IESBS: The linguistic expression of space

Abstract

Spatial cognition is central to *human thinking*, and *spatial language* is thus an important area of study, as it may reveal fundamental properties of human thought. Recent research reveals that spatial language is much more divergent across languages than had been thought, suggesting significant cultural patterning of spatial conceptualization. Space can be treated as a complex semantic field with a number of distinct sub-domains. The location of the figure object, the thing to be located, is normally specified with reference to one or more ground objects or landmarks - with distinct subsystems involved when the figure is static vs. in motion, and if static when the figure is contiguous with the ground or displaced in space. Beyond this, universals of spatial language are quite abstract, involving e.g. optional selection of major types of coordinate system. This *semantic diversity* is also matched by diversity of expression: languages express spatial relations in many different parts of speech or construction.

Space, The linguistic expression of

Spatial cognition is at the heart of much human thinking, as evidenced for example in the explanatory power of spatial metaphors and diagrams, and the explication of spatial concepts has thus played a key role in the development of Western mathematics and philosophy over two and a half millennia (see Jammer 1954). It is therefore easy to assume that spatial notions form a robust, universal core of human cognition. But naïve human spatial language turns out to vary significantly across languages, both in the way it is semantically organized and the way in which it coded. This has major implications for how we should think about universals in human thought and language.

The Western intellectual tradition has provided an elaborate metalanguage for spatial concepts, but the conceptual underpinnings of naïve human spatial language utilize only a small subset of these concepts. Moreover, there are many aspects of our spatial perception and motor control which utilize much richer and more precise representations of space than are coded in language. The study of the representation of space in language, and its relation to cognition, must therefore be treated as an empirical enterprise, and this article reports on the still quite limited cross-linguistic information about how different languages structure the spatial domain (see Levinson and Wilkins in preparation).

1. Space as a semantic domain

Languages tend not to treat space as a single, coherent semantic field in the same way that they treat e.g. *color* (q.v.), *kinship* (q.v.) or ethnobotany – rather space is structured as a large semantic field with many distinct subdomains, each of which is closely structured (and often varies considerably across languages). Nearly all languages have 'where'-questions which cover the entire field (that is with the same or morphologically related forms for 'where-to', 'where-from', 'where-at') and describe the location of one object primarily with respect to another. But beyond these general properties, spatial expressions are structured in distinct subdomains, notably topology, frames of reference, and motion, with place names and spatial deixis as complementary areas. These subdomains cross-cut in certain ways (e.g. frames of reference may play a role in motion description), but because they have their own internal organization they need to be kept analytically distinct.

Although, the philosophical and scientific literature gives us many different ways to talk about space, natural languages tend to structure spatial description more in accord with the ideas of Leibniz than of Newton. That is, location is thought about as the place of one thing relative to another (rather than, as in Newtonian thinking, as specifications in the coordinates of an infinite, abstract three-dimensional 'box'). We will call the object to be located the 'figure', and the object with respect to which the location is specified 'the ground' (other equivalent terms in the literature are 'theme' vs. relatum' or 'trajector' vs. 'landmark'). As Talmy (1983) noted, a good ground or landmark object is larger than and less mobile than the figure object to be located. The problems of location specification then largely boil down to the following functional considerations:

(1) Where figure F and ground G are contiguous or coincident, a static F may be said to be 'at G'. Where G is large, it can be subdivided, so that F can be said to be 'at the X-part of G'. This is, roughly, the subdomain of topology.
(2) Where F and G are separated in space, the problem is to specify an angle or direction from G in which F can be found (the search domain). This involves a coordinate system of some kind, a 'frame of reference', of which there are three main types found in languages.
(3) Where F is in motion, two kinds of ground are especially relevant, the source or the goal of the motion. To indicate the progression of motion (i.e. the increase or decrease of distance from a ground), motion can be specified as 'F is moving towards goal G' or 'F is moving from source S'. In addition, motion can be thought of bringing about, or destroying, a topological relation, as in 'F moves into G'. But to indicate a direction or vector of motion, both S and G must be specified, or a coordinate system of the kind mentioned in (2) utilized. (Of course, motion can also be specified as taking place within a location, in which case the systems in (1) and (2) can be utilized.)

These functional distinctions give us a number of cleavages: stasis (or location) vs. kinesis (or motion), non-angular topological relationships, vs. angular relations specified in frames of reference, with potentially cross-cutting domains as in Figure 1.

- Figure 1 here -

Some further details in Figure 1, like the three frames of reference, will be described below. But two subfields which will not receive further discussion need to be mentioned here. One is *deixis* (treated in a separate article), which concerns the way in which the location of the speech participants can constitute a special ground or landmark (as in *here*), which then

makes interpretation dependent on determining that location (as in *He used to come here*). Languages universally seem to provide a structured set of deictic elements with distinctions that are often spatial (demonstratives like 'this' vs. 'that', adverbs like 'here', vs. 'there'). Deictic anchoring of spatial expressions is however often implicit or pragmatic: *the local pub* implies a pub close to some reference point, which unless specified is taken to be the place of speaking.

A second subfield not treated further here is toponymy, or systems of place names. Place names have been much investigated from an historical point of view: since they are highly conservative they reveal much about the locations of ancient languages and peoples. However, the theory and cross-linguistic typology of place names – e.g. why some are descriptive, others not – is hardly developed at all (see e.g. Hunn 1993).

2. Universals and variation in the semantic parameters in spatial subdomains

In this section, the semantic parameters involved in spatial description in two major subdomains are described to illustrate the different ways in which languages structure the spatial domain.

Topology

This subdomain, as mentioned, concerns contiguous relations between figure and ground. The term is potentially misleading – topology proper is a branch of geometry concerned with constancies under continuous distortions such as stretching, but is used in studies of spatial language (following *Piaget*, q.v.) to describe the sort of spatial relations covered by the English prepositions *on, in, at* (Herskovits 1986). These spatial terms are amongst the earliest

learnt by Western children, and it has therefore been supposed that they form a universal innate core of spatial notions. However, cross-linguistic studies show that universal semantic concepts are only to be found at a more abstract level. Take for example the spatial relations covered by English *on*, as in *The cup is on the table, The picture is on the wall,* or *The fresco is on the ceiling* – clearly the term covers a wide area, which is already subdivided in the adpositions (prepositions or postpositions) of many other European languages. Some languages (like Japanese) conflate 'on'-relations with 'over'-relations (as in 'The light is over the table') in their adpositions, others (like Yukatek) even include 'under'-relations as well (as in 'The ball is under the table'). A detailed analysis of a dozen languages from different families suggest that universal semantic concepts in this domain lie at a more atomic level (Levinson and Wilkins in preparation). If we think of the core, prototype of English *on* as consisting of the notion of vertical superposition of figure over ground, with a horizontal ground supporting a non-attached figure, then the kind of notions that look universal are at the level of 'vertical superposition', 'contact', 'horizontal supporting surface', (non) 'attachment'. Clearly these more abstract atomic concepts can be rearranged in many different ways to constitute the semantic relations expressible in an individual language.

Topological relations are coded in the European languages primarily in adpositions or case, but as we shall see these are not the only possibilities – some languages code topological relations entirely in nouns or verbs.

Frames of reference

Linguists have presumed that there are two main frames of reference, which are often called 'deictic' and 'intrinsic', and which can be illustrated by the ambiguity of *The boy is behind the bus* – either the bus is between the boy and us ('deictic') or he is at the rear of the bus

('intrinsic'). Psychologists have long known however that on the vertical dimension our perceptual systems use three frames of reference against which to measure uprightness: an object-centered frame, a viewer-centered frame and an environmental frame. Cross-linguistic research shows that in fact these three frames of reference, which we will call the intrinsic, the relative and the absolute frame respectively, may be used on the horizontal plane too (Levinson 1996). These three frames appear to be universally available, yet not all languages make systematic use of them all – some use the absolute frame, others the relative frame, while most use the intrinsic frame, and some use all three (the main universal constraint appears to be that the relative frame is dependent on the possession of the intrinsic frame).

The intrinsic frame of reference, as its name implies, has to do with the intrinsic parts of ground objects. Recollect that frames of reference have to do with specifying angles or directions from a landmark. One way to achieve this is to designate a side or facet of an object, so that the figure can be said to be lying on an axis drawn from the center of the object through the designated side. Most languages provide a vocabulary for parts of objects, but the ways in which they partition objects can be very variable. In English, for example, the criteria for assigning the *front* of an object involve a complex mix of functional and orientational information: the front of a bus is the direction in which it canonically moves, the front of a building is the side in which it is normally entered, and the front of a television the side designed to be watched. In English the *top* of a bottle remains the top even when tipped over, but in other languages (like Zapotec) a more strictly orientational approach may assign the 'top' to whatever side is currently uppermost. Alternatively (as in Tzeltal), the assignment may rely entirely on the internal axial geometry of the object, so that e.g. the 'face' of an object may be a flat side on a secondary axis, even if normally this is undermost. What all these systems have in common is that they provide a system of designated sides which is

independent of the position of the viewer, and (apart from the vertical axis) independent of an environmental orientation – how they achieve this differs not only in detail but in fundamentals.

Another way of obtaining angular distinctions on the horizontal plane is to use the body-axes of the viewer. We can then say that something is, for example, to the 'left' of something else in the visual field. Full versions of such systems use a left/right axis and an orthogonal front/back axis, but again the way in which they map bodily axes onto the ground object is very variable. Although these systems are often called 'deictic' in the literature, this is misleading – they typically have a deictic center but they need not (as in *He kicked the ball to the left of the goal*), and the other two frames of reference can also have deictic centers. Hence these systems are here said to be 'relative' frames of reference, because they are relative to the body-axes of some observer. Some languages translate the bodily coordinates onto the ground object without rotation: in such languages (like Hausa) 'The boy is to the left of the tree' means just what it does in English, but 'The boy is in front of the tree' means what in English is described as *The boy is behind the tree*. In contrast, some languages rotate the axes, so that the front of the tree is towards us, but the left of the tree is what we would in English call its right (this is probably a minority option, but is found in some dialects of Tamil). Some languages reflect the axes, as in English, so that left and right remain in the same directions as the viewer's body, but front and back are reversed or 'flipped' over.

Notice that terms like 'front' and 'back' and 'left' and 'right' have intrinsic interpretations (as in *He's sitting at the chairman's left*), and for that reason ambiguities arise of the kind illustrated above with *The boy is behind the bus*. Relative systems are based on the intrinsic sides of humans, and probably arise as extensions of an intrinsic system to objects (like trees

or balls) which resist the assignment of named sides. Hence the implicational relation: all relative systems are associated with intrinsic systems, but the possession of an intrinsic system does not necessarily imply the use of a relative one. Relative systems had been thought to be universal, but in fact it turns out that perhaps as many as a third of the world's languages do not employ them, instead making use of absolute systems.

Absolute systems rely on environmental gradients or 'geocentric' coordinates. Such systems use absolute directions, or fixed bearings, a bit like English North, but unlike in English, they are often used on all scales (as in 'The cup to the north of yours is mine', or even 'There's a spider on your northern leg'), completely replacing the need for relative systems. There are many different varieties of such systems. Some of them (as in Australian Aboriginal languages) are fully abstract cardinal direction systems, with terms that may gloss 'North', 'South', etc., but which denote quadrants or arcs of specific angle, and are often based on bearings rotated from our cardinal directions. To use a system of this kind, speakers must always orient themselves precisely, using multiple environmental clues (wind directions, solar angles, sidereal ecliptics, landscape features and the like). Other systems are based more directly on one major environmental cue, like prevailing winds (as in languages of the Torres Straits), river drainage (as in Alaska), or prevailing slopes in mountainous terrain (as in the Himalayas). For example, Tenejapan Tzeltal uses an 'uphill', 'downhill', 'across' system, based on the general lie of the land in the territory of Tenejapa (Chiapas, Mexico), but the system has been abstracted from the terrain to provide fixed orientation, so that the bearings remain constant outside the territory. Many systems use fixed orthogonal axes, but not all: for example, the Austronesian languages in the Pacific islands typically use the monsoon winds as the basis for one axis, but an inland-sea opposition as the basis for another axis – as one moves around the island, the angles between the axes constantly change.

3. How spatial distinctions are coded in language forms

Much of the literature gives the impression that spatial distinctions are primarily coded in adpositions, as in the prepositions of English. In fact, in most languages spatial information is distributed throughout the clause. Some languages have a score or more local cases (nominal suffixes) covering roughly the same distinctions as English prepositions (e.g. Finnish or the NE Caucasian language Avar). Other languages use a combination of case and adposition (as in Tamil), or case and spatial nominal (as in many Australian languages). Special classes of spatial nominals do a lot of the work in isolating languages like Chinese, and they play special roles in other languages (cf. *front* in the English complex preposition *in front of*, and *North* in the adverbial use *He went North*). Many spatial oppositions are made constructionally, as when German prepositions like *auf* take the dative to indicate location, and the accusative to indicate motion. Finally, verbs play a crucial role in spatial description. In the case of motion, there is often a special form-class of motion verbs, and languages tend to conflate motion with manner (as in English *crawl*) or direction or 'path' (as in Spanish *salir* 'to go out'), but not generally both (Talmy 1983). In many languages (e.g. Dutch), there is a small set of contrasting verbs (often derived from posture verbs) used to describe static location, encoding properties of the figure, or ground or both. Some languages have a larger set (as in Tzeltal), and in this case most of the semantic load is taken by the verbs, which may encode such specific details as 'be located in a bowl-shaped container'.

In conclusion, it is clear that spatial concepts form a complex semantic field made up of structured linguistic subdomains. The semantic parameters involved may ultimately have a universal base, but the ways in which the semantic subdomains are organized displays considerable cross-linguistic variation. There is also considerable cross-linguistic variation in

the way in which such distinctions are encoded in the form-classes of languages. This linguistic variation is especially interesting given the centrality of spatial concepts in human thinking – and indeed it can be shown that linguistic differences in frames of reference make a difference to how humans memorize and reason non-linguistically (Levinson 1996, in prep., Pederson et al. 1998; see *Sapir-Whorf Hypothesis*).

Bibliography

Bloom P, Peterson M, Nadel L, Garrett M (eds.) 1996 *Language and Space*. MIT Press, Cambridge, MA.

Herskovits A 1986 *Language and spatial cognition*. Cambridge University Press, Cambridge

Hunn E 1993 Columbia Plateau Indian place names: what can they teach us*? Journal of Linguistic Anthropology* 6(1): 3-26

Jammer M 1954 *Concepts of Space: the history of theories of space in physics*. Harvard University Press, Cambridge, MA

Miller G, Johnson-Laird P 1976 *Language and Perception*. Cambridge University Press, Cambridge

Landau B, Jackendoff R 1993 "What" and "Where" in spatial language and spatial cognition. *BBS* 16(2): 217-265

Levinson S C 1996 Frames of reference and Molyneux's question: crosslinguistic evidence. In: Bloom et al. 1996: 109-170

Levinson S C in preparation Space in Language and Cognition: Explorations in Linguistic Diversity. Cambridge University Press, Cambridge

Levinson S C, Wilkins D (eds.) in preparation Grammars of Space: Towards a Semantic Typology. Cambridge University Press, Cambridge

Lyons J 1977 *Semantics*. Cambridge University Press, Cambridge

Pederson E, Danziger E, Wilkins D, Levinson S C, Kita S, Senft G 1998 Semantic typology and spatial conceptualization. *Language* 74: 557-589

Piaget J, Inhelder B 1956 The child's conception of space. Routledge, London

Talmy L 1983 How language structures space. In: Pick H, Acredolo L (eds.) *Spatial orientation: theory, research and application*. Plenum Press, New York

Talmy L 2000 *Toward a cognitive semantics*. Vols. 1 and 2. MIT Press, Cambridge, MA

Svorou S 1993 *The Grammar of Space*. Benjamins, Amsterdam.

Vandeloise C 1991 *Spatial prepositions*. University of Chicago Press, Chicago

Stephen C. Levinson

Max Planck Institute for Psycholinguistics

Nijmegen, The Netherlands

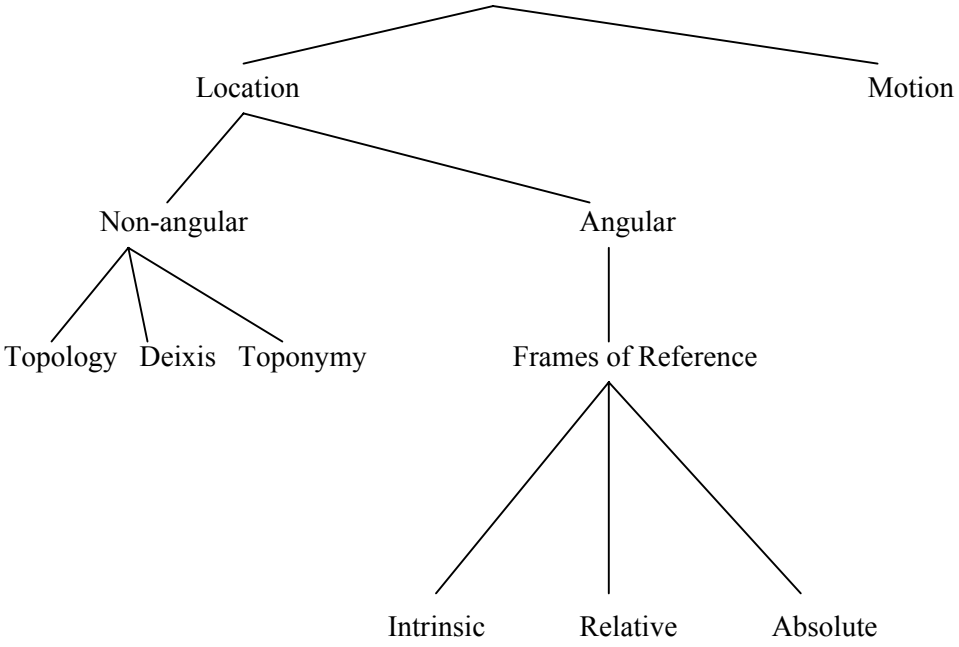

Figure 1

Cross-cutting subdomains of spatial language