11

Space

Proposed Universals of Space

Whorf (1956:158–9) had the following to say about space:

> But what about our concept of "space," which was also included in our first question? There is no such striking difference between Hopi and SAE about space as about time, and probably the apprehension of space is given in substantially that same form by experience irrespective of language. The experiments of the Gestalt psychologists with visual perception appear to establish this as a fact.

Surprisingly, Whorf's ideas about space tally fairly closely with much of the received wisdom within current linguistics and cognitive psychology (Clark 1973; Lyons 1977; Miller and Johnson-Laird 1976; Talmy 1983). Basically, this view is the following. Spatial conception is strongly informed by innate, presumably biologically based, universals, so that it is essentially the same in all languages and cultures. Given these universal conditions and our ecological niche as terrestrial, diurnal creatures, it is claimed that we are predisposed to conceive of space in relativistic and egocentric terms, projecting out from the anatomical patterns of our bodies. Thus, the coordinates through which spatial orientation are established are projected from ego, the deictic central reference point for all spatial reckoning, along two horizontal axes and one vertical. The vertical one, drawn from our upright position or, perhaps, the experience of gravity establishes the UP–DOWN axis; the horizontal axes are FRONT–BACK, derived from the anatomically asymmetric division of the body into two halves, and LEFT–RIGHT, from the symmetrical division. The location of objects in space then is always determined relative to the orientation of the speaker: if we are standing eye to eye across from each other, my left is your right. There are no fixed, absolute angles used in human spatial orientation. Thus, the universal terms

of spatial conception in this hypothesis are like those of English and familar European languages. Terms like LEFT–RIGHT, FRONT–BACK should not only be lexical universals among the languages of the world, but their actual usage should closely parallel that of the English terms.

Relativities in Spatial Conceptualization: The Case of Guugu-Yimidhirr

Recent work by researchers associated with the Cognitive Anthropology Research Group at the Max-Planck Institute in Nijmegen, the Netherlands (Brown and Levinson 1992, 1993, 1994; Haviland 1993; Levinson 1992, 1994a, b; Levinson and Brown 1994) poses a serious challenge to these strong universalist claims about the bases of spatial conception and, contrary to the surprising claim of Whorf's above, rather suggests findings more consonant with the Principle of Linguistic Relativity. It now appears that different languages have fundamentally different ways of describing spatial orientation and that these differences correspond systematically to differences in cognitive behavior, suggesting, along Whorfian lines, a correlation between linguistic patterns and habitual thought. It now appears that sensible experience, in the form of the categories of the native language that one learns, has an important role in molding one's spatial cognition, contrary to strong universalist and rationalist assumptions now current within the cognitive sciences like linguistics and psychology. This is not to claim that there are no universal innate conditions in this area. There almost certainly are. It is simply to claim that they greatly underdetermine the range of possible cognitive systems, leaving wide latitude for contingent human experience, in the form of languages and cultures, to play a guiding role in spatial cognition.

Perhaps the most surprising finding of the Nijmegen research group is the discovery of languages (and speakers!) for whom space is conceived of not relatively, using concepts like LEFT, RIGHT, FRONT, BACK, which have no fixed designation and depend on the speaker's viewpoint, but *absolutely*, with axes fixed in geographic space, rather like our cardinal directions, north, south, east, and west. Such languages have been found in Australia, South Asia, Oceania, and Mesoamerica. A particularly striking example is Guugu-Yimidhirr, of north-eastern Australia. This language completely lacks all spatial terms which are relative to body orientation; in particular there are *no* terms for locating the position of objects in space equivalent to FRONT, BACK, LEFT, RIGHT (e.g. the latter two terms can only be used to refer to the left and right hands and perhaps other symmetrical body parts like eyes, legs, etc.). Rather, the langnage heavily employs four roots, corresponding roughly to the four cardinal directions as shown in 11.1 (Haviland 1993). The Guugu-Yimidhirr terms do not

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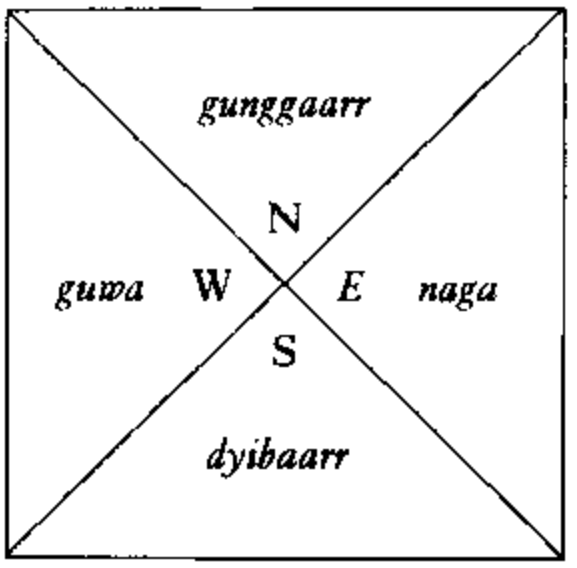

describe compass points, as do their English equivalents, but, rather, quadrants of a hypothetical horizontal plane. Further, it is rotated slightly clockwise from the corresponding European compass points so that the median of the north quadrant is actually oriented slightly north-east (about 15°) according to our compass point equivalents.

Note that these spatial categories are absolutely fixed, due to the geography of the earth, and are not subject to variation according to the spatial orientation of the speaker. If something is to my north, it is to my north regardless of whether it is in front of me, to the back of me, to my left, or to my right. Its spatial position is absolutely fixed with respect to mine, regardless of my relative viewpoint. The astounding thing about languages like Guugu-Yimidhirr is that it is these absolutely based terms that are habitually used by speakers to describe location or motion. It is as if in response to a question "where's the salt?," I responded "it's there, to the east." In the relativistic, egocentric spatial universe of the English speaker, this is likely to provide little enlightenment and lead to a puzzled look or worse, but this is exactly how a Guugu-Yimidhirr speaker would respond. All borizontal spatial information is described in these terms: the sun doesn't go down, it goes west; the fork isn't at my left, it lies south; the tide doesn't go out, it goes east. Note that while English speakers can use such an absolute system for large, global distances (i.e. Africa lies south of Europe), Guugu-Yimidhirr uses it for all degrees of spatial distance, from the knife, a centimeter to the south, to Sydney, 2000 km to the south. All movement is also described in these terms; I don't just go to the store, I go north to the store.

It is unlikely that the differences in spatial orientation for English and Guugu-Yimidhirr speakers are restricted just to verbal description; the thoroughgoing differences between the absolute and relative systems suggest real differences in speakers' experience and conception of space. Brown and Levinson (1993) provides a nice illustration of what these differences in experience might be like. Consider a table of four, dining in the revolving

restaurant at the top of the Centrepoint Tower in Sydney. I am sitting facing the Prime Minister, who is at the head of the table, with Madonna to my left and Hillary Clinton to my right. This is the relative, egocentric construal of their location in space. At 8.00 p.m., when we all sit down to dinner, the table is aligned so that the Prime Minister is at the north, I, to the south, and Madonna and Hillary Clinton to the west and east respectively; this is the absolute reckoning of spatial location. However, at 8.30 p.m., due to the revolving of the restaurant, the Prime Minister is now east, I, west, and Madonna and Hillary Clinton, north and south respectively. But from an egocentric, relativistic point of view, nothing has changed at all; everyone is in the same position they were half an hour ago. The differences do not stop there; consider the layout of cutlery at any individual place setting: fork to the left of the sitter, knife to the right. But for a Guugu-Yimidhirr speaker, no such general rule is possible: at the northern end of the table, fork to the east, and knife to the west, but with a complete reversal on the southern end, never mind the complexities of the east and west edges.

Clearly, the potential cognitive consequences of the difference in the geocentric absolute system for spatial reckoning of Guugu-Yimidhirr and the egocentric relative one of European languages like English are manifold. Exquisitely simple and straightforward in design, the Guugu-Yimidhirr system does always require an amazing ability to determine the exact lay of the four quadrants in any geographical space. In open country and daylight conditions, this may not be too taxing, using the sun as a guide, but it is also commonly done in thick rainforest conditions and at night! What this does appear to require is that Guugu-Yimidhirr speakers carry about a kind of mental map of their country, aligued for the quadrants and allowing them to fix the location of any object within it with respect to their own position. Indeed, given their ecological conditions, the Guugu-Yimidhirr absolute system seems especially suited to navigation within their country, always providing fixed coordinates for the speaker's own position and any landmark he wishes to describe. The egocentric, relative system of English is actually much less suited to these conditions, as anyone lost in a forest will testify. Directions like "go 3 km to the left, then 6 km to the right, and finally 2 km to the right again" are highly unlikely to get one home for dinner time! Guugu-Yimidhirr directions like "go 3 km to the east, then 6 km south, and finally 2 km to the west" probably would.

Testing for Relativities of Understanding

Levinson (1992) has investigated the cognitive consequences of the absolute spatial reckoning system of Guugu-Yimidhirr speakers and contrasted them with a control group of Dutch speakers, whose linguistic system is the

egocentric, relativistic equivalent to English. He approached this question experimentally, devising a few non-linguistic tasks that should reveal the cognitive functioning of this system. First, he attempted to test the ability of ten Guugn-Yimidhirr speakers to indicate the directions of particular locations beyond the range of vision, ranging from a few kilometers as the crow flies to a couple of hundred. They were driven through the bush by various circuitous routes and, on halting at a place with restricted visibility (e.g. dense rainforest), asked to perform this task. The results were amazing: the average error was 13.9° or less than 4 percent. This shows a remarkable facility of Guugu-Yimidhirr speakers in using this absolute system. In order to determine the location of these landmarks it was not sufficient to simply know the direction of north, south, east, and west; a particular landmark might be south of one part of Guugu-Yimidhirr territory, but north of another. Thus, the Guugu-Yimidhirr speaker must be absolutely sure of his location, so that any landmark can be located with respect to it and assigned to the proper quadrant. This is evidence that Guugu-Yimidhirr speakers do indeed carry about some type of mental map of their territory with a proper alignment of quadrants. The Dutch sample shows no such comparable ability; preliminary results suggested that they can probably not even achieve a 90° average error in related tasks.

Levinson's (1992) experiments further probed the cognitive consequences of this absolute system by systematically testing the recognition and recall of spatial orientation of objects for Guugu-Yimidhirr men. In one recognition test, speakers facing north were shown two cards, each with a red square and a blue rectangle toward an edge. On one card the red square was to the viewer's left and the blue rectangle to his right; the other was reversed (of course, they were identical cards, just rotated 180°). The speaker was asked to choose one card and remember it. He was then led into another room, with another table with the same two cards lying on it, but now facing south. Note that Guugu-Yimidhirr speakers and Dutch speakers should behave differently here. If a Dutch speaker chose the card with the red square to his left (in the west quadrant), when rotated south he should still choose a card with the red square to his left (but this time in the *east* quadrant). The Guugu-Yimidhirr speaker should show no such switch; having chosen the card with the red square to the west, he should stick with this choice, regardless of the fact that the square is now on his right when previously it was on his left, see 11.2 (Levinson 1992:20). The results were exactly as predicted: 9 out of 10 Guugu-Yimidhirr speakers chose the card with the red square in the same quadrant regardless of whether they were looking north or south, demonstrating that they were clearly identifying the cards on the basis of absolutely aligned quadrants. All 15 subjects of a Dutch control group contrasted in identifying the cards on the basis of a relativistic egocentric LEFT–RIGHT axis.

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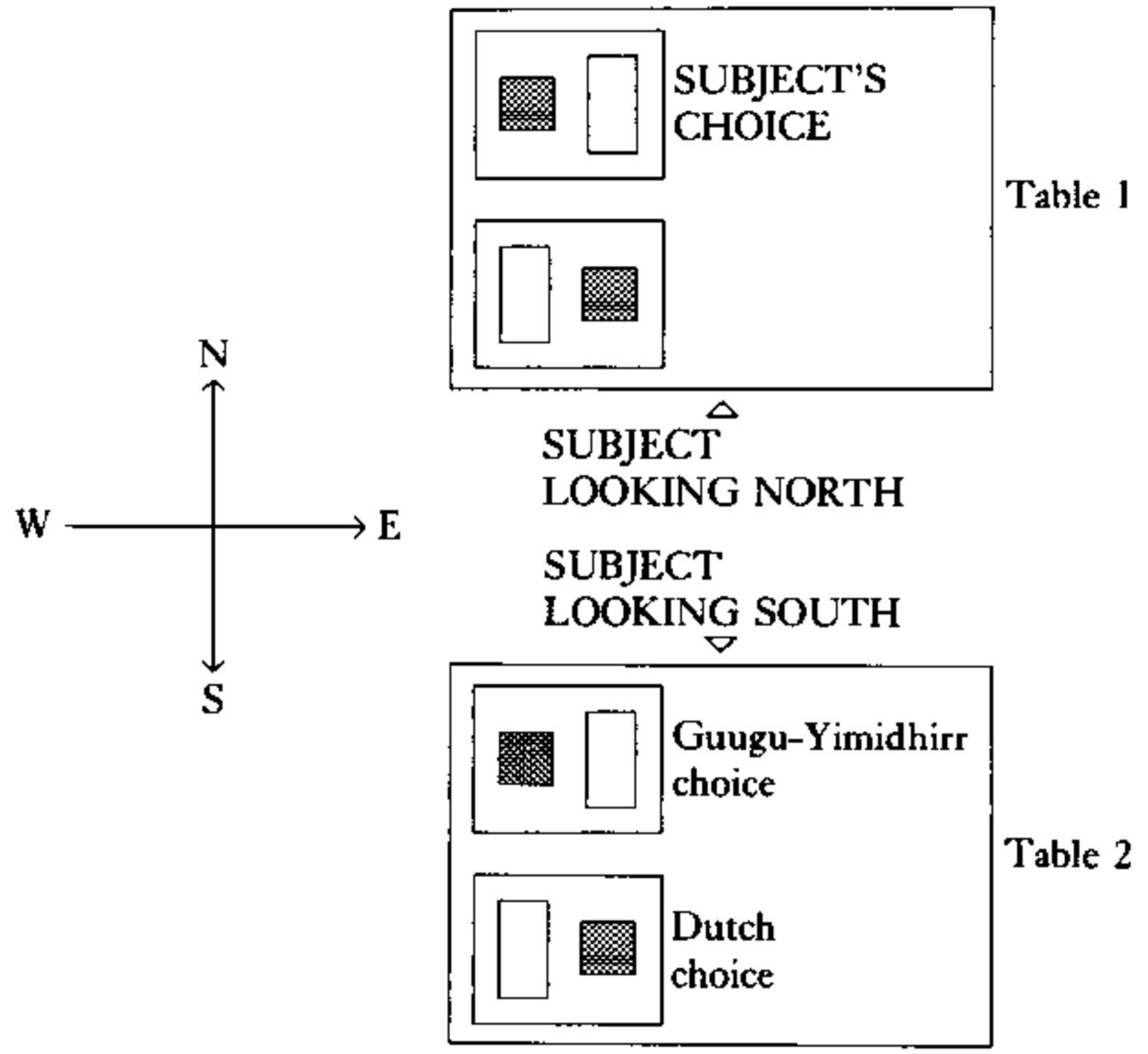

A simple recall experiment showed similar results. A table facing north was laid out with a lineup of three toy animals, all facing one direction, say east and to the right. The subject was asked to remember it, and it was then destroyed. He was then led into another room, with a table facing south and asked to reproduce the alignment. If he does this task absolutely, he will set up the line facing east, but this time to the left. If, on the other hand, he does it relatively, the line will be set up facing right, but to the west. Results for this test were not as strong as the previous one, but were in line with predictions: 9 out of 15 of Guugu-Yimidhirr subjects preserved the absolute eastward alignment of the array, while 13 of 15 Dutch control subjects preserved the relative rightward alignment.

A final experiment tested both memory and inference. A subject facing south was shown a route map diagrammatically indicated by arrows, such as 11.3 (Levinson 1992:28). He was then led to another room, where, now facing north he was asked to choose from three cards to complete the route, see 11.4 (Levinson 1992:28). Note that A and C are identical cards, just rotated 180°. If the subject rotates the map along with himself 180° along a relative LEFT–RIGHT axis, he should choose C. If, on the other hand, he holds the original map in fixed absolutely aligned axes, he should select A,

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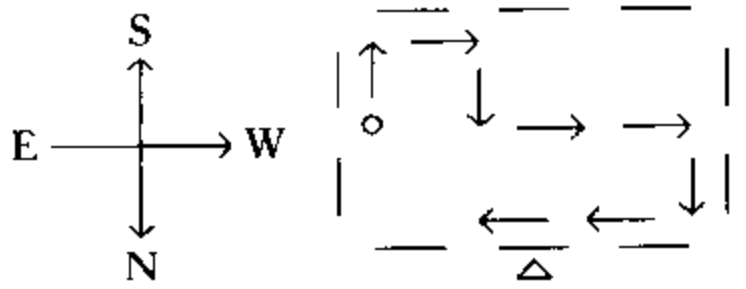

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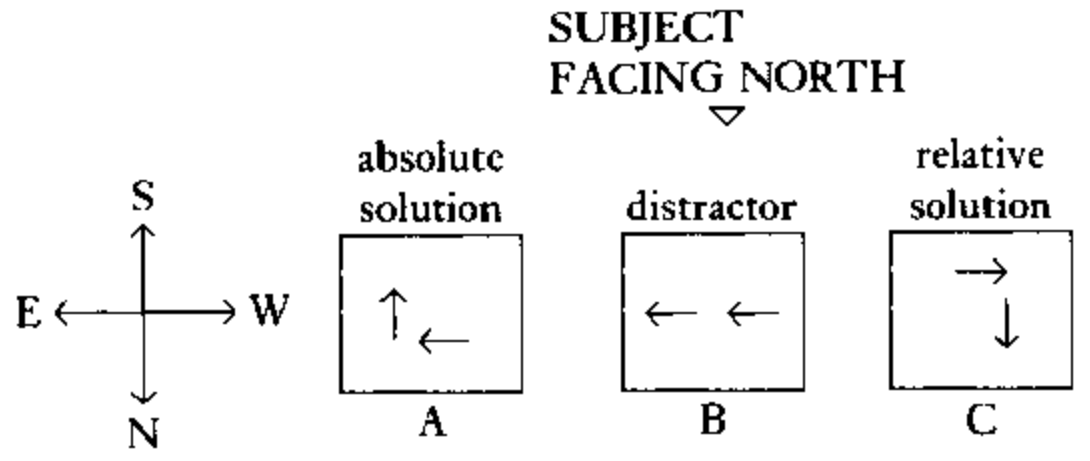


which completes the map without rotation. 8 out of 12 of Guugu-Yimidhirr men chose A to complete the map, while all 15 of a Dutch control group chose C, as predicted.

Levinson's (1992) findings with Guugu-Yimidhirr speakers are powerful support for the Principle of Linguistic Relativity. These experiments suggest that the expressive devices of the Guugu-Yimidhirr language do seem to have direct effects on the habitual thought processes, in recognition, memory and inference, of its speakers. Guugu-Yimidhirr speakers must store spatial information in memory in a distinct way from English or Dutch speakers – any object is always anchored in a kind of concrete space, already aligned according to the axes of the four quadrants. Astounding confirmation of this is provided by Haviland (1993). Guugu-Yimidhirr speakers typically gesture to indicate direction when they tell narratives, and these gestures preserve absolute orientation, so that if an event occurs to the east in the narrative, the narrator will gesture to the east, regardless of his personal orientation. Haviland videotaped the story of a capsized boat in 1980; two years later Levinson serendipitously also videotaped the same story. In the 1980 rendering, the narrator is seated facing west, while in the 1982 version, he is facing north. However, in both renditions his gestures are absolutely oriented, so that when he gestures south to indicate a southerly direction in the story's events in the 1980 version he gestures to his left, but in the 1982 version over his shoulder. Throughout both renditions of the story, gestures to indicate orientation and motion in the story's events are accurately given, but due to the different orientation of the story's narrator,

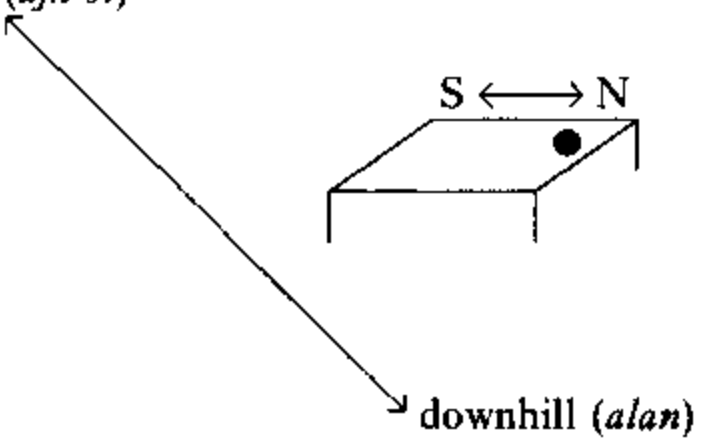
they are necessarily differently oriented gestures in each case. This strongly supports the contention that the participants, places, and events in this story are known by the narrator with their orientation and motion coordinates already specified according to the fixed absolute axes of the quadrants. This is no mean mental feat and seems to be linked to the expressive needs of the Guugu-Yimidhirr language which require it. It is strong support for the Principle of Linguistic Relativity: the channelling effect of language categories on habitual thought.

It is vital to note that claiming the effects of linguistic relativity for spatial cognition for Dutch versus Guugu-Yimidhirr speakers does not vitiate the claim of the psychic unity of humanity. Cognitive abilities, independent of language, of both types, relative and absolute, are available to any cognizer. This is why speakers of English with a relative strategy can learn Watam, which employs an absolute one. Note that there is not infinite variation in the choice of strategy; the choice is restricted to absolute or relative strategies (or a third, intrinsic strategy that I will not talk about here (see Levy 1994; Levinson 1994a)). Subjects may fall back on these when presented with unfamiliar cognitive tasks, such as some of these experiments, hence the lack of 100 percent statistical consistency in the above examples (i.e. only 67 percent of Guugu-Yimidhirr speakers chose the absolute card in the map completion test, rather than 100 percent). However, the language categories of Dutch versus Guugu-Yimidhirr privilege only one of these strategies as a way of talking about space. This may have a channelling effect on coguition through an impulse to have isomorphism among the various systems which store spatial information in memory, specifically the visual and linguistic ones (see Levinson (1994a) for an argument suggesting this might be so). This pressure for isomorphism in the categories used for the storage of a given bit of information in memory is a likely source for the Principle of Linguistic Relativity; it would seem that linguistic categnries are somewhat more weighty tban others. This is perbaps not surprising, given the discussion in chapter 2 on the extent to which we are langnage-constituted beings.

Another Example: Tzeltal of Mexico

The cardinal points or quadrants type of the absolute spatial-reckoning system found in Guugu-Yimidhirr is not the only kind attested around the world. Many coastal Indonesian and Pacific island communities have absolute systems consisting of an axis contrasting seawards with inland/mountainwards and roughly an east–west axis derived from the path of the sun or the seasonal monsoonal winds. Longgu of the Solomon Islands is one such language (Hill 1993). In mountainous country absolute systems typically

11.5 uphill (*ajk'ol*)



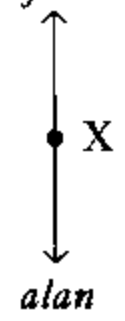
the ball is at the table's downhill (*alan*)

consist of a dominant uphill–downhill axis with a weaker side axis. Tzeltal, as spoken in a Mayan community of southern Mexico, illustrates this latter system and has recently been described in some detail by Brown and Levinson (1992, 1993, 1994), and Levinson and Brown (1994). The Tzeltal speakers of Tenejapa area live in mountainous country ranging from elevations of 2800 metres to 900 metres. The land falls from highland south to lowland north, so that the downhill/uphill axes correspond roughly to our north/south. The terms are downhill/north *alan* and uphill/south *ajk'ol*. Orthogonal to this is a transverse axis, *jejch*, with the poles unnamed. As in Guugu-Yimidhirr, this absolute system is used for all scales of spatial location, from millimetres to hundreds of kilometres, the terms *left* and *right* being restricted to the designation of hands only.

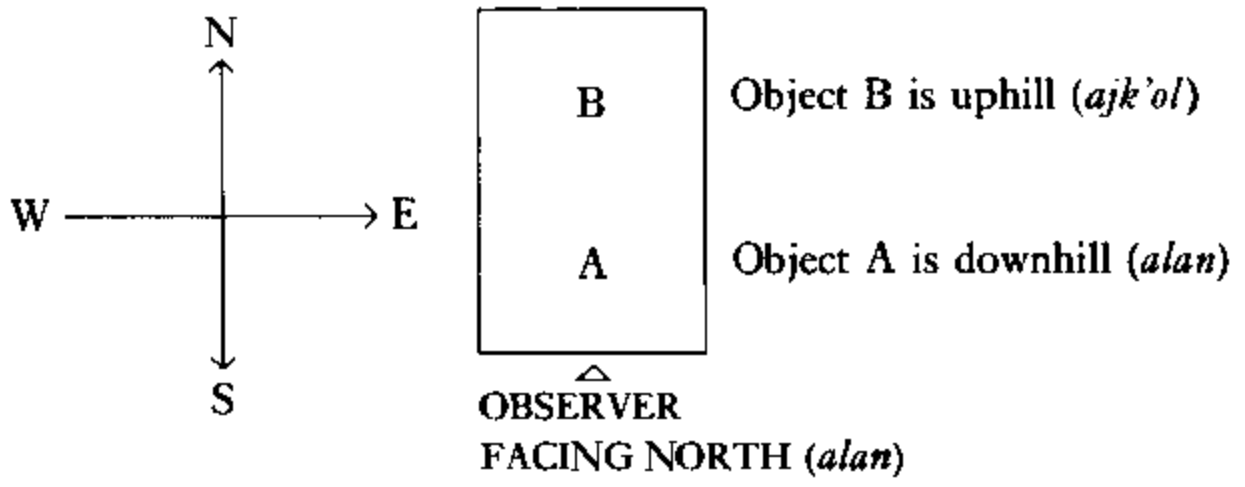
Unlike Guugu-Yimidhirr, the Tzeltal system is not a cardinal point or quadrant system. Rather, it is a single 45° inclined axis (*alan/ajk'ol*) with locations orthognnal to it (*jejch*), although the actual direction orthogonal to the main axis (east/west or left/right) remains undiscriminated. In the steeply inclined country of the Tzeltal, the downhill/uphill meaning of *alan/ajk'ol* predominates, but what happens on a horizontal surface, say, a table? In this case, the north/south reading emerges; a ball may be described as being at the north end (*alan*) of the table, for example, if the alignment of the table within the room is more or less consonant with the downhill/uphill layout of Tenejapa country (11.5). In addition to this extension of the 45° inclined (*alan/ajk'ol*) axis to the 0° horizon, there is also an extended use to the 90° vertical axis, so that locations can be described as being above here or some point X with *ajk'ol* and below with *alan* (11.6).

Finally, the *alan/ajk'ol* axis can be used to indicate the relative nearness of two objects with respect to an observer's position. The close object is called downhill (*alan*) and the further one, uphill (*ajk'ol*). This occurs regardless of the geographical orientation of the observer, say, facing north (11.7). Note that this last use of the axis is a relative one: which object is uphill (*ajk'ol*) or downhill (*alan*) depends on the position of the observer.

11.6 *ajk'ol*



11.7



If, in the above diagram, the observer was at the north end of the table facing south, B would be downhill (*alan*) and A uphill (*ajk'ol*). The reason for this seeming aberrant usage seems to be that when we look at two objects lying in front of us from a standing position, the closer one actually projects onto our two-dimensional visual field as being below the one farther away. This suggests that this relative usage of the downhill/uphill (*alan/ajk'ol*) axis actually derives from the previous up–down use of it in the 90° vertical dimension.

Brown and Levinson (1992, 1993, 1994) have experimented with giving Tzeltal speakers similar cognitive tasks as administered to Guugu-Yimidhirr speakers and, not surprisingly, given the similarity in absolute systems of spatial orientation, have achieved roughly parallel results. In the memory experiment involving the alignment of the three toy animals, nearly 80 percent of Tzeltal speakers performed absolutely, while almost 100 percent of a Dutch control group did so relatively. In the incomplete map test of memory and inference, again, Tzeltal speakers tended to perform absolutely, with Dutch speakers overwhelmingly (nearly 100 percent) relatively. Finally, the recognition test involving the red square and the blue rectangle affixed to a card aligned in a particular way showed the same result: Tzeltal speakers tending toward absolute reckoning, Dutch speakers contrastively nearly always performing relatively. Indeed, on the card recognition task and the map memory and inference test, Dutch speakers *never* performed

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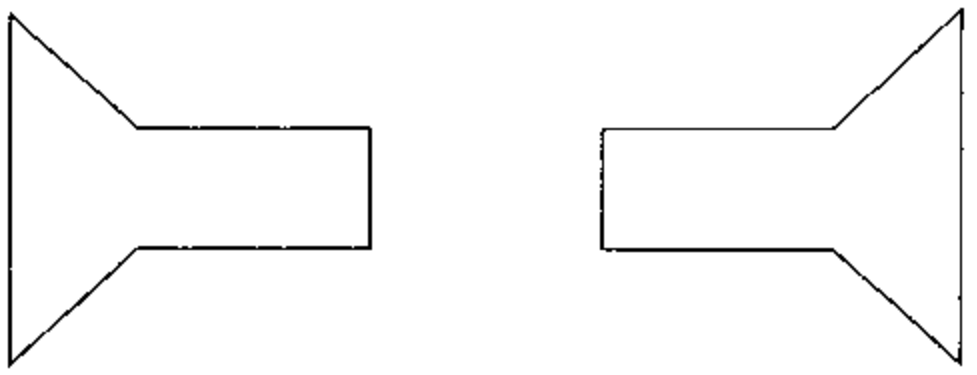

absolutely, and only one did on the toy animal alignment test for memory. As with the Guugu-Yimidhirr results, these findings support the claim of an interference of linguistic systems, in this case, the *alan/ajk'ol* axis and its semantic parameters, on the contents and processes of habitual thought: Tzeltal speakers and Dutch speakers behave differently in these tasks because their languages are systematically different in exactly that area which the tasks are designed to probe. Again, the claims of the Principle of Linguistic Relativity seem substantiated.

An interesting difference between Tzeltal and Guugu-Yimidhirr is an unequal salience of the two axes. In Guugu-Yimidhirr all four named quadrants seem equally so, but in Tzeltal the main downhill/uphill (*alan/ajk'ol*) or north/south axis seems much more developed than the transverse (*jejch*). Correlated to this is the fact that, as pointed out by Levinson and Brown (1994), the whole notion of 180° asymmetry associated with the relative LEFT–RIGHT axis (my left and right hand are not identical, but are 180° flops of each other – figures related in this way are called enantiomorphs) seems curiously missing in Tzeltal. Presented with figures which differed in being enantiomorphs of each other (11.8), Tzeltal speakers generally simply failed to recognize the difference. They typically failed to recognize such left–right inversions in pictures of inanimate objects; indeed, subjects were quite adamant there was no difference. Tzeltal speakers seem largely to ignore differences in shape due solely to rotation around 180° (in contrast to their keen and abiding interest in other details of shape, see Brown (1991) and Levinson (1994b)). This is undoubtedly connected to the lack of a LEFT–RIGHT axis for the plane of rotation and, further, the weak development overall of the *jejch* axis transverse to the dominant 45° incline downhill/uphill (*alan/ajk'ol*) axis.

Topological Properties of Space

Continuing on with the notion of space, let us look at some other systematic linguistic differences in the description of space across languages and their possible cognitive correlates. In many cases an object (figure) is located with respect to some place or object (ground) by specifying some topological

properties of the ground. If we say the *cat is on the mat*, the figure (cat) is located at a place with respect to the mat (ground) by specifying with the preposition *on* some of the topological properties of the mat (it is a surface plane capable of supporting an object, in this case, the figure, the cat). It is the function of spatial adpositions (English, Korean), case endings (Finnish, Hungarian), or locative adverbials (Yimas) to specify the topological properties of the ground, so that the figure can be located with respect to it. The topological properties of the figure are not so specified. Thus, if I say *Rose is waiting at/on/in the corner*, the choice of the different prepositions reflects a difference in the spatial topological properties of the ground and, hence, where the figure could be located: *at* the corner is a place without extension, the figure is located there; *on* the corner is a surface capable of supporting the figure, the figure is located there; *in* the corner is viewed as a container, the figure is contained within it.

These spatial particles like English prepositions carry the crucial semantic information for locating the figure with respect to the ground. However, the semantic information carried by such particles varies widely from language to language; could these linguistic differences correspond to cognitive ones in accordance with the Principle of Linguistic Relativity? Even in closely related languages there may be interesting semantic contrasts. Bowerman (1993, 1994) points out that the semantic range of English *on* corresponds to three distinct prepositions in Dutch, *op*, *aan*, and *om*. Crucially, English *on* requires that the figure is in contact with the exterior surface of the ground and is supported by it. The corresponding Dutch prepositions break this up into three categories in the following way: a figure is described as *aan* the ground if it resists gravity by being attached to it (*handle **aan** pan*, *picture **aan** wall*); as *om* the ground for encirclement relations parallel to English *around* (*ring **om** finger*); and as *op* the ground for natural relationships of support, like a flat plane below the figure (*cup **op** table*), or sticky legs or a maguetic strip (*fly **op** wall*, *sticker **op** refrigerator*), or other natural situations (*boil **op** leg*). Clearly, if a child is learning English or Dutch, she will have to pay attention to different types of topological relationships to master the correct use of these prepositions.

That this is true is demonstrated by further work by Bowerman, jointly with the Korean-speaking linguist S. Choi (Choi and Bowerman 1992). English expresses motion with a general manner verb followed by a preposition indicating the spatial information about the path (*John walked into/out of the theater*; *the bottle floated up/down-stream*). Korean, like Romance languages, has the main verb in transitive clauses expressing the path, with the manner an optional constituent (rather like *John entered the theater walking*). With intransitive inchoative verbs, motion, path and, optionally, manner are all separate constituents (like *the bottle went/up-stream floating*). In both cases the path information is essentially expressed by the verbs.

There are two further important differences between English and Korean. First, English uses the same path preposition for causative or inchoative events (*the snake crawled into the stove*; *Harry put the snake into the stove*). Korean does not, using distinct verb roots for these two syntactic frames: *tule kata* enter go "go in" versus *nehta* "put in." Second, English prepositions contrast with Korean path verbs in their semantics; for example, there is no global Korean equivalent to *in* and *on*, requiring instead more specific verbs that vary according to the properties of the figure and ground. Finally, there are some systematic differences in the meanings of roughly equivalent verbs; English uses *put on* for clothing of all types, whereas Korean has different verbs for putting clothes on different parts of the body.

Relativities of Spatial Conception and Language Acquisition

The Principle of Linguistic Relativity would predict that systematic linguistic differences such as these should be reflected in the process of language acquisition, suggesting cognitive correlates for the speakers of the two languages. Specifically, if the particular properties of the languages in question are found early in the language acquisition process, this indicates that any universal constraints for the organization of spatial information are not bindingly strong (although clearly present as in the earlier discussion) and that experience in the form of the language being learned actually plays a crucial role in the structuring of this domain. This is exactly what Choi and Bowerman (1992) found. By 20 months both English- and Korean-speaking children betray clear evidence of using linguistic elements expressing spatial information in the way found in the corresponding adult language. For example, English children freely use prepositions like *in, out, on, off* in both causative and inchoative syntactic frames, saying *out* for climbing out of a bag or taking something out of it. In contrast, Korean children make a strict distinction between these two usages, in the fashion of the adult language, saying *kkenayta* for taking something out of a loose container, but not for getting out of the bathtub. English children early master the distinction between *in* for containment and *on* for support, using these creatively, like English-speaking adults: *in* for containment within containers regardless of a tight or loose fit and *on* for both surface attachment (i.e. Lego pieces) and surface contact (climbing on a chair). Korean children like adult speakers of the language have no global semantic categories of containment or surface contact and support. By 20 months Korean children use the proper specific verbs; *nehta* "put into a loose container," *nonta* "put on a loose surface," *ipta/ssuta/sinta* "put clothing on trunk/head/feet." In summary,

by 20 months the linguistic output of English and Korean children in this domain of spatial expressions is more like that of adult speakers of the same language than like each other. This is further evidence, this time from the area of language acquisition, for the operation of the Principle of Linguistic Relativity in the domain of spatial language and conception: experience in the form of expressive devices for spatial information provided by the language one learns and speaks plays a critical channelling role in the way one habitually thinks about, recognizes, and remembers spatial concepts.

But why should this be? Why should we expect spatial conceptualization to be informed by experience and not simply dictated by innate and universal psychological structures? Simply because our spatial conceptualization provides the wherewithal by which we navigate through the world, and we would thereby expect that our history of structural coupling, our experience, will then play a role in molding this conceptualization. The environment talked about in spatial language is practically known to us; it exists for and through our active engagement with it in structural coupling. The spatial understanding of the world is not arrived at by some passive bird's eye mapping of our environment, but by understandings of it worked out by practical interaction with it and in it, through knowledge stored in labor, myth, ritual, kinship, and other activities. The different linguistic systems for talking about spatial information in English, Guugu-Yimidhirr, Tzeltal, and Korean, are not the result of minor embroidery on a universal base, permutations on a foundational psychological algorithm, but the end result of thousands of years and millions of human beings' life histories in structural couplings, and "languaging" ideas about space within this coupling. They reflect no more and no less than the life world of the speakers of these languages in this domain.

Summary

Whorf, along with much of current cognitive science, argues that spatial conception is strongly informed by innate, probably biologically based, universals and is therefore essentially the same in all languages and cultures, making use of axes like UP–DOWN, FRONT–BACK and LEFT–RIGHT. Recent work argues that these claims are false, that languages have fundamentally different ways of describing spatial information and that these differences are systematically related to cognitive effects, evidence for the operation of linguistic relativity. It has been demonstrated that not all languages describe spatial information in relative, egocentric terms like FRONT–BACK or LEFT–RIGHT, tied to body orientation, but that many use absolute terms, fixed in geographical space, like EAST–WEST or UPRIVER–DOWNRIVER. These variations in linguistic description are systemically

related to differences in cognition, speakers of languages with relative terms regularly perform differently in psychological tests than do speakers of languages with absolute terms. This conclusion is supported by findings in the field of language acquisition: even very young children learning languages with contrastive systems for expressing spatial relations use spatial terms rather like adult speakers of the target language, arguing against a strong binding influence of universal constraints in the structuring of this domain and supporting a claim for the powerfully relativizing effects of the categories of the language being learned. How we talk about space is not solely, nor perhaps even primarily, a result of our innate biological endowment, but also our history of engaging with our spatial environment and sedimented in our linguistic practices.

Further Reading

The work on space is mainly recent research from the Cognitive Anthropology Research Group at the Max-Planck Institute of Psycholinguistics; see Brown and Levinson (1992, 1993, 1994), Haviland (1993), Levinson (1992), and Levinson and Brown (1994). Bowerman's work is found in Bowerman (1993), and Choi and Bowerman (1992). Other sources on space include Ingold (1986), Landau and Jackendoff (1993), and Pinxten, van Dooren, and Harvey (1983).