements are sensitive, in their specifications, to the distinctions of this category. But there appear to be no grammatical elements that solely specify discreteness or continuity for a quantity, and also none that signal an operation for reversing a quantity's lexically specified state of dividedness.[12] In consequence, there is difficulty in demonstrating this category explicitly by itself, and so we defer its treatment until the next section, where it can be seen in interaction with the other categories.

2.1 - 2.4 The Disposition of a Quantity

The preceding four categories of attributes all pertain to a quantity simultaneously and, taken together, can be considered to constitute a system of attributes that may be termed a quantity's "disposition". The particular intersections of the several attributes will be the main object of attention here. These, firstly, can be schematized as in (19):

(19).



\+ the distinction between matter and action, which cross-cuts all of the above[13]

Each intersection of attributes indicated here has been found specified by various lexical items. An example or two (most seen earlier) is given for each intersection in (20):[14]

(20)

Ā:	timber/furniture (to) breathe	B̄:	water (to) sleep
A:	(a) family (to) button up	B:	(a) sea/tear (to) zip up
a:	(a) bird (to) sigh		

Now if the particular contentful referent for which one chooses a lexical item happens to be wedded, by that lexical item, to an unwanted set of structural specifications, there generally are grammatical means available for altering this to a desired set. Such means range in directness from specifying the single apt alteration to involving a circuitous sequence of operations. A number of starting- and ending-points for alterations, and the means for accomplishing them, are indicated in (21):

(21)

Ā → A	a stand of timber breathe for 1 hr.	B̄ → B	a body of water sleep for 1 hr.
Ā → a	a piece of furnit. take a breath/ breathe in	-----	
A → a	a member of a fmly go through a step of buttoning up	-----	
A → Ā	members of a fmly (A → a → Ā) button on and on	B → B̄	tears (*tearage) (B → a → Ā → B̄) zip on and on
a → Ā	trees keep sighing	-----	
a → A	a stand of trees (a → Ā → A) sigh for a while	-----	

2.5 Degree of Extensionality

Implicit in the vertical dimension of the schematic arrangement in (19) is a further category[15] that can be called "degree of extensionality". This category has three member notions, terms for which are given in (22) together with schematics of the notions for the linear dimension:

(22)

point	bounded extent	unbounded extent
•	•——•	- - - ——— ..

Lexical items with either a matter or an action referent can make concurrent structural specifications for their referent as to its basic degree of extensionality. Three examples--specifying objects of different linear extensionalities--are the words

(23)

speck	ladder	river

Now a lexical referent that is perhaps most basically to be conceived as of one particular degree of extensionality can, by various grammatical specifications that induce a shift, be idealized as being of some other degree of extensionality. For a first example, consider the event referent of climb a ladder, which seems basically of bounded linear extent (of time), as is in fact manifested in (24) in conjunction with the grammatical element "in + $NP_{extent\text{-}of\text{-}time}$":

(24) She climbed up the fire-ladder in 5 mins.

With a different accompanying grammatical element, like the "at + $NP_{point\text{-}of\text{-}time}$" in (25), (as well as different contextual specifications), the event referent of the preceding can be shifted toward idealiz-

ation as a point of time--i.e., as being point-durational:

(25) Moving along on the training course,
she climbed the fire-ladder at exactly midday.

This shift in the cognized extensionality of the event can be thought to involve a cognitive process of "reduction" or of "taking the long-range view". The shift can also go in the other direction. The event referent can be idealized as an unbounded extent from the effect of grammatical elements like "keep -ing", "-er and -er", and "as + S", as in (26):

(26) She kept climbing higher and higher up the
fire-ladder as we watched.

Here there would seem to have taken place a cognitive process of "magnification" or of "taking the close-up view". In such a process, a perspective is established whereby the existence of any exterior bounds falls outside of view and attention--or, at most, are asymptotically approachable.

The preceding event referent was continuous, but a discrete case can exhibit the same shifts of extensionality. One such case, perhaps to be considered as most basically of bounded extent, is shown with that degree of extensionality in (27a). But the referent can also be idealized as a point, as in (27b) (it is clear that the cows here did not all die at the same moment, and yet the spread of their death times is conceptually collapsed into such a single moment). Or, the referent can be idealized as an unbounded extent, as in (27c):

(27) a. The cows all died in a month.
b. When the cows all died, we sold our farm.
c. The cows kept dying (and dying)
until the serum finally arrived.

The alternative idealizations of extensionality just seen as specifiable for an event referent are generally also available for an object referent. Thus, e.g., the referent of (a) box can be specified for idealization as a point or as a bounded extent (of area or volume). Some grammatical elements making such specifications are illustrated in (28). Also set forth here are the homologies between these and the event-specific elements:

(28)

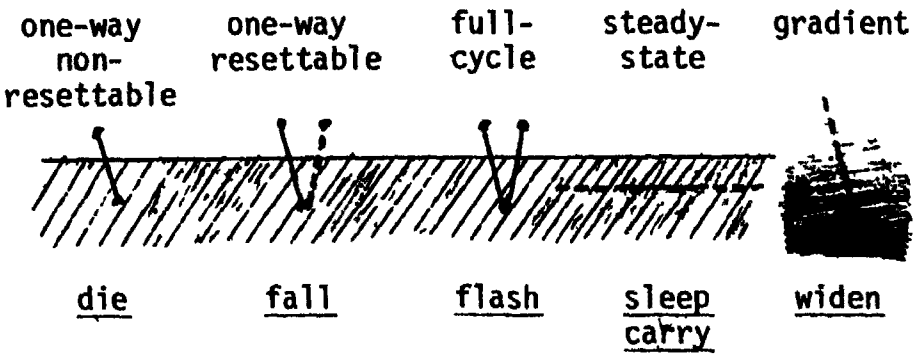
point	The box is 20 ft. away from the wall. I read the book 20 yrs. ago.
bounded extent	The box is 2 ft. across. I read the book in 2 hrs.
(point within) bounded extent	The ball is in the box. She arrived as I was reading the book.

2.6 Pattern of Distribution

The pattern of distribution of matter through space or of action through time is a further category of notions that can be both grammatically and lexically specified.[16] For action through time--the only dimension we will be looking at now--this category together with the preceding one largely constitute the traditional category of "aspect".

Several of the main patterns of distribution for action through time are shown schematically in (29) (the dots here, representing situatedness in complementary states, should really be adjacent, but they are sketched apart with a connecting line to show the crossing of state-interfaces). Shown, too, are example verbs whose basic distributional specifications are as in the corresponding schematic:

(29)



One can determine that these lexical items have the specifications indicated by noting the grammatical elements with which they can and cannot occur (or, to put the latter case in our terms: ...grammatical elements toward whose specifications they will not shift). A full demonstration is not in order here, but a few examples show the principle: The resettable type of a one-way event is distinguished from the non-resettable type by its compatibility in sentences like: He fell 3 times, which the other lacks: *He died 3 times. This same one-way form is distinguished from a full-cycle form by its ability to appear in sentences like: He fell and then got up, which the latter cannot do: *The beacon flashed and then went off.

We can now consider the cirsumstance where a verb of one type appears with grammatical elements of another type and shifts in certain of its specifications of distribution. For an example we again take die, whose basic specifications can be adjudged as point-durational one-way non-resettable--schematizable, now more precisely, as: . This verb is used with its basic specifications in a sentence like (30a).

(30) a. He died as she looked on.
b. He was (slowly) dying as she looked on.

But in a sentence like (30b), the grammatical element "be + -ing" induces a shift. In effect, the infinitesimal interval between the two states involved for die--viz., 'aliveness' and 'deadness'--is spread out, with the creation thereby of an extent-durational gradient. This is the shift in the distribution pattern's structural type. But concomitantly, a shift in the basic contentful referent is engendered. Instead of 'dying', the new gradient refers to 'moribundity'. The distinction becomes clear in noting that one can have been dying without having died, and, correlatively, one can have died without having been dying.[17]

2.7 Perspectival Mode

A specified action (which, in our terms, can as equally be static as involve change) has been seen to have its own, perhaps most basic, pattern of distribution through time. But, as it turns out, there can be independent specification for a mode of attending to the action that has a distinct temporal pattern of distribution, one that is either equal or unequal to the action's. In what we shall now consider, there are two types of such "attentional" or "perspectival mode" viz.:

(31) The assuming of:
a. a steady-state long-range perspective point with synoptic scope of attention
b. a moving close-up perspective point with local scope of attention

To illustrate, we first consider an example with a basically steady-state referent, viz., objects in location. The (31a) type of perspectival mode--the one more congruent with such a referent--holds in (32a), multiply specified/determined there by the set of grammatical elements shown underlined. But by substituting grammatical elements coding for the (31b) perspectival mode, as is done in (32b), the scene evoked can be shifted to one where one's mental gaze or one's own projected location jumps in turn from object to object. In effect, a steady-state multiplexity of objects has been converted to a sequential multiplexity of events, viz., of conceptualized encounters with the objects.

(32) a. There are houses here and there in the valley.
b. There is a house every now and then through the valley.

In a comparable case, the moving-perspective form, shown in (33b), is the only mode that can be specified using everyday language. One must resort to scientific language, as in (33a), in order to establish the synoptic perspective:

(33)

a. The telephone poles' heights form a gradient that correlates with their locations on the road.
b. The telephone poles get taller the further down the road they are.

The reverse of the preceding circumstances is also encountered. An example involving a sequential multiplexity of events is shown in (34a) with the more congruent moving-perspective mode specified. In (34b), the same referent instead becomes the object of synoptic viewing. In metaphorical terms, the effect here is as if the vertical time line is tilted up into present-moment horizontality for integrated or summational assessment.

(34)

a. I took an aspirin time after time during/ in the course of the last hour.
b. I have taken a number of aspirins in the last hour.[18]

2.8 Level of Synthesis

The category to be considered now pertains to bounded quantities, like those schematized in the A/B row in (19). One form of locution already seen to specify such quantities is the particular type of "NP of NP" construction illustrated in (35a). Here the second NP specifies the identity of the quantity involved, itself conceptualized as without intrinsic bounds, while the first NP specifies the bounding (or "portion-taking") per se of the quantity:

(35) a. a set of trees — a body of water
b. a cluster of trees — a puddle/drop of water

Now, beyond the fact alone of bounding off a portion, the first NP can additionally specify the particular configuration or form that the portion takes, as in (35b).[19] Especially with regard to internally discrete quantities--as with a cluster of trees--the two NPs can here be seen as coding for two different "levels of synthesis": The later NP specifies an unsynthesized multiplexity, while the earlier NP specifies a particular geatalt synthesized therefrom.

There is a further cognitive distinction involved here that language usually makes: either level of synthesis can be placed in the foreground of attention while the other level is placed in the background. One grammatical form that specifies this involves placing the foregrounded NP-type first, as shown in (36a). With the use of this grammatical device, moreover, predications can be made that pertain solely to one level of synthesis or the other, as seen in (36b):

(36) a. the cluster of trees / the trees in the cluster
b. That cluster of trees is small.
≠ The trees in that cluster are small.

There are certain surface forms, furthermore, whose referents are keyed to applying to only one or the other level of synthesis. Thus, together (toward each other) tends to correlate with multiple objects, while in (upon itself) tends to correlate with a composite thereof:

(37) The bricks in the pyramid came crashing together/?in.
The pyramid of bricks came crashing in (upon itself)/?together.

The preceding has involved shifting attention from a multiplexity to the gestalt that it constitutes. Also encountered in language are means for specifying the reverse: shifting attention from a gestalt to the components that constitute it. This procedure can take place when the starting lexical item specifies an entity taken to be already at the more synthetic level, as is the case with iceberg in (38a). By grammatical devices like those seen in (38b), such an entity can be broken down from conception as a coherent whole and presented in terms of component parts and their interrelations:

(38) a. The iceberg broke in two.
b. The two halves of the iceberg broke apart (*in two).

Again we encounter a surface form--in two--that correlates with only one level of synthesis and not the other.[20]

2.9 Level of Exemplarity

The specification for a multiplexity of objects can have a further cognitive distinction made pertaining to it. This distinction does not affect the basic reference to all the members of the multiplexity, but addresses how attention is directed therein. Either the full complement of the multiplexity is in the foreground of attention, with perhaps individual items here and there singled out in the background of attention. Or a single exemplar out of the multiplexity is placed in the foreground of attention, with the remaining items more dimly conceived in the background of attention. Perhaps most languages have several grammatical devices for specifying this distinction as to the "level of exemplarity". But English stands out in the extensiveness of its forms:

there are different pairs of grammatical elements that mark the distinction for a number of distinct types of multiplexity. A rather full list of these pairs is illustrated in (39):

(39)

a. Oysters have siphons/a siphon.
   An oyster has siphons/a siphon.[21]

b. All oysters have siphons/a siphon.
   Every oyster has siphons/a siphon.

c. All the members raised their hand(s).
d. Each member raised his hand(s).

d. Many members raised their hand(s).
   Many a member raised his hand(s).

e. Some members here and there raised their hand(s).
   A member here and there raised his hand(s).

f. Members one after another raised their hand(s).
   One member after another raised his hand(s).

g. Hardly any members raised their hand(s).
   Hardly a member raised his hand(s).

h. No members raised their hand(s).
   No member (Not a member) raised his hand(s).

i. She held a gun in both hands.
   She held a gun in either hand.[23]

2.10 Other Categories and Processes

More notional categories and cognitive processes have been worked up than there is opportunity to present here. Some of this other material is treated in an earlier work, Talmy (1977) (which itself lacks some of the material presented here). But we will briefly indicate some of the concepts involved.

The adjectives in a pair like sick/well behave differently in association with grammatical elements specifying vectoral degree, as shown in (40). In this they parallel the behavior of certain spatial expressions like at the border/past the border:

(40)
He's slightly { sick/past the border. / *well/*at the border. }
He's almost { well/at the border. / ?sick/?past the border. }

This behavior can be accounted for by positing that such adjectives are not simply "opposites", but, rather, imply for some semantic notion, e.g., that of 'health', a particular abstract topological axis of which each adjective labels a certain portion. The forms here seem in particular to imply a line bounded at one end; well refers to the end-point while sick refers to the remainder of the line. These are the lexical items' "axial characteristics", i.e., the particular (topological) relations each has to a particular semantic axis and to other items along the same axis. Certain grammatical elements, like those underlined in (40), also specify axial characteristics. Used incompatibly, they can cause a shift in an associated adjective's specifications. Thus, in (41), sick seems to label an end-point, and of a different axis as well, that of 'feeling bad':

(41) (After eating the shrimp, he felt worse and worse and) he was almost sick at one point/ he finally got sick in 5 hrs.

Lexical expressions like cottage and hotel room may be taken to have "associated characteristics"--here, respectively, those of 'permanent residence' and 'temporary lodging'. These attributes may mesh or conflict with the specifications of another element in the same sentence, e.g., with the directional adverb home, which specifies a permanent residence. In the case of conflict, as in (42b), the lexical item is operated on by a cognitive process that leaves its essential characteristics intact but replaces its incidental characteristics:

(42) a. He drove home to his cottage in the suburbs.
     b. He drove home to his hotel room.

The "scene-breakup characteristics" of a lexical item like serve refer to its basic specification of a dyadic event, in particular, a social event involving the two roles of 'host' and 'guest', as is manifested in (43a). But in a sentence like (43b), such a lexical item shifts to specifying a monadic event comparable to a basically monadic lexical expression like that in (43c). This shift in (42b) takes place in accommodation of the subject-plus-reflexive's single-role specification. (Though this grammatical element is determinative in setting the role-number as monadic, the verb's influence remains: blended in here is the metaphoric suggestion of a dyad, as if both 'host' and 'guest' are to be found in the "I"):

(43) a. The host served me some dessert from the kitchen.
     b. I served myself some dessert from the kitchen.
     c. I went and got some dessert from the kitchen.

A major aim in cognitive linguistics must be to investigate the interactions between lexical and grammatical specifications arising in a single sentence. Included here are the cognitive accommodations that take place where there are conflicting specifications. A number of interactions have been provisionally identified, and four seem definitely established: operations, shifts, blends (of two kinds: superimposed and introjected), and juxtapositions. The last three of these are treated at length in Talmy (1977).

2.11 Nesting

The operations and shifts seen in 2.1 - 2.6 need not take place singly. The output of one can serve as the input to another, up to as many as five hierarchical levels of "nesting". While there are a number of interesting examples of this for different types of matter and action, we will go directly to illustrating one of the longest cases:

(44)

a. The beacon flashed (as I glanced over).
b. The beacon kept flashing.
c. The beacon flashed 5 times in a row.
d. The beacon kept flashing 5 times at a stretch.
e. The beacon flashed 5 times at a stretch for 3 hrs.

In (44a), the lexical verb flash appears with its basic structural specification as a point-durational full-cycle uniplex event. This undergoes the process of multiplexing, to yield the unbounded multiplexity in (44b). This then undergoes bounding in (44c). This bounded multiplexity is then first put through

the process of reduction to become idealized as a point. and this is in turn multiplexed, yielding (44d). This new unbounded multiplexity is finally then bounded in (44e). The nesting of structural specifications in this last stage can be represented schematically as in (45):

(45) [('''''') - ('''''').....(''''''') - ('''''')]

3. Further Cognitive Connections

Grammatically specified structuring appears to be similar, in certain of its characteristics and functions, to the structuring in other cognitive domains, notably that of visual perception. In particular, the characteristic of being quasi-topological can be pointed to, and three major functions can be identified: classification, synoptics, and continuity. The thinking here is not equally far along on all these matters, but something of its directions can be indicated.

Grammatical specifications can be seen to constitute a classification with regard to the vast variety of learned, conceived, and perceived material. They gather different portions of the material together into subdivisions distinct from each other. By this, any particular currently cognized element is associated with its implicit "subdivision-mates". An illustrative case here are the twenty-odd motion-related prepositions in English, such as through and into, which together subdivide the domain of paths considered with respect to reference-objects'. This domain covers a great and varied range, but any particular "path" falls within the purvue of one or another preposition, associated there with other "paths" The associations are often language-specific and sometimes seem arbitrary or idiosynchratic. Thus, as seen earlier, classed together by through are such dissimilar cases as a straightforward liquid-parting course (walking through water) and a zig-zag obstacle-avoiding course (walking through timber). The question arises why such distinctions should be effaced by the grammatical system, while they are observed by the lexical and other cognitive systems. Why are grammatical elements--say, such prepostions--not a large and open class marking indefinitely many distinctions? One may speculate that the cognitive function of such classification lies in rendering contentful material manipulable--i.e., amenable to transmission, storage, and processing--and that its lack would render content an ineffective agglomeration.

The original assumption made in this paper about grammatical specification involved the synoptic function. That is, the grammatical elements of any particular sentence together specify the structure of the cognitive representation evoked by that sentence. Their specifications act as a scaffolding or framework across which contentful material can be splayed or draped. It can be speculated that such structure is necessary for a disparate quantity of contentful material to cohere in any sensible way or to be simultaneously cognized as a gestalt.

In the course of discourse, a great welter of notions pass in rapid succession. But there are several ways in which a cognitive continuity is maintained through this flux and a coherent gestalt is summated over time. For one, there are cognitive processes whereby the successive notions generally can be sensibly connected together or fit into a conceptual matrix. For another, rhetorical specifications --all the yes, buts, on the other hands, and a number of subtler elements not generally recognized for this--direct the illocutionary flow and make up the "logical" tissue of the discourse. Through this, grammatical elements appear to play a determinative role. Their specifications establish a structural level with greater temporal constancy amidst more fleeting aspects of content.

These forms of grammatically specified structuring seem to parallel forms discernable in the operation of visual perception.[24] First, the perception of any particular object is mediated by its association with related objects in a classificatory schema.

Secondly, the welter of visual sensations cognized at any given moment for some whole scene is rendered coherent by the perception of structural delineations running through it. One specialized form of this is discernable when one intends to move through a space, say, from one to the opposite corner of a restaurant. The sensations of tables, chairs,etc. are, in effect, perceived in simplified spatial arrangements as if from an aerial view, and the plot of a course one could follow through that is sensed.

Thirdly, in the course of motion through space over time, there is a great flux of visual sensations rushing past, but sense of continuity is maintained by the perception of structure running through the successive scenes. Two levels of "scene-structure constancy" are maintained. In the first, the perceived delineations afford greater permanence than the sensory flux, but do slowly shift. This is the level where, say, in walking past a table, its perceived outline is maintained but shifts gradually from a quadrilateral to a trapezoid and back to a quadrilateral. A deeper level of greater constancy is also maintained, from which the table continues to be perceived as a rectangle no matter where one is in relation to it. For a final parallel with grammatical specification, the topology-like nature of visual perception is evident here. For certain abstract characteristics of a scene and its contents are maintained constant while other, more metrical and Euclidean characteristics are free to vary without relevance thereto.

4. Notes

1. The word "evoke" is used because the relationship is not direct. The CR is an emergent, compounded by various cognitive processes out of the sentence elements' referential meanings, understanding of the present situation, general knowledge, etc.

Our term "cognitive representation" is similar in purport to Fillmore's (1975) "scene" but is chosen over that more specifically visual term. The linguistically evoked complex can have much from other sense modalities (notably som/kinesthetic and auditory) as well as meta-modal aspects.

2. Comprehension, rather than production, is the direction we limit ourselves to in the initial endeavor. This direction would seem to yield more immediately reliable findings, since its starting point is with more overtly manifest, hence handleable, forms like grammatical elements rather than with meanings and experiential complexes, which rely more on introspection and reports of introspection. Nevertheless, each direction does involve both the manifest and the experiential sides of language.

3. This is a classical linguistic distinction. A class in which morphemes are formally gathered is considered open if it is quite large and easily augment-

able relative to other classes. A class is considered closed if it is relatively small and fixed in membership.

4. Also includable here are "lexical complexes" like lodge a complaint or zero in on. Excluded are adverbs, which seem in all languages to derive from the other three open classes rather than from any open class of specifically adverbial stems.

5. Since the term "structure" has broad usage, we can help focus in on the intended sense with alternative terms: "principles of organization", "pattern of delineations", "schematic framework".

6. The fact of dual lexical specifications that can lead to conflict is a mojor issue that will be treated below under shifts. Some grammatical elements also cross the line and make contentful specifications along with structural ones. This is a more tangential issue that can be touched on here. The crossing ranges from the incorporation of a single contentful notion to the orderly interweaving of contentful and sturctural notions. Thus, upon in We rode/sailed/rushed upon the enemy incorporates the notion of 'attack', seemingly equivalent to the paraphrase 'into attack upon'. The closed-class adverb tomorrow is equivalent to the phrase 'during the day that occurs next after the day during which I am now speaking', an example of an organized interlacing.

7. One can note, for example, the effect on one's internal cognitive representation in considering first the sentence I looked at the dog and then I looked at the dogs. The addition of the grammatical element -s has a major effect on the delineational breakup of--to put it visually--the scene before the mind's eye.

8. For example, augmentative and diminutive inflections, insofar as they refer to actual size, seem to specify size relatively greater or lesser than the norm for an object. And grammatical elements specifying distance (like English way and just appearing, e.g., before up there) appear to specify notions of 'far' and 'near' that are relative to the current situation.

9. It is true that there are the traditional terms "semelfactive" and "iterative" referring, respectively, to one and more than one instantiation of an event. But there is no real equivalent to number: "aspect" includes too much else about the temporal structure of action. And in any case, none of the traditional terms refer generally to both the dimensions.

10. The mechanism actually resorted to by both English and French in many such cases, including that of tear, is the use of the plural, as in:

(i) Tears flowed through that channel in Hades.

There seems to be a sequence of cognitive operations here in getting from a bounded to an unbounded quantity. Speculatively, the bounded quantity is first treated as a uniplex entity, it is then multiplexed, the resultant entities are conceived as spatially juxtaposed, and their boundaries are lastly effaced.

11. The present category may be prone to confusion with the preceding one. Contributory here is the normal meaning range of continuous, which as easily covers 'boundlessness' as it does 'internal seamlessness'. However, the two categories can vary independently. Thus, in the preceding section, the lexical examples given for unboundedness, water and sleep, happened also to be internally continuous; but the same demonstration of unboundedness could have been made with internally discrete examples like timber and breathe

12. There do exist certain mechanisms for such reversal. Thus, taking an unbounded case, the continuity-specifying word water can be shifted toward being cognized as discrete by the locution particles of water, as in:

(i) Water/Particles of water filled the vessel.

However, the grammatical complex used here does not directly specify the shift but, like the one in Note 10, seems to involve a several-atage route of cognitive operations.

13. For schematizing action along the one-dimensional time axis, an adaptation of the two-dimensional A, B, A, and B diagrams would be necessary--and can be readily visualized.

14. The lexical types for several of these intersections, it should be noted, do have traditional terms. Thus, nominal forms of the a, A, and B types, respectively, have been called count nouns, collective nouns, and mass nouns. And verbal forms of the a and B types, respectively, have been called punctual and durative verbs. The matrix presented here augments, systematizes, and generalizes the traditional notions.

15. It may be considered an extension of the category of state-of-boundedness via the incorporation of the notion of uniplexity.

16. This category might be considered an extension or generalization of the "disposition of a quantity". Clearly, this category and the preceding five all belong together in treating the greater disposition of a quantity, but the relationships have not yet all been worked out.

17. Our main purpose here is to note the shift in structure type. The shift in content, which will doubtless prove to have some regularity is not clearly understood at this point.

18. A major function of perfect forms in language indeed appears to be the one involved here. More particularly, the perfect seems able to specify the temporal counterpart of matter located within a bounded extent of space, as in (i). That is, a sentence containing the perfect, as in (ii), suggests a paraphrase like that in (iii), which is homologous with (i):

(i) There were 5 aspirins on the table.
(ii) I have taken 5 aspirins in the last hour.
(iii) There were 5 aspirin-takings in the last hour.

(In support of this interpretation, as pointed out to me by Peyton Todd, the per[illegible] can be noted always to involve a temporal span bounded at both ends.)

19. All three notion--identity of a quantity, portion-taking of a quantity, configuration of the portion--are generally specified simultaneously (or, "conflatedly" --see Talmy (1975)) by lexical items that would fit in the A/B row of (20). For example, (a) tear specifies not only a certain shape of quantum, but also the

material involved: lachrymal fluid. Such words generally do not participate in an "NP of NP" construction --like *a tear of milk--unless they in fact accede to a shift toward the type of word represented in drop.

20. There is a foursome of apt terms that can be applied to the two levels of synthesis in the two directions of shift, as indicated in (i). Employed here is the term "Figure" as it is used in my other work (Talmy 1978, 1976):

(i) cluster: "composite Figure" iceberg: "meta-Figure"
trees: "multiple Figures" 2 halves: "component Figures"

21. For the plural form oysters, the plural form siphons is ambiguous as to whether there are one or more siphons per oyster. All the other combinations unambiguously indicate the number of siphons per oyster. Thus, the exemplar form is always unambiguous in this reagard--one of its advantages over the full-complement form. This same arrangement holds through the list.

22. I have long wondered what the differences between each and every might be. One apparent difference shows up here. Each seems to be the exemplar counterpart of all the but not of all without the (*Each oyster has a siphon makes a poor generic assertion). Every is not constrained in this way, though it does strike me as more comfortably the counterpart of all without the.

23. One more pair can be added to this list by adjoining two complementary unpaired forms from two different languages. The English form some, as in some friends of mine, requires the plural and has no singular counterpart. The Italian form qualque, as in qualque amico mio, requires the singular and lacks a plural.

24. It seems likely that the language-related portions of the brain could have evolved to their present functions only in the presence of these already existing cognitive mechanisms and have incorporated their operation.

5. References

Fillmore, C. 1975. An alternative to checklist theories of meaning. In: Berkeley studies in syntax and semantics, vol 1. University of California, Berkeley.

-----. 1976. The need for a frame semantics within linguistics. In: Statistical methods in linguistics. Stockholm: Skriptor.

Talmy, L. 1975. Semantics and syntax of motion. In: Syntax and semantics, vol. 4. J. Kimball, ed. Academic Press.

-----. 1976. Semantic causative types. In: Syntax and semantics, vol. 6. M. Shibatani, ed. Academic Press.

----. 1977. Rubber-sheet cognition in language. In: Papers from the 13th regional meeting, Chicago linguistic society. University of Chicago.

-----. 1978. Figure and Ground in complex sentences. In: Universals of human language. Greenberg, Ferguson, Moravcsik, eds. Stanford University.