

RELATIVITY IN SPATIAL CONCEPTION AND DESCRIPTION

STEPHEN C. LEVINSON

1 Preamble

The rise of the cognitive sciences has caused a sea-change in our approach to issues concerning the relation between language, culture, and thought. Presuppositions have changed, in epistemology from empiricist to rationalist, in ontology from idealist to realist, and accordingly goals have switched from the description of cultural variation to the search for fundamental underlying universals. In this light, the Sapir-Whorf hypothesis seems uninteresting: it is either (*ex hypothesi*) just plain false, or if (God forbid) true, the weakest and most disappointing of hypotheses one could imagine.¹

Yet there is surely something wrong about a theory of human cognition that treats that great cultural bulk of human conceptual structure as obfuscating detail: the fact that human cognition is built for culture, and thus built for enculturated variation, is a central fact about it. Like the common juniper, which varies from a three-inch shrub to a twenty-foot tree according to the prevailing conditions, so the important thing about the human mental genotype may be its design for phenotypic variation. From that perspective, a good grasp of the cultural variation is just as important to a science of Mind as it is to a science of Culture. And every plausible universal that fails is actually rather interesting.

In this chapter, we examine a number of plausible cognitive science generalizations about spatial conception and language which seem to be falsified by a couple of errant cultures. It is hard to draw strong conclusions from such failures – different or more abstract universal generalizations may yet be shown to hold. Nevertheless, it is at least tempting to draw the conclusion that a model of universal conceptual constraints ought not to be invariably in the strong Mendelian style (permutations and combinations of a set inventory) favored, for example, by Chomsky, but rather should sometimes be viewed as a set of filters which may radically under-determine the phenotypic cultural variants.² This would leave Sapir and Whorf hedged in, but hardly hobbled.

On this view, the filters that constrain how we think about some domain would include at least:

- (a) the intrinsic structure of the domain (in relation to our use of it);
- (b) our perceptual and cognitive propensities;
- (c) intrinsic linguistic structures and communication constraints (including pragmatic constraints).³

A set of strong universal filters, however restrictive, may still largely under-determine cultural variation in domain-conceptualization, as illustrated by the following analogy. Consider a map, taken as a conceptual structure B representing terrain A. The intrinsic structure of domain A (mountains, rivers, roads) constrains possible conceptualizations B, B', etc. So does our perceptual apparatus: we can only discern certain sensory or measurable properties of A (and indeed of B). So does our conceptual apparatus: perhaps we find roads more significant than similar-scale streams. These constraints are detailed, interesting, and important. Still, all these constraints leave the possible structure of B pretty unrestricted (two or three dimensions, colors, scale, projection, coordinates, topographical vs. geographical, degree of stylization, etc.), as the history and ethnography of cartography will confirm. It is the last constraint -- that B must satisfy the demands of a communication system -- that most fully determines the final characteristics of the map: conventions about how to represent features of terrain (semantics), and, equally important, principles about what can be safely omitted as taken-for-granted-for-current-purposes (pragmatics).

Just to amplify the last point: note that part of what is omitted on a map is unreconstructable -- the scale may simply be too small to show certain features for example, the symbol for 'church' may fail to give any indication of size. However, other omissions are themselves telling: for example, if the map is of an appropriate scale, where no bridge is shown, there is no bridge; where a building is shown, but is not marked more specifically with the symbol for 'church,' then the building is not a church; where a church is shown, we expect a stereotypical church, not a ruin or a Mormon tabernacle. To some rather interesting extent, such patterns of presumption are independent of the cartographic conventions and the nature of the terrain mapped. They constitute the systematic pragmatics, another kind of systematic filter on arbitrary variation which we shall (somewhat inconclusively) attend to below.

We now turn to examine a particular domain, spatial conception and description, and ask how strongly each of these various kinds of constraints can there be formulated. We contrast a number of proposed universals with the facts from two speech communities of non-Indo-European stock, concentrating on the Mayan language Tzeltal.⁴ We

focus first on cognitive constraints, then linguistic constraints, and finally (and briefly) on pragmatic constraints.

2 Spatial conception

There are many reasons to think spatial conceptualization central to human cognition: spatial understanding is perhaps the first great intellectual task facing the child, a task which human mobility makes mandatory, but above all spatial thinking invades our conceptualizations of many other domains as diverse as time, social structure, and mathematics.⁵

Spatial conceptualization is also an interesting domain through which to explore issues of cultural relativity, as it is clearly highly constrained by the nature of the physical world as well as by the nature of human psycho-biology. Space has, it would seem, intrinsic physico-mathematical properties, explored in our geometries of two and three dimensions. In addition, our perception, especially our visual system, constrains how we will perceive terrestrial surfaces, while our upright posture, related in turn to the nature of terrestrial gravity, provides one fixed co-ordinate. There is much known, also much unknown, about the physiology, neurology and cognition of vision, motor co-ordination relative to spatial constraints, and spatial conception.⁶ Yet there are still, it turns out, quite surprising cultural variations in the conceptualization and linguistic coding of spatial location, some results of which I here briefly report on.⁷

2.1 Under-determination by the cognitive constraints

Obviously, it is not easy to tease apart constraints due to the intrinsic structure of all languages from those due to cognitive constraints of other kinds. However, we describe here a handful of proposed universals that might be attributed directly to cognitive constraints, and briefly describe how they fail, postponing richer linguistic detail to the next section. The proposed universals are:

- (a) naive human spatial conception makes no use of fixed "absolute" angles (Miller & Johnson-Laird 1976, Talmy 1983);
- (b) it is primarily ego-centric in nature (Piaget & Inhelder 1948, Clark 1973, Miller & Johnson-Laird 1976, Lyons 1977, and many other sources);
- (c) it is anthropomorphic: the co-ordinates are established by the verticality and the asymmetry (back front) of our bodies, with the additional left/right orthogonal. Secondly, this co-ordinate system may be projected onto an interlocutor or oriented object (Clark 1973, Miller & Johnson-Laird 1976, Lyons 1977: 690-1).

It has been supposed by many psychologists that nearly everything interesting about spatial conception follows from intrinsic perceptual and cognitive constraints: specifically the presumed fact that human perceptual space is ego-centered and relativistic. Miller & Johnson-Laird sum up these ideas as follows:

The conceptual core of space probably originates, as Cassirer (1923) and others have maintained, with the body concept – with what is at, in, or on our own bodies. The first spatial relatum we learn to use is ego... Piaget & Inhelder (1948) claim that escape from this egocentric space requires considerable cognitive development... The ability to decenter does not displace the egocentric conception of space, but it supplements it... Egocentric use of the space concept places ego at the center of the universe. From this point of origin ego can lay out a three-dimensional co-ordinate system that depends on his own orientation. With respect to this landmark other objects can be located as above or below (ego), in front or in back (of ego), to the left or to the right (of ego). (1976: 394–5)

Using these orthogonals, with ego as the origin of the axes, we can then define search-domains of indefinite extent, radiating out from ego's 'front,' 'back,' 'left,' 'right'; secondarily, we can shift the origin to other objects (*in front of the church*). This then gives the underlying basis for a system of spatial description where objects are located in a projected space relative to another reference object, prototypically the self, which itself provides orientational co-ordinates. In effect, the essential characteristics of human spatial conception are supposed to follow from our being ego-centric, forward-looking and -oriented bipedal primates wandering on a planet with significant gravity.

This view can easily be shown to be wrong by looking cross-culturally at entirely different solutions to spatial conception. Take, for example, the case of the Guugu Yimithirr speakers of N. Queensland, who utilize a system of spatial conception and description which is fundamentally different from that of English-speakers.⁸ Instead of concepts of relativistic space, wherein one object is located by reference to demarcated regions projected out from another reference object (ego, or some landmark) according to *its* orientation, Guugu Yimithirr speakers use a system of absolute orientation (similar to cardinal directions) which fixes absolute angles regardless of the orientation of the reference object. Instead of notions like 'in front of,' 'behind,' 'to the left of,' 'opposite,' etc., which concepts are uncoded in the language, Guugu Yimithirr speakers must specify locations as (in rough English gloss) 'to the North of,' 'to the South of,' 'to the East of,' etc. The system is used at every level of scale, from millimeters to miles, for there is (effectively) no other system available in the language; there is simply no analogue of the Indo-European prepositional concepts.⁹

The cognitive prerequisites and consequences of such a linguistic system are fundamental and far-reaching: every speaker must be absolutely oriented at all times, and when moving must dead-reckon all locations that may need to be referred to, or used as reference points. These cognitive processes can be demonstrated independently of language (Levinson 1992b): Guugu Yimithirr speakers can be shown during travel to be able to estimate the directions of other locations with an average error of less than 14°. It can also be demonstrated experimentally that they remember spatial arrays not in terms of egocentric co-ordinates (like in front, behind, to the left or right), but in terms of the cardinal directions in which objects lie. Thus Guugu Yimithirr speakers appear to think about space in a fundamentally different way than we do. That in turn makes available a gestural system (see Haviland 1986 and in this volume), which has further deep interactional and indeed linguistic consequences (e.g. widespread zero-anaphora reinforced by gesture).¹⁰

Space (of another sort) precludes further details about the Guugu Yimithirr system. We mention it here merely to show how the intrinsic nature of spatial organization, and of our perceptual and cognitive abilities, largely under-determines solutions to the problem of spatial conception and description. There is simply nothing in the world or in the mind that makes a concept like 'in front of' natural or essential.¹¹

We turn now to another system of spatial description, that utilized by the Mayan (Tzeltal-speaking) Indians of Tenejapa.¹² This system again makes many contrasts with spatial description in the familiar Indo-European languages. First, there is also, as in Guugu Yimithirr, a use of absolute or fixed angles of orientation, by virtue of reference to a fixed notional 'uphill'/'downhill' inclined plane (corresponding to the overall fall of the terrain along a South/North axis). Thus, even on the flat, two referents can be discriminated by describing the Northerly one as 'downhill' of the other. The system is quite complex and the subject of another paper (Brown & Levinson 1993a). Suffice it to say here that, just as in the Guugu Yimithirr case, we can demonstrate that this system has fundamental cognitive consequences. Spatial arrays are memorized in terms of absolute, fixed directions, not in terms of egocentric co-ordinates. Thus if a Tenejapan is presented with an array like a cup in front of a bottle, and is rotated 180° and asked to make the same array again, he will in nearly all cases arrange the bottle in front of the cup – the egocentric viewpoint is thrown away in order to retain the orientation of the objects on, for example, the 'uphill'/'downhill' axis. Likewise, when required to make non-verbal spatial inferences about locations of objects, the use of a fixed absolute system of directions can be demonstrated.¹³

However, unlike the Guugu Yimithirr system, the Tzeltal system of fixed directions is supplemented by a rich system of spatial description which describes objects as positioned relative to other objects without reference to "absolute" co-ordinates. At first sight such a system looks much more like our own "relative" system of co-ordinates. However, and this is the second point of departure from the Indo-European pattern described in the Miller & Johnson-Laird quote above, the non-absolute system in Tzeltal is not essentially egocentric in character. Instead it makes minimal use of the orientation of the speaker, or the "intrinsic" orientation of other relata: referents are spatially related to other things essentially by being in (near or) *actual contact* with them, not by falling within spaces projected off oriented facets of "landmark" objects (ego or otherwise). Thus the allegedly universal canonical three-coordinate system (up/down, front/back, left/right) does *not* form the core of the Tzeltal spatial reference system: indeed there are no terms for 'to the left' or 'to the right' at all, the terms for 'face' and 'back' refer to body-parts rather than spatial regions, and there is even a possible argument that the vertical dimension is only conceived of as the limiting case of the notional inclined plane mentioned above. That these are more than lexical gaps – i.e., also conceptual gaps – is clear from a series of informal experiments.¹⁴ Tenejapans show an interesting tendency to confuse left–right inversions or mirror-images (i.e., reflections across the apparent vertical axis), even when visually presented simultaneously, which seems related to their absence of 'left' and 'right' terms, and the absence of related asymmetries in their material culture. Indeed, the (at least partial) eclipse of an egocentric co-ordinate system forms an interesting cultural, linguistic, and cognitive complex (see Levinson & Brown 1994).

Tzeltal undermines a third kind of generalization about human spatial conceptualization, namely that naive geometry is topological rather than classically geometrical. Len Talmy (1983) makes this claim in terms that suggest he sees the generalization as a constraint imposed by "natural language schemas," i.e., by coding-constraints rather than conceptual constraints, and we will deal with the issue in those terms below.

Finally, the Tzeltal system arguably undermines the very notion of a naturally delimited conceptual domain concerning spatial location, because spatial locutions in Tzeltal nearly always involve ancillary information (especially shape, position, of the figure but also adhesion, manner in which position was obtained, etc.).¹⁵ English prepositions (and indeed Guugu Yimithirr cardinal point terms) form a contrast set covering a single, coherent, abstract spatial domain, without curious "selectional restrictions" of this sort: we do not, for example, expect an Indo-European language to present us with two locutions for 'in front

of,' depending on the texture or other incidental property of the relatum; but in Tzeltal there are many "locative" predicates that distinguish, for example, flexible vs. nonflexible, thick vs. thin, figure-objects.

2.2 Linguistic constraints and Tzeltal locative expressions

We turn now to examine how the following proposed universals of spatial description seem to be falsified by Tzeltal:

- (a) motion-description and location-description significantly overlap (utilize the same expressions); the former is primary, the latter often derivative (Talmy 1983);
- (b) the geometry of the figure is characterized much more simply than the geometry of the ground (Talmy 1983: 233);¹⁶
- (c) the spatial geometry employed in natural language is topological, not Euclidean (Talmy 1983: 261);
- (d) languages make ontological commitment to the notion of *place* as distincts from the notion of *entity* (perhaps attributable to Lyons 1977, W. Klein 1990). (Tzeltal data equivocal.)

We will make the points discursively while introducing the nature of Tzeltal spatial description.

Tzeltal spatial description makes a fundamental cut between motion-description and location-description: the former is coded by a small set (14) of motion verb roots, the latter by a large set (c. 300) of stative adjectival predicates, which although derived are never derived from the motion-verb roots. For example, the concepts of 'going up' or 'going down' are lexically unrelated to 'being up' and 'being down' and the motion verb for 'going across' is unrelated to the stative predicate for 'lying across.'¹⁷ There is almost no overlap between locative and motion description, and no evidence for the derivative nature of the former (*contra* Talmy 1983).

We concentrate now just on Tzeltal locative descriptions; even here, though, we shall have to simplify considerably (see P. Brown 1991 for an overall sketch). The basic Tzeltal locative construction consists of a stative adjectival predicate, its nominal subject (the figure to be located), and a prepositional phrase (describing the ground) providing the nominal denoting the *relatum* or landmark-object from whose location the figure-object can be found. Stated thus, the Tzeltal locative construction sounds rather like the basic English prepositional locative construction:

- (1) *The cat is on the mat*
 SUBJECT PREDICATE PREPOSITION NP
 [Referent] { Relation [Relatum]
 (figure) (_____ ground _____)

The English sentence *The cat is on the mat* states that the cat may be found in a search-domain relative to the relatum (the mat), as further specified by the support-relation encoded by *on* (cf. *above*, *near*, etc.). Nearly all the semantic load in English is carried by the preposition, and the predicate is nearly vacuous, but in any case what matters is the relation of the figure to the relatum. Hence in English the preposition encodes a great deal about the geometry of the ground, but little or none about the figure. For example, the preposition *opposite* in *The bank is opposite the supermarket* projects a geometrical set-up in which a parallel-edged ribbon or rectangle (e.g. river, road, square) separates referent (bank) and relatum (supermarket) which both fall on a line drawn orthogonal to the ribbon or rectangle.¹⁸ This geometry of the ground is indifferent to the geometrical properties of the figure.

All this makes good sense for conceptual reasons, or so one might suppose: the function of a locative description is to tell us where to find the figure-object, so what we need information about is (a) the ground-object (the relatum), and (b) the geometrical nature of the search-domain projected from the relatum by the relation. On this basis we can construct some very plausible universals about spatial conception, claiming centrally that spatial descriptions specify the geometrical nature of the ground, not the figure (Talmy 1983, see also Miller & Johnson-Laird 1976, Herskovits 1986).

However, Tzeltal locative descriptions don't work this way. Consider the following exemplar of the basic Tzeltal locative construction, here describing the location of a gourd as on a table (glosses very rough):

(2) <i>pachal</i>	<i>ta</i>	<i>mexa</i>	<i>boch</i>
sitting-bowl-like	AT	table	gourd
PREDICATE-ADJ	PREP	NP	SUBJECT NP
Positional	Relation	Relatum	Referent
(_____ <u>ground</u> _____)			(figure)

'The gourd is on the table'

The predicate adjective *pachal* is derived from one of a set of roots (a core subset of which are called *positional* roots by Mayanists) that describe the disposition of objects in a highly discriminated fashion; for example, other such roots describe of flexible sheets how many times they are folded, or of ropes exactly how they are coiled.¹⁹ Here *pachal* specifies upright location, of a vessel whose greatest diameter is not greater than its mouth. The subject, *boch*, a type of bowl-shaped gourd, meets the specification. For other kinds of vessels, for example, those with upright cylindrical bodies, or narrow necks, other stative predicates will be required. These stative adjectives thus describe in great detail the geometrical nature of the figure rather than that of the ground. Although

unlike adjectives without locative uses they collocate with a prepositional phrase which describes the ground, that phrase is optional. Further, the preposition *ta* in Tzeltal is vacuous, because there is only one preposition in the language which has to serve for every spatial and non-spatial (e.g. temporal or manner-adverbial) relation too. The geometrical nature of the ground is almost entirely unspecified in the basic Tzeltal locative construction (but it may be optionally developed by body-part terms, as will be described below).

Thus the "natural" English strategy of presupposing the structure of the figure, but detailing the nature of the ground (i.e. the relation and the relatum) so that the figure may be found within it, is not followed in the Tzeltal case at all. Instead, Tzeltal takes the strategy of specifying in great detail the figure, while presuming the general nature of the ground – the strategy in effect is: "look for something of *exactly this* shape and disposition, which has some unspecified stereotypical relation to the relatum, if a relatum has been provided." A choice of one out of 300 or so detailed predicates is more or less obligatory; one can hardly escape detailing the geometry of the figure, but the ground may be only alluded to or even omitted altogether.²⁰

Why does Tzeltal force the speaker into such an arbitrarily detailed geometry of the figure? One answer may be, as just hinted, that the main function of locative expressions is merely to provide a means of successful reference. In that case, Tzeltal emphasizes an alternative strategy for achieving successful reference – English does it by telling you where to look, Tzeltal by telling you what to look for. (The Tzeltal locative construction provides equally good answers to 'Where?' questions and to 'How does it look?' questions.) However, another intriguing suggestion has been made by John Lucy (1992: 73ff.) on the basis of work on the related language Yucatec Maya. Like Tzeltal, Yucatec has a developed set of numeral classifiers. The motivation, Lucy claims, is that nominals in Yucatec fail, by themselves, to individuate entities. It is only by collocation with a numeral classifier or some other shape-discriminating phrase that such nouns can come to designate countable entities. This thesis, carried to its logical extreme, would amount to the claim that all nominals in Yucatec are essentially *mass* nouns and that the language makes no ontological commitment to *entities* as opposed to materials, essence or "stuff" at all. In order to individuate entities, a numeral classifier or some predicate is required to impose individuation on the material, metaphorically in much the way that a cookie-cutter cuts up undifferentiated dough!²¹

If the thesis held even partially for Tzeltal, it would help to explain the Tzeltal insistence on specifying the geometrical nature of the figure. Consider, for example, the fact that the Tzeltal nominal *lo'bal* could be

glossed 'banana stuff,' because it refers equally to all the parts of the natural kind: to the fruits, to a single fruit, to clusters of fruits, to the trunk of the banana tree, to the leaves of the tree, and so on. Now, given a nominal of such a nature, the kind of geometric and shape information encoded in the stative locative predicates we have examined is not as redundant with the information contained within the subject noun as it first might seem. Consider the examples in (3).

- (3) a. *jipil ta laso lo'bal*
 hanging AT rope banana
 'the banana(-fruits) are hanging from the rope'
- b. *k'atal ta s-ba s-k'iyobil kapej te lo'bale*
 lying-across AT its-top its-drying coffee the banana
 'the banana(-trunks) are situated across the top of the coffee-drying patio'
- c. *palal lo'bal ta xujk na*
 attached-in-bunches banana AT its-side house
 'the banana(-bunches) are against the inside side-wall of the house'

The figure in these three examples is designated by the nominal *lo'bal*. In each case, the 'banana-stuff' to which it refers gets formed up, as it were, by the positional predicate which indicates the nature of the individuated entities involved. Thus, Lucy's conjecture would go rather a long way to explain why it is that Tzeltal and languages like it have such a wealth of locative (and other) predicates, making such fine discriminations between shapes and dispositions of the figure.

Natural languages have finite vocabularies. It follows that lexemes must be semantically general over indefinite exemplary referents (languages are "efficient" as Barwise & Perry 1983 put it). Thus they must "schematize." Are there general principles of schematization? Talmy (1983) claims "yes."²² One of them, he suggests, is that natural language geometry is *topological*, rather than "Euclidean." Popularly conceived of as "rubber-sheet geometry," topology makes fundamental distinctions between continuous and non-continuous transformations of a geometrical figure (where, informally, continuous transformations ensure that two points that are close together at the start of the transformations are close at the end). Thus a circle and an ellipse, or a straight vs. a curved line, or a square vs. a triangle, are topologically equivalent pairs, though Euclideanly distinct. Talmy's claim is that natural language characterizes spatial relations (and objects generally) "almost solely by more qualitative or 'topological' properties" (1983: 234). The plausibility of the claim can easily be seen by considering Indo-European prepositions like English *in*, which seem to have a topological flexibility of application.²³

- (4) a. The peaches are in the can [enclosed]
 b. The peaches are in the bowl [partially enclosed]
 c. The dog is in the yard [bounded in 2 dimensions]
 d. The shuttle is in outer space [unbounded??]

Yet Tzeltal seems much more thoroughly metric and "Euclidean." Consider for example the following stative predicates which distinguish between size and shape (large sphere/small sphere, spherical vs. ovoidal) of the figure. Small deformations, for example of a ball of corn-dough, will cause a category change:

- (5) a. *wolol ta mexa* ('sitting-of-small-sphere AT table')
 b. *k'lol ta mexa* ('ditto, of large sphere')
 c. *telet ta mexa* ('ditto, of slightly deformed sphere')

Talmy (1983: 234) claims that "missing from the catalog of geometric types [employed in natural languages], for example, are virtually all properties specific to metric spaces (including the Euclidean) such as particular size, length, distance, angle or contour." Here are some Tzeltal locative/stative predicates as counter-examples that speak for themselves:²⁴

- (6) The relevance of exact contour (shape)
- a. *t'ikil ta tz'ulja matz*
 contained₁ AT globular-gourd corn-dough
 ('contained, of stuff in vessel with narrow opening')
- b. *pachal ta boch matz*
 contained₂ AT hemispherical-gourd corn-dough
 ('contained, of stuff in vessel with wide opening')
- c. *pachal boch*
 located-upright₁ hemispherical-gourd
 ('upright, of wide-mouthed vessel')
- d. *waxal p'in*
 located-upright₂ necked-vessel
 ('upright, of narrow-mouthed tall container')
- e. *jukul matz*
 located-upright₃ corn-dough
 ('upright, of wide-bottomed cone')

(7) The relevance of exact angle/curve

- a. *xik'il si'*
 leaning-0°-to-30°-from-vertical fire-wood
- b. *ta'al si'*
 leaning-30°-to-60°-from-vertical fire-wood
- c. *nubil laso*
 pulled-into-tight-line the rope
- d. *timil laso*
 pulled-tight-sagging-slightly the rope

- c. *pok'ol* *laso*
sagging-deeply-curved the rope

We turn to consider how Tzeltal provides an exception to the egocentric projection of the human frame that Lyons, Clark, Miller, & Johnson-Laird, and others have claimed to be central to natural language spatial description: "Looked at from one point of view, man is merely a middle-sized physical object. But in man's world – the world as man sees it and describes it in everyday language – he is, in the most literal sense, the measure of all things. Anthropocentrism and anthropomorphism are woven into the very fabric of his language" (Lyons 1977: 690). The English system is anthropomorphic in the sense that it takes the essential co-ordinates of up/down, front/back, left/right, from the oriented human frame. It is egocentric in the sense that the primary usage of this system seems to be deictic (*at my side, at my front, etc.*) i.e., it has ego as relatum; as a secondary usage, we can transfer the center of the co-ordinates onto an object, assign it a *front, back, and sides, etc.*, so that we can use that object as a relatum.²⁵ The core of this system is the need to *orient* a relatum, because the system makes use of extensive search-domains projected out from these oriented facets (along the co-ordinates up/down, front/back, left/right). For example in English, *I left my bike in front of/at the front of the cathedral*, asserts that the bike could be found in some quadrant-like projection off that face of the cathedral that can be called its *front*. Similarly for *in front of me, at my left, at my right, behind me, etc.*, using ego as relatum.

Now the Tzeltal system at first sight does not seem so very different from the English one (setting apart the just described hypertrophy of geometrical detail about the figure encoded in stative predicates). One can find prepositional phrases that gloss rather similarly to English: cf. English *in front of the house* with Tzeltal *ta y-elaw na* 'AT the face of the house.' Yet the Tzeltal pattern is in fact fundamentally different. As mentioned, Tzeltal only has one preposition which cannot therefore achieve discriminations between 'at,' 'in,' 'on,' etc. (we will gloss it arbitrarily as 'AT'); instead, it is possible to build up a complex ground by using possessed body-part terms to designate some part of the ground-object, with literal glosses like 'AT the table's head,' 'AT the house's mouth (= door),' 'AT the house's back,' etc. Compare for example:

- (8) a. *waxal ta mexa te limite*
standing AT table the bottle
'the bottle is standing on the table'
- b. *waxal ta s-jol mexa te limite*
standing AT 3sPOSS-head table the bottle
'the bottle is standing on the 'head' (end) of the table'

Like many Meso-American languages, Tzeltal analogically maps human and animal body parts onto almost every physical object, ranging in size from a coffee-bean to a mountain, and in ephemerality from a stone to a cloud (cf. e.g. Friedrich 1969 on Tarascan, MacLaury 1989 on Zapotec). The mapping is partially conventional, but largely productive, even open to free invention and can be instantly applied to novel objects. Whether the system is primarily anthropomorphic or animomorphic in origin is perhaps moot: 'tails' and 'horns' figure too, and quadrupedal stance is sometimes the root analogy.²⁶ In any case, the application of the terms synchronically seems in fact to be governed almost purely by shape (e.g., a small pointed three-dimensional protrusion is called a 'nose'). The mapping requires a partition of the surface of objects, perhaps along similar lines to Marr's theory of visual decomposition of complex objects, a geometric analysis of these segments in terms of major and minor axes, and an analysis of the shapes of the extremities of these axes (see Levinson 1994). The underlying geometry is quite detailed and specific, and is distinctly non-topological in character. Given this geometric basis for the application of body parts to segmented objects, using the possessive construction one can build phrases that have a superficial resemblance to English complex prepositional phrases like *in front of*, *to the side of*, etc.:

(9) Body-part specification of the ground

- a. *jipil te baj-te' ta xujk na*
 hanging the shelf AT its-side house
 'the shelf is hanging on the side of the house'
- b. *pachal moch ta xujk si'*
 sitting the basket AT its-side the firewood
 'The basket is alongside (touching) the firewood'
- c. *palal lo'bal ta xujk na*
 situated-in-bunches banana AT its-side house
 'The banana-bunches are against the (inside) shortwall of the house'
- d. *potzol lo'bal ta xujk p'in*
 wrapped-up bananas AT its-side pot
 'The bananas are in a bag by the side of the pot'
- e. *waxal kajpej ta s-ti' k'ajk'*
 standing coffee AT its-mouth;lips fire
 'The coffee is standing at the edge of the fire'
- f. *xik'il si' ta pat-na*
 leaning-almost-vertically firewood AT back-house
 'The firewood is stacked vertically against the back of the house'
 (in this case the front!)

Yet in fact the underlying *conceptual parallelism* between, say, English *in front of* and the Tzeltal phrase glossing as 'AT the face of' is not there at all. First, the point of the Tzeltal body-part assignment is *not* to establish the orientation of the object: the 'face' of an object is the most salient flat surface in any orientation whatsoever – for example the 'face' of a stone may be upside-down.²⁷ Thus the 'back' of a log-stool is the sitting surface, on analogy to a quadruped's back, not the side away from one; and the 'head,' 'nose,' 'sides,' 'butt' of any object remain the same when it is inverted in any plane. Secondly, the point of the Tzeltal expressions is *not* to establish a relatum or landmark from which a large search-domain or space can be projected (cf. English *in front of the cathedral*). Instead, all the Tzeltal body-part terminology does is partition objects into their named parts by analogy to the human or animal body. What use is that? It divides the ground-object into smaller named units, and allows one to describe the figure-object as exactly there, in or at one of those smaller units. Thus when one specifies that the figure-object is 'AT the face of' the ground-object, one means exactly that: the figure-object must be located in actual contact (or some close approximation to that) with the flat-facet of any object that can be called its 'face.' There are no extended search-domains. It follows that I cannot refer to the mountain behind me as 'AT my back,' nor to Xpet standing near me on the left as 'AT my side' (there is in any case no word for 'left,' as opposed to the anatomical part 'left hand').²⁸

In Tzeltal locative descriptions with body-part expressions, objects are related directly to other objects or their parts. It is as if there were only things, and parts of things, and no such stuff as "space." Indeed, on this evidence alone, one would have to conclude that Tzeltal makes no ontological commitment to any abstract notion of a "space," as conceptually distinct from the objects that fill it.²⁹ Lyons (1977) has pointed out that, conceptually, places and entities are ontologically of different kinds,³⁰ yet many languages partially conflate them, for example treating both as common nouns, subjects of equative constructions, etc. In Tzeltal the conflation is extreme because there are no unequivocally locative constructions, the single preposition being used, for example, to introduce temporal and manner adverbials, while the stative verbs that take a locatively interpreted prepositional phrase do so optionally, and are equivocal in their nature.

It is unfashionable to ask what ontological commitments a particular language makes; instead, the question is only asked in a general and abstract way by roving philosophers, while the answer is already universally presumed in formal semantics on the basis of mathematical motivations. Nevertheless, a few stout souls like Lyons (1977: 438ff.) point out that we only identify nouns, verbs, and so on in another

language on the basis of a mix of syntactic and ontological criteria, and that one can hardly escape the question of language-specific ontology. Consider again Lucy's conjecture about Yucatec nouns as denoting material or essence, not objects (as exemplified above by the remarks on Tzeltal 'banana-stuff'): that would make the ontological prototype for that syntactic category be a property and not an entity. It is not obviously false, it is not obviously unfalsifiable, so it is an interesting idea. It is of course vintage Whorf – see Lucy (1985: 84ff.).

It is worth mentioning that there may well be a connection between the particular nature of these Tzeltal locative descriptions and the cognitive propensity to confuse or conflate mirror-images, as mentioned above. These object-oriented locative descriptions, with their preoccupation with shape and contiguity, contrast with locative descriptions based squarely on abstract spatial predicates, projecting search-domains of indefinite extent from reference objects. As Kant pointed out over two centuries ago, the internal geometry of an object cannot form the basis for distinguishing between an object and its enantiomorph or "mirror-image": to make that distinction one seems to need an overarching system of abstract spatial co-ordinates, like our egocentric system of front, back, left, and right.³¹ Tzeltal does offer an overarching system of co-ordinates, namely one that is cardinal-direction-like, but it has the peculiar property that if one is facing North ('downhill'), East and West are designated (at least within that system of grammatical oppositions) by the same term, 'across.' These two facts perhaps conspire to make the distinction between mirror-images like "d" and "b" non-salient to the degree that for most Tenejapans the opposition is conceptually unavailable. For example, given a task of distinguishing various photos, some pairs of which were identical except that they depicted left-right inversions of familiar objects, informants seemed simply unable to tell the inversions apart on repeated trials, despite great success with other distinctions which would have been hard to express in English.³² Given time and incentive to ruminate on the difference between such a pair of photos, informants pointed to minute asymmetries in arrangement of the objects or in photographic finish. In effect, left-right inversions appeared to be quite literally *invisible* to our informants. Even after training in mirror-image detection, subjects in experiments conflated mirror-images most of the time.³³ The conclusion that I want to draw from the remarks in this and the preceding section is that, although many plausible suggestions have been made about universal constraints on human spatial conception as encoded in language – due to human perceptual and cognitive propensities and the particular schematizing properties of language – most of them fail on just the Guugu Yimithirr and Tzeltal examples, let alone a reasonable cross-cultural sample. There

must be some such rich set of intrinsic constraints of course, but whatever they are, they largely under-determine linguistic/cultural solutions to the practical problem of spatial description.³⁴

2.3 Pragmatic constraints

So far we have seen that neither intrinsic conceptual/perceptual constraints nor constraints on semantic structure seem to severely restrict, or at least determine, the cultural/linguistic conceptualization of a domain like space. However, there are further potential universal constraints on semantic encoding that have to be considered.

The idea of a universal pragmatics is a relatively new ingredient in the relativity debate. Grice and those who have followed him closely, like Atlas, Horn, and myself, have presumed that universal principles of rationality would motivate certain principles of language usage;³⁵ others, notably Sperber & Wilson (1986), have sought universal usage principles in innate principles of information processing.³⁶ Pragmaticists of both persuasions argue that much that has been thought of as the semantics of particular lexical items is in fact not part of lexical entries at all, because the information is "read into" the meaning of lexemes by virtue of powerful, general principles of pragmatic interpretation. Consequently, lexical semantics can be much more "sketchy" and schematic than had been thought. Under modern universal theories of syntax and morphology, lexical semantics had alone remained relatively free hunting ground for Whorfians (excluding a handful of domains like color and kinship); now that too is threatened by an unexpected source of universal constraints.

Gricean principles significantly constrain lexicalization possibilities. Horn (1984, 1989), for example, has noted that what is implicated is rarely lexicalized. Thus, given, for example, a contrastive pair of alternates like (*all, some*), where one item is informationally "stronger" than the other, the use of the "weaker" (*some*) will by default implicate 'some but not all' by the first maxim of Quantity (which enjoins the speaker to use the "stronger" description if applicable). It then follows that we do not expect to find a lexical item **nall* meaning 'some but not all' - that would be redundant, its job already done by *some* with its attendant default implicature.

It is worth sketching how such default implicatures may play an important role in the interpretation of English spatial prepositions (especially as there is little such speculation in the literature). In my own version of the Gricean principles, there are three pertinent ones (Levinson 1987). The first (Quantity maxim 1) generates default implicatures as just illustrated, by contrasts of relative informativeness. By this principle the

locative prepositions (*at*, *near*) form a contrast set, such that the use of *near* implicates (rather than entails) 'not at': for example, it would be true but misleading to say *The train is near the station* when it had already reached it; in that case, a co-operative speaker ought to say *The train is at the station*.³⁷

The second (Manner) principle derives default implicatures from implicit contrasts between unmarked and (more or less synonymous) marked expressions. By this principle, there is an opposition between {*on*, *on-top-of*} in at least certain uses (where the relatum has a flat top): *The lamp is on top of the table* suggests some non-canonical relation – perhaps the lamp is normally on the floor, or is not directly supported by the table – all by virtue of the speaker's avoidance of the simpler, unmarked prepositional phrase *on the table*.

The third neo-Gricean principle is derived from Grice's second maxim of Quantity by which, in the interpretation of this principle proposed in Levinson (1987), unmarked expressions will pick out stereotypical interpretations or exemplifications unless the hearer is warned otherwise. It is this last principle which accounts for the divergent interpretations of the preposition in *The coffee is in the cup* vs. *The pencils are in the cup*. Stereotypically, the coffee may be presumed to be in liquid form (or perhaps granules of the instant variety) and thus contained completely within the cup, but one does not expect liquid or granulated pencils, and so presumes that the pencils will lie only partially within the vessel, projecting up and out of a cup of stereotypical size.³⁸ In this sort of way, as just sketched, it is fairly self-evident how to develop a pragmatic account of the interpretation of English prepositions.

If such principles are indeed universal (and there is a good smattering of evidence for that claim), they might play an important role in constraining the lexicalization of various domains. We expect no English preposition **nat*, meaning 'near but not at,' because of the available contrast (*at*, *near*). Further we can see that a good deal of pragmatic load can be carried by opposing marked and unmarked synonyms: *on* will pick up stereotypical interpretations readily, *on top of* will stoically resist them. Thus the communicational load of a lexical item is greatly increased by giving it partners in "metalinguistic," pragmatic opposition; the usage of one such item will then always potentially carry information on the basis that its partners have been avoided. This information however can be cancelled by linguistic or non-linguistic context: thus with one lexical item *near* we end up with two interpretations, 'near, but not at' (the default interpretation), 'near and perhaps at' (the possible alternative). Thus we can double the interpretations without doubling the lexicon.

The Tzeltal facts are partially in line and partially out of line with such a theory. The theory stoutly predicts (at least strongly suggests) that no language should have just one preposition. Such a language violates Zipfian first principles.³⁹ Tzeltal obliges us with a refutation. Why should that be? It is not particularly easy in English to find a function-word with no available oppositions.⁴⁰ On the other hand, pragmatic mechanisms of the kind just explicated allow radical under-specification of lexical meaning of just the kind we find in the Tzeltal vacuous preposition, by encouraging rich interpretations of minimal specifications.

In the Tzeltal case, clearly all the interpretive load is handled by the stative/locative predicates. These at least should provide the pragmatic oppositions we have come to expect between saliently contrastive linguistic expressions. For example, the positional adjective *kajal*, glossing as 'lying on,' is unusually weak in specifying no geometrical properties of figure and minimal ones of ground; its use would seem to suggest that a more specific positional would be inappropriate (for example, because the subject is a conjunction of figures with different geometrical properties).

Given the rich lexical content, further enriched by pragmatic oppositions, the interpretation of the preposition can follow the one non-contrastive pragmatic principle sketched above, the interpretation to the stereotype. By providing a superfluity of information about the figure, the addressee is invited to guess the stereotypical disposition of figure to ground. The following examples with identical prepositional phrases but distinct ground-interpretations should suggest how this works:

- (10) a. *chawal koel ta k'ajk' te chan*
 face-up descending AT fire the beetle
 'The beetle is lying upside-down (cooking) in the fire'
- b. *lechel xalten ta k'ajk'*
 flat-plane-horizontal saucepan AT fire
 'The saucepan is lying horizontally on top of the fire'
- c. *bichil si' ta k'ajk'*
 limb-sticking-up firewood AT fire
 'The firewood is in the fire with a fork projecting up out of it'
- d. *p'ekel ta k'ajk' si'*
 lying-low AT fire firewood
 'The firewood is lying flat in the fire'

In sum, the universal pragmaticist may be able to hang on to his principles faced with the Tzeltal data, and indeed may point to the semantically vacuous preposition as evidence for the power of contextual inference. Yet such pragmatic constraints clearly enforce no conformity on the lexicalization of a conceptual domain.

3 Conclusions

On the face of it, developments in the cognitive sciences since the 1960s seem to cast doubt on any rampant Whorfianism. Theory, preconception, and, in certain domains at least, substantial evidence emphasize the importance of universal constraints on many levels: the intrinsic structure of the world, the intrinsic structure of our perceptual and cognitive apparatus, the universal structure of our syntactico-semantic system – and even universal constraints on language usage.

Those developments have been coupled with the discovery of some spectacular cross-cultural uniformities in domain conceptualization: arguably in kinship, certainly in color, and in ethnobotany and -zoology. The Berlin & Kay (1969) results almost instantly undermined the empiricist predilections of anthropologists, and gave us a strong model of universal semantic constraints similar to one of universal phonetic constraints: cultural selection from a small, finite inventory of possible percepts/concepts.⁴¹

Yet the findings reported here do not seem to support such a strong determinism by universal constraints. In an important conceptual domain like space, with its concrete instantiations in the world around us and with our specialized anatomical and neuro-physiological adaptations to that concrete world, such universal constraints seem to under-determine the range of possible conceptual solutions to describing spatial arrangements. There are fundamentally different solutions available, as shown for example by the Guugu Yimithirr use of an "absolute" system of fixed angles in contradistinction to our English "relative" system of search-domains anchored to an ego or viewpoint. Tzeltal introduces a third variant: it has both a system of fixed angles, but of a kind quite different from the Guugu Yimithirr system, and an "intrinsic" system whereby the locations of objects can be specified with regard to other objects without specification of fixed angles. Yet this latter system only serves to show how different such object-oriented systems can be from the kind of system familiar to speakers of European languages: the Tzeltal system de-emphasizes ground (or landmark) objects, does not endow such objects with intrinsic orientations but instead optionally partitions them into named parts on the basis of unoriented shape, eschews extended search-domains projected from them, while simultaneously requiring elaborate non-topological geometrical specifications of the nature of the figure object. In general, Tzeltal does not conform to the "anthropomorphic anthropocentrism" that linguists and psychologists had confidently come to expect.

That universal constraints on so many different levels, which indubitably exist in a field like spatial conception, should fail to produce

any kind of cross-cultural conceptual conformity in this domain may certainly be cause for surprise. Good comparative information about the spatial domain is still so thin that we can only expect further surprises from more cross-cultural and crosslinguistic research. Yet even the two cultural systems, the Guugu Yimithirr and the Tzeltal, taken together, give some ground for doubting the likelihood that cultures select (as it were) from a small inventory of possible modes of spatial conception. Taking the Guugu Yimithirr and the English cases alone, one might well argue that the universal inventory offers (a) a system of absolute angles (the Guugu Yimithirr cardinal direction system), (b) a system of search-domains projected from oriented objects, with anthropomorphic and egocentric prototypes, (c) some mix. After all, English-speaking navigators (or dwellers in grid-layout cities) adapt easily to a partial (a)-type system; while all languages do seem to have some spatial deixis, and thus some aspects of a (b) system.⁴² However, the core Tzeltal system of locative description is quite different again, with its non-egocentric character, its lack of projected spaces, and its preoccupation with the geometry of the figure. There are not obvious parallels to such a scheme taken as a whole in the other two languages (although analogies may be drawn to specific parts).

Three languages, three largely distinct systems. An inadequate sample of course. Still, this kind of result suggests that a treatment of universal constraints as filters, leaving open indefinite possible cultural variation within outer limits, may in the end not be too weak.⁴³ There would then be no necessary inconsistency between a rich set of universal constraints and a moderately strong brand of linguistic relativity in at least some domains. The indefinite possible variations within the constraints can then be thought about in two ways. Either the choice is arbitrary: members of the same speech community adopt whatever conceptualization other members use - it mattering little which one is adopted, so long as all settle for it (in the manner of David Lewis's analysis of convention; see Clark, this volume). Or the choice is motivated by other neighbouring conceptualizations, in language or other aspects of culture. Like all good holistic functionalists, and of course like Whorf, one ought to opt for the latter. That would re-legitimize all those Durkheimian speculations about the relation between conceptual structures and social structures.

Notes

- 1 Presuming of course it's clear enough to be a hypothesis at all! From the point of view of generalizing science, the hypothesis is weak of course, because it seems to make no real predictions about what kinds of linguistic or conceptual variation are to be found.

- 2 By a "filter" I mean a negative, relatively weak, boundary condition.
- 3 All the terms here are contentious of course: for example, where constraint A *constrains* cognitive structure B, we might mean that it rules out cognitive structure B', or merely A favours B over B', e.g. makes B "more accessible" than B'. See, e.g., R. Brown & Lenneberg (1954).
- 4 Since the conference for which this chapter was prepared, parallel work on about fifteen other non-Indo-European languages has been conducted by researchers at the Cognitive Anthropology Research Group at the Max Planck Institute for Psycholinguistics (see Annual Reports for 1992 and 1993). This work confirms the message given by the Tzeltal example here, but the typology of spatial systems in language is now considerably more advanced. See Levinson (in press).
- 5 Miller & Johnson-Laird (1976) provide a useful synopsis of much relevant literature. See also Levinson (1992a).
- 6 See, e.g., Stiles-Davis, Kritchevsky, & Bellugi (1988) for summary. As an example of what is still unclear, one may refer, e.g., to the controversy over whether humans have a magnetic sense (see Baker 1989).
- 7 For more detailed reports, see Bowerman (this volume, and references therein); Levinson (in press).
- 8 Following initial work by John Haviland, the system has been further explored by Penny Brown, Lourdes de León, and myself, in collaboration with Haviland.
- 9 See Haviland (1979, 1986, 1993, and this volume) for a description of the linguistic system.
- 10 See Haviland (1986), Levinson (1986, 1987).
- 11 The way in which the Guugu Yimithirr system undermines current cognitive science hypotheses should be clear from the following quotations: "Ordinary languages are designed to deal with relativistic space; with space relative to objects that occupy it. Relativistic space provides three orthogonal coordinates, just as Newtonian space does, but *no fixed units of angle or distance* are involved, nor is there any need for coordinates to extend without limit in any direction" (Miller & Johnson-Laird 1976: 380, my italics); "Language's spatial schema... abstracts away from any specificity as to shape (curvature) or magnitude... hence also *from any specificity as to angles...*" (Talmy 1983: 262, my italics and abbreviation)
- 12 By Penelope Brown and myself in joint work; parallel work by Lourdes de León and John Haviland on the closely related language Tzotzil provides an important control and source of inspiration. We have been able to build on prior grammatical and lexical work on Tzeltal by Berlin, Kaufman, & Maffi (1990).
- 13 See Brown & Levinson (1993b) for details of the relevant experiments.
- 14 See Brown & Levinson (1993a).
- 15 As Wolfgang Klein has put it, we would be loath to consider the verb *drink* a spatial predicate, despite the fact that it describes the motion of stuff into containers. Both the kind of stuff and the kind of container are too specific!
- 16 We borrow this terminology from Talmy with a slight revision: the *figure* is the **description** of the object (the referent) to be located, the *ground* is the **description** of the **whole complex** of the *relatum* (the landmark-object), the *search-domain* (the space, anchored to the relatum, in which the referent is to be found), and the *relation* (between referent and relatum). See example (1).

- 17 Although there are occasional uses of motion adverbials in conjunction with locative expressions, these seem to occur in a motivated way: e.g., where a wire is said to hang across the tops of poles, it may also 'move across,' such being the sweep of one's eyes. There are also some marginal uses of the directionals *tal*, 'coming,' and *bel*, 'going,' to describe static alignments. Such usages depend on a close analogy between vector and alignment, and do not extend to static arrays in general.
- 18 My crude analysis; see Talmy (1983) on *across*.
- 19 Readers may know Berlin's (1968) description of 545 acutely discriminative Tzeltal numeral classifiers: many of the same roots are involved in locative description.
- 20 It is an interesting question whether these stative predicates really are locative in character. Functionally there is no doubt. Syntactically however they are one-place predicates, but they optionally subcategorize for a locatively interpreted prepositional phrase, unlike other Tzeltal stative predicates (e.g. color adjectives) – in this regard a bit like English *sit* or *stand* (*John is sitting* vs. *John is sitting on the bench*; cf. *John is tall* vs. **John is tall on the bench*). Semantically, they are even more equivocal, some exhibiting peculiar figure/ground ambiguities and associated switches from one to two semantic arguments. Thus *pachal* can either mean 'sitting-bowl-like' or 'contained within a bowl-like vessel' (see P. Brown 1994: 772ff.). True locatives, one supposes, must be semantically two-place predicates (*x is on/in/at y*); but as Lyons (1977: 477) warns "locative expressions... have of their very nature a certain syntactic ambivalence."
- 21 Lucy (1992, this volume) found, for example, that in experimental tasks his Yucatec informants sort entities not primarily according to shape, color or other surface property, but rather according to the stuff out of which things are made.
- 22 Incidentally, although I quarrel with some details of Talmy's ideas here, his general program is of great interest to the comparative study of semantic systems. Using crosslinguistic evidence as clues, he tries to outline the main components of, e.g., state- or event-descriptions, and to explore the different ways in which such components are fused in single lexicalizations in different language types (see also Talmy 1985).
- 23 Further thought, though, makes the claim less plausible for English too: consider the non-topological concepts of 'parallel,' 'orthogonal,' etc., encoded in a preposition like *across* or *opposite*. See Herskovits (1986).
- 24 Such distinctions are not only made in locative/statives but also in descriptive adjectival predicates:
- | | |
|-------------------------|------------|
| a. <i>mak'al</i> | <i>si'</i> |
| sliced-at-90°-angle | fire-wood |
| | |
| b. <i>p'axal</i> | <i>si'</i> |
| sliced-at-oblique-angle | fire-wood |
- 25 That this so-called 'intrinsic' usage is secondary may be doubted given the order in acquisition, but, as Clark (1973) points out, the usage often seems to be modelled on how we *confront* things, so that the *left side of the chest of drawers* is defined by the speaker's left, even though it could be said to have an intrinsic front/back, and thus its own right, which we call the left!

- 26 On the other hand, animal body-part terms are partially based on human ones – e.g. the front limbs of cows are ‘arms’! See Hunn (1977). See Levinson (1994) for discussion.
- 27 There are certain deictic uses of this and a handful of other body-part terms which are exceptions: e.g. the ‘face’ of a door can mean whichever side is facing the speaker.
- 28 To invoke such large search-domains, I must use the cardinal direction terms of the ‘uphill’/‘downhill’ system (see the following footnote).
- 29 In fact, the most fulsome Whorfian position, that Tzeltal makes no ontological commitment to *spaces* as opposed to the objects that fill them, would not be tenable, because there are ancillary ways of indicating search-domains. The central method is similar to the Guugu Yimithirr one, namely to employ fixed angles of a cardinal-point type; in Tenejapan Tzeltal the relevant expressions gloss as ‘uphill’ and ‘downhill,’ but the angle is fixed by the prevailing lie of the land (see Brown & Levinson 1993a).
- 30 Klein (1990) makes the same point by insisting that semantically *The cup is in the cupboard* is a relation between places, which happen to be identified by the objects that occupy them.
- 31 For discussion of these Kantian themes in the context of Tzeltal, see Levinson & Brown (1994).
- 32 Our task-replicated one devised by Lourdes de León (1991) and applied to Tzotzil informants, with similar, but not identical, results.
- 33 See the experiment described in Levinson & Brown (1994).
- 34 Nothing said here diminishes the plausibility of general, cross-domain, universals of semantic structure, e.g. on the argument structure of predicates. Curiously, though, Tzeltal locative/stative predicates exhibit variable polyadicity at the semantic level while failing ambiguity tests, thus violating one such possible constraint. See Levinson (1991).
- 35 See, e.g., Atlas & Levinson (1981), Horn (1989).
- 36 See Levinson (1989) for review.
- 37 Similarly, in turn, for (*on, at*): *John is at the table* suggests he is not on it. Notice that these inferences are cancellable without contradiction: one can say *The train is near to, in fact at, the station* (cancelling the ‘not at’ implicature from *near*); and *John is at, in fact on, the basketball court* (cancelling the ‘not on’ implicature from *at*).
- 38 It is clear that such a pragmatic account is in many cases an alternative to a “prototype” theory of the semantic content of expressions. It is preferable in a great range of cases just in the way sketched, because the stereotypical meanings vary with context and collocation.
- 39 Although Zipf’s Force of Unification, or Speaker’s Economy, “operating unchecked would result in the evolution of exactly one totally unmarked infinitely ambiguous vocable,” it is systematically checked by the antithetical Force of Diversification or Auditor’s Economy “leading toward the establishment of as many different expressions as there are messages to communicate” (Horn 1984: 11). Horn identifies these with competing Gricean maxims.
- 40 The possessive construction comes close: it is semantically very general indeed (*John’s books* can be any old books with some connection, causal, resultative, or possessive, to John). Yet even here we have two constructions allowing the Manner opposition *John’s picture vs. The picture of John*, which at least helps to narrow down the interpretations (only the former could be a picture made by John).

- 41 It would be useful to have a better hierarchy of "strength" for universal hypotheses, according to their logical types, perhaps (where L is a language and F, G conceivable properties of languages):
- 1 Absolute (unconditional: "all Ls are F"):
 - 1.1 whole set ("all Ls have all properties F & G, etc.")
 - 1.2 selective ("all Ls have at least one of F or G, etc.")
 - 2 Conditional ("If an L has F, it has G"):
 - 2.1 whole set ("G₁ & G₂..." etc.)
 - 2.2 selective ("G₁ or G₂...")
 - 3 negative (filters):
 - 3.1 absolute ("all Ls are not-F")
 - 3.2 conditional ("If an L has F, it has no G")

and so on. Berlin & Kay's (1969) hypothesis was a heady mix of absolute (at least two basic color terms, at most eleven) and conditional (if blue, then red, etc.). Filters only rule things out, they do not tell you how things will be: "Ravens are non-white" is not as informative as "Ravens are black."

- 42 Tzeltal has a normal-looking deictic system, with expressions glossing 'here,' 'there,' 'yonder,' 'this,' and 'that.' See Hanks (1990, and this volume).
- 43 Since this paper was written, work on a dozen more non-Indo-European languages has been conducted in systematic fashion by scholars at the Max Planck Institute for Psycholinguistics. This work suggests that there may indeed after all be just three main spatial systems or frames of reference in language, construed just slightly differently from the three systems as described here. Nevertheless, these three systems are themselves each a broad family of possible solutions, leaving open indefinite variations within them. See Levinson (in press).

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