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Language as Nature and Language as Art

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Abstract

'Nature'/'Nurture' controversies have been perennial in the study of language, one of the oldest subjects of intellectual endeavor. The first half of this century saw us at the Nurture pole of the oscillation, the second half has placed us at the Nature pole. It would be desirable to escape this pendulum.

The main current approach to 'naturalizing' language is what I shall call 'Simple Nativism'. It holds that both in form (syntax) and content (semantics) language is essentially innate. Syntax is governed by an innate 'Universal Grammar', and the ideas encoded are just elements of the 'Language of Thought'. The problem with this approach is that it minimizes the very substantial differences between languages in both form and content. An alternative strategy for naturalizing language is coevolutionary theory, which conceives of culture as a self-replicating track of information parallel to, and interacting with, the genome, but with faster rates of adaptation and change. On this view, language is a hybrid biological/cultural phenomenon, and the human language ability has a built-in expectation of variation.

In the body of the paper, I focus on the issue of whether the content of linguistic categories is a direct projection from an innate 'Language of Thought'. I review three conceptual domains (color, kinship and space) often claimed to be the locus of semantic universals and argue that the substantial variations across languages fits a coevolutionary perspective much better than a Simple Nativist one. Linguistic categories evolve to solve local adaptive problems, and they strongly influence the conceptual categories in which people think. I conclude that a coevolutionary perspective, by attempting to 'naturalize Nurture',

offers a prospect for escaping the perennial oscillations between radical nativism and radical relativism, and should be further explored in the domain of language.

1. Background

The perennial pendulum

Observations and theories about the nature of language constitute one of the oldest forms of intellectual inquiry. The preoccupation is not hard to understand: language and human nature seem inextricably intertwined, and the gulf between our own species and other animals – whether it is conceived of as the possession of high intelligence, consciousness or culture – seems intimately connected to the possession of language. The lack of continuity with other species, together with our own cultural diversity, has invited us over the millennia to think of ourselves as *outside nature*, as quintessentially products of culture. But there has always been a perennial view of another kind: that we are cultural and linguistic beasts by virtue of *human nature*. On the first view what is emphasized is the variety of languages, on the second what is emphasized is the deep, hidden commonalities between languages. Eight hundred years ago, scholarship already lurched between the poles of linguistic relativism and universal grammar.[1] Indeed, over two and half millennia of the Western intellectual tradition views have oscillated between viewing language as part of human nature, or alternatively, seeing language as essentially part of human culture. Although the twentieth century has seen a veritable explosion of knowledge and theory in the language sciences, this particular ideological issue continues to dog us. We still have not found a satisfactory way to bridge the tired old Nature:Nurture issues.[2] As the authors of a recent book on the subject put it: "The answer is not Nature *or* Nurture, but Nature *and* Nurture. But to say that is to trade one platitude for another; what is necessary is to understand the nature of that interaction" (Elman *et al.*, 1996:357). The current swing of the pendulum has the language sciences out on a Nature pole, with language often treated as an 'instinct' (Pinker, 1994, Gopnik, 1997; but see Tomasello, 1995). But what I want to suggest in this paper is that to transcend the oscillations of the pendulum we need to find a new framework that will focus our inquiry on the peculiar kind of interaction in language between biology and culture.

2.0 Strategies for naturalizing language

The last half of this century has been much preoccupied with *naturalizing language*. By this I mean, trying to find a place in nature for what a long tradition has often assumed is indisputably a part of culture. Like most practicing linguists, I am generally sympathetic to the strategy. We are awed by the complexity of language, and the ease with which children learn it. We are also impressed by the neurophysiological adaptations that make language possible. But the particular 'naturalizing' strategy generally adopted in the language sciences has taken a peculiar turn with which I want to quarrel.

'Simple Nativism' vs. 'Coevolutionism': or why there is more than one language

The particular strategy for naturalizing language now dominant amongst linguists and psychologists holds that language is a mere projection of universal internal mental structures. I will dub the view 'Simple Nativism'. On this view, natural selection – or even perhaps an evolutionary accident - has delivered to our species two fundamental kinds of mental endowment which are directly reflected in language. The one is architectural and is constituted by universals of syntax, which are constraints on possible rule systems. The view that this system ('Universal Grammar') is innate is of course associated with Chomsky. The other relevant endowment, on this view, is a structure of mental content: a rich set of innate concepts, given by some uniform central 'language of thought', together with specialized mental faculties that input to it, as in the influential views of Fodor (1975, 1983) - or alternatively, as given solely by a prestructuring of specific domains of human problem-solving, as in the views of the 'evolutionary psychologists' (see Barkow *et al.*, 1992).

'Simple Nativism' might seem inevitably to presuppose an evolutionary perspective. But Chomsky for one decisively rejects the idea that our innate linguistic abilities have evolved as adaptive features.[3] He thinks he has discerned deep, underlying, quirky constraints which limit the class of possible human grammars and which are in many respects anti-

adaptive – e.g. they make the parsing of sentences difficult. Dennett (1995:487) puts his finger on the issue:

> The very considerations that in other parts of the biosphere count *for* an explanation in terms of natural selection of an adaptation – manifest utility, obvious value, undeniable reasonableness of design - count *against* the *need* for any such explanation in the case of human behavior. If a trick is that good it will be routinely rediscovered by every culture.

So we have a kind of reversal of the general line of argumentation: in the human field, adaptive strategies need no genetic underpinning, only non-adaptive ones do! Hence Chomsky's interest in the quirky details of syntax and the belief that it is these non-adaptive patterns which establish the innate nature of language in his very special sense of 'Universal Grammar'. In fact, there is no real incompatibility between the common-sense view that language in a broad sense has evolved as a highly adaptive communication system and Chomsky's view that the quirky details of syntax are accidental – the latter may well be side-effects of the evolution of language as a communication system. For this reason, Simple Nativism seems quite compatible with an evolutionary perspective (Pinker and Bloom, 1990).

However, this entire strategy for naturalizing language seems to me to be wrong, at least in emphasis. For it entails ignoring or minimizing the very substantial differences between languages and cultures.[4] Culture itself is an evolved system that allows rapid adaptation to varying conditions and which has made it possible for us to invade almost every ecological niche on the planet. The right strategy for naturalizing language, I will argue, is therefore not to ignore those linguistic and cultural differences, but to embrace them. We are built to handle the diversity: language is a bio-cultural hybrid. The way to naturalize this duality of traditions, genetic and cultural, is through the theory of coevolution. Coevolution can be studied in symbiotic relations between species. But the idea of the mutual adaptation of two gene lines can be extended (perhaps somewhat metaphorically) to the idea of the mutual adaptation of a gene line and a line of cultural transmission.[5] The concept of genetic/cultural coevolution is now familiar through the work of Dawkins, 1976; Cavalli-

Sforza and Feldman, 1981; Boyd and Richerson, 1985; Lumsden and Wilson, 1981; Durham, 1991; Laland *et al.*, 1995, and others. Theories here vary across a spectrum from sociobiological reductionism to mild interactionism – in what follows I shall presume a model of the mild interactionist type (as in Durham, 1991) in which culture has a life of its own, but nevertheless is supported by and interacts with our biology. There is evidence for adaptation of the human gene pool to such cultural practices as dairy farming, swidden agriculture (increased malarial ecologies being compensated for by malarial resistance), female infanticide, and so forth. But the very best and most obvious exemplar is language, which for inexplicable reasons has so far played little role in coevolutionary models (but cf. Deacon, 1997). We cannot run like a horse because we have a vocal tract in the way; we are the only mammal that cannot eat and breathe at the same time, because our larynx is lowered in order to maximize the length of the vocal tract; we have hearing specialized to the frequencies of human speech; we have brain areas and neural pathways dedicated to speech processing (see Lieberman, 1984). And all this hardware is there because the cultural traditions of languages are there; and the cultural traditions are there, because the hardware enables them.

Without this theory of twin-track evolution, it would be hard indeed to understand *why there is not just one language*. Pinker and Bloom (1990:716), Simple Nativists by inclination, consider this conundrum as it pertains to word meaning. They admit to no firm answers, but add that it is just more practical for "the genome to store the vocabulary in the environment". But for the 'environment to store the information', it has to be a self-reproducing system of its own. That is the whole point of the co-evolutionary perspective: culture creates and maintains just the environment that will exploit the possibilities in the genome, which in turn enable the culture. Because the genome has, as it were, yielded over the business of fast adaptation to another self-replicating line, we inevitably end up with one species with many languages.

Much more needs to be said about both coevolutionary theory in general, and its application to language in particular, but that would be another paper and indeed another author. Suffice it to say that, as Dobzhansky (1962:18) said 40 years ago, there is a feedback

relation between culture and biology and that we have some worked-out ideas about how to account for the apparent Lamarkian effects of culture on genome – through such mechanisms as sexual selection, the Baldwin effect and (most controversially) group selection. Contrary to some Simple Nativists (e.g., Tooby and Cosmides, 1992) there is nothing mystical in these sorts of processes, whereby, for example, cultural adaptations like warm clothing and harpoon technology make possible the colonization of the Arctic circle, whereupon natural selection in turn engenders physiological adaptations to cold (such as stock body form, or vasodilatation in the limbs). Moreover these processes give us some glimpse of the origin of language in the tension between cultural and genetic tracks, where ever more complex behavioral demands put a premium on cognitive capacities, whose development in turn made possible higher orders of cultural form in an accelerating spiral of cognitive and cultural complexity.

Simple Nativists, if they are aware of this line of argument at all, are unaccountably hostile to it: they claim that all the regularities have long been fixed in the human mind, and that ideas about interactions at the biology/culture interface are as vague as the cultural relativism which is their main target.[6] They take as their bottom line the fact that languages just seem too complex for children to learn – neither the smartest apes nor the smartest machines can do it. If language is essentially coded in the genes, then it seems that the apparent diversity must be mere surface camouflage on invariant substrate. But this argument carries little weight with coevolutionists: the complexity can be divided between innate learning biases on the one hand and patterns stored in the cultural environment on the other – patterns that have precisely evolved to fit the learning biases. For a language to be viable as a cultural tradition, it has to be designed to latch on to innate learning biases.

Unfortunately, it is doubtful that the development of a sophisticated co-evolutionary theory of language is likely to carry much weight with Simple Nativists. What may have more effect is to collect examples of the kinds of phenomenon which seem more tractable to a co-evolutionary view than to a Simple Nativist one, and that is the strategy I shall follow here.

A telling example: infants are built to 'tune in' to specific languages

Let me provide an immediate example of the way in which we seem *built* to handle linguistic diversity. Infants, long before they learn language, are highly sensitive to the speech sounds around them. There seem to be a number of initial innate biases. Acoustic continua are categorically perceived, so that e.g. a continuous series of sounds between /i/ and /e/ and /å/ is partitioned into just three kinds of sound. There thus seems to be a kind of innate category grid. But something dramatic happens to this initial state within the first six months of an infant's exposure to the sounds of a particular language: the acoustic space becomes systematically and ineradicably distorted - sounds that are acoustically equidistant will now become assigned to same or different categories along language-specific lines (Kuhl and Meltzoff, 1996; 1997).

The end result is, as we all know, the set of spectacular biases in our auditory perception which make adults unable even to *hear* the difference between sounds that are fundamentally distinct in some other language. Thus the initial, innate categorical perception system ends up systematically skewed. Exposure to a specific language *rebuilds* our perceptual acuities, and it does so at such an early age that it seems inescapable that the system is built for variation, i.e., built for "tuning in" to the local system, whatever it turns out to be. But the character of that cultural tradition in turn is bound to be organized around a selection from the initial innate category grid – because cultural transmission and learning will always be biased by prototype sounds.

- Figure 1 about here -

We are in the unusual position, thanks to the work of Kuhl, that we know that monkeys also subject acoustic continua to the same sort of categorical perception. But they do not have the ability to warp the perceptual space in accord with the dominant speech sounds –

indeed there is very little evidence of any learning from the acoustic character of others monkeys' calls (Kuhl, 1991; Kuhl and Meltzoff, 1997; Hauser, 1997:324).

Now a Simple Nativist perspective might well predict the initial perceptual biases here, but it would be hard put to explain the specifically human characteristic – namely the restructuring of acoustic space to suit the local language in the first months after birth. Here a co-evolution perspective makes a lot more sense: since cultural traditions change at a much faster rate than the genome, the system is built to handle diversity. In fact we know a great deal about the rapidity of sound changes in language (e.g., in New York, /ɛ/ went through /e/ to /i/ in words like *bad* in just 65 years; Labov, 1994:74-5), and we also know that sharing accents is a crucial marker of group membership, which deeply effects the life chances of individuals.

3.0 The content of linguistic categories

As mentioned earlier, Simple Nativism is a double-barreled doctrine about the prestructured nature of both the form (or grammar) and the content (or semantics) of natural languages. Both aspects of the doctrine are open to serious question, but for reasons of space I shall here confine myself to a critique of the content side. The idea, recall, is that the *content* of language, the conceptual categories underlying linguistic expressions, are universal by virtue of innate endowment. Languages merely code a pre-existing universal 'language of thought' (Fodor *et al.*, 1975).[7] As Pinker (1994:82) has succinctly put it:

"Knowing a language then is knowing how to translate mentalese into strings of words and vice versa. People without a language would still have mentalese, and babies and many nonhuman animals presumably have simpler dialects".

Three domains are often cited to substantiate such semantic universals: the domains of kinship, color and spatial categories.[8] The spatial ones are the most interesting, because it seems clear that spatial reasoning seems to lie behind many other kinds of thinking – we

seem to be highly visual spatial creatures, whose natural aptitudes in spatial reasoning lend themselves to adoption in other domains. But let me turn first to color and kinship.

3.1 Color categories in language

Until 1967 it was generally thought that the way in which languages segment the color space was essentially arbitrary, or culturally relative. Then Berlin and Kay (1969) collecting data from twenty languages, showed that there were fundamental shared patterns under the diversity. In a revised version of the theory (by Kay and McDaniel, 1978), the following are the main universal claims:

1. All languages have Basic Color Terms, that is, a set of terms which jointly exhaust the color space. (Words like *blonde* restricted to hair, or *scarlet* which is kind of red, or *avocado* which is primarily a name of an object, are not Basic Color terms.)
2. There are 6 primary foci, or landmark colors, black and white and the four Hering opponent colors (red vs., green, blue vs. yellow), which form the 'best exemplars' of the six first color words.
3. There is a cultural evolution of languages, such that at *Stage 1* languages divide the color space into cold/dark and warm/light areas (with three of the perceptual foci each), then at *Stage 2*, the warm/light area (covering red, yellow, white) splits into white vs. red/yellow categories, and so on successively until each of these composite categories breaks down into its elementary primaries, the Hering opponent hues.

Figure 2 shows the expected division of the color space for a Stage 2 language with three basic color terms, with a 'warm' vs. a 'white' vs. a 'cold' term dividing up the color space among them (it also shows the universal foci around which color terms are organized).[9]

- Figure 2 about here –

The theory is a frequently-cited, textbook example of semantic universals, which seems indeed to fit the Simple Nativist account: our innate perceptual and categorial system projects 'color' as a semantic domain, and systematically constrains its subdivision. From this, the lesson has been taken that in time the rest of the lexicon will be found in a similar way to be projected from perceptual and cognitive universals.[10]

But recent findings have opened up the entire issue again, challenging especially the first and third claims, that all languages have Basic Color Words in the favoured sense, with the composite semantics indicated. For example, in the language Yélî Dnye (spoken on Rossel Island in Papua New Guinea), the existence of Basic Color Words as originally envisaged must be in doubt (Levinson, 2000). To describe colors, reduplicated descriptive terms are used (e.g. "cockatoo - cockatoo" to denote white). Three of these – those describing black, white and red – are fairly conventional metaphors (although not without competing alternatives), but the rest grade into fresh simile and metaphor. On the face of it, this may look like an incipient Stage 2 three-term system, but the terms are not composite (e.g. the 'black' term does not cover blue and green, or the 'red' term red and yellow) as predicted by generalization 3 above. Nor do the three terms exhaust the color space as predicted by generalization 1; indeed using all the resources at their command (including fresh metaphors), informants leave about half of the color space unnamed. There is also a great deal of subject variation. Figure 3 shows a typical subject response: the "parrot" term covers pure reds only, the "cockatoo" term pure whites, the "nut" term pure black. These are the relatively three well-established terms, which the theory wrongly predicts should universally pattern as in Figure 2. This subject also uses similes for yellow ('dried leaves'), green ('fresh leaves'), and purple ('fruit species'), but there is much individual variation here.

By the original definitions, these Yélî Dnye terms thus fail to constitute BCTs (which should be simplex lexemes, not primarily referring to objects, that together jointly exhaust the color space), and the expressions fail to form a fully conventionalized semantic field.

- Figure 3 about here -

One of the original authors (see Kay and Maffi, 1999) of the theory has recently reviewed this and other counterexamples to the original theory, and now adopts the position (originally advanced by Lyons, 1995; 1999), that there are indeed languages which do not have a systematic semantic domain covering color. Instead, he suggests that there are two major routes to the development of a full color lexicon, one as originally hypothesized, and another that allows incipient color words to emerge *before* there is any systematic treatment of color as a lexical domain.[11]

The consequence is that systematic color terms are not *linguistic* universals: there is no automatic projection of color as a domain into the lexicon of every language. As the Simple Nativist account begins to looks less attractive, so a coevolutionary account begins to look more plausible. On a coevolutionary account, color perception gives us 'landmark colors'. These landmark colors will then act as attractors for any color terms that emerge: as Deacon (1997:119-20) remarks "the pattern of errors in use and transmission of color terms will be biased like a loaded die, so that over time the linguistic references will converge to match the neurophysiological foci of perceptual experience". It takes a process of transmission with modification – a process of linguistic evolution – to fix a perceptual bias in a cultural tradition. A second factor that favours a co-evolutionary approach is the fact, originally noted by Berlin and Kay (1969), that the number of color words in a language is correlated with technological complexity in a society. Now, a language like Yélî Dnye, which has no systematic color domain, is found in a culture in which there is no technology of color at all – that is, no dyeing, weaving, painting tradition. If you do not have dye or paint – that is applicable color separated from objects that naturally have colors – you do not need color words – you may as well describe red fruit as 'ripe fruit', or green leaves as 'young leaves', and so forth.

In sum, then, a coevolutionary perspective seems better able to predict the facts than a Simple Nativist perspective: we shift the burden of explanation for language patterns away

from intrinsic properties of mind alone and instead focus on the interaction between innate perceptual (or cognitive) propensities on the one hand and cultural traditions on the other.[12]

3.2 Kinship terminologies: supra-individual systems of bio-social classification

Let me now turn to kinship, because it illustrates a simple but important point: languages are not the projection of individual minds. Kin term systems organize a diversity of individual perspectives – those of males and females, parents and children, etc. – into one integrated system, which in turn is adapted to the surrounding social system, where it serves to guide biological reproduction.

Kin terminologies have been thought to be candidate semantic universals for the following reasons: all languages seem to have systematic set of words which codify socio-biological ties, and in the great majority of cases at least these seem to be built on the same 'elementary kin types', namely M (mother), F (father), B (brother), Z (sister), S (son) and D (daughter), H (husband), W(wife). Now immediate qualifications are in order here. First, given adoption and other social practices, it is not biological ties that are classified by such systems, so much as relationships treated *in the idiom of biological ties*. Secondly, the 'elementary kin-types' are the members of the nuclear family, and many societies don't have nuclear families, downgrade paternity, have transitory marital relationships and so on, so the primary status of notions like 'father' may be in doubt.[13] But my purpose is not to question the basic assumptions here, but to point out how kin-term systems require a coevolutionary perspective.

Take the Dravidian kin-term system, variants of which are used by all the Dravidian societies of South India and beyond, and whose proto-Dravidian ancestor can be reconstructed dating back 5000 years or more (Trautman, 1981).[14] The Dravidian terminology fits into the world of South Indian castes. The system is exhaustive: anyone in one's caste is a presumptive kinsman, and one must marry inside one's caste, and thus marry a kinsman.

- Figure 4 about here -

Like many other kinship systems, the Dravidian system makes distinctions between males and females, older and younger siblings, and 2 or more generations up and down from ego, as indicated in Figure 4 (from Levinson, 1977). But the essence of the Dravidian kinship terminology is a cultural distinction between 'parallel' and 'cross' kin, which assigns siblings of generations above ego to different categories. Thus my MZ (mother's sister) and FB (father's brother) are, for me, in the parallel category; but my MB and FZ are in the cross-category.[15] For the generations above ego, the rules for assigning kin to parallel vs. cross categories are essentially: (a) opposite sex-siblings are of opposite category, same sex siblings are of same category, (b) marriage joins persons of the same category, (c) sons are of the same category as their fathers, daughters are of opposite category, except that (d) children in ego's generation are of the same category as their parents, and finally (c) ego's parents are always parallel. The application of these rules is illustrated in Figure 5.

- Figure 5 about here –

Now, crucially the term for MB is also the term for FZH, and the very same term is typically used for a wife's father. These equations indicate a presumption of a man's marriage to the daughter of his MB or his FZ; and most Dravidian societies have a rule of cross-cousin marriage, enjoining marriage with either FZD or MBD or both (and as a matter of fact an average of about 20% of marriages are with first cousins of this type in Dravidian societies – Trautman, 1981:216-28).

Now a moment's reflection will show that the rules for cross/parallel assignment just given for ascending generations would, if applied to ego's generation and below, engender incest: marriage joins people of the same category, and since (for ego's generation) children are the same category as their parents, a male might be enjoined by the rules to marry his

sister! Thus the rules for cross/parallel assignment must change: in ego's generation and below one must marry a person of *opposite category*, and brothers and sisters must be of the *same* category, thus ensuring outbreeding – as illustrated in Figure 6:

- Figure 6 about here -

The kin diagram also makes clear another fundamental point: the system organizes many different points of view into a coherent whole. For example, my sister and I share the same terminology for the generations above. But for the generations below, we have different points of view: my children are Parallel for me (or for my brother), but Cross for my sister.

The point of this example is the following. Here is a set of terms which have a culture-specific dimension – the Cross/Parallel distinction – which is adapted to the societal conditions, including a cross-cousin marriage rule and an assumption that every caste-member is a kinsman. It has a supra-individual logic of design, yet it organizes individual viewpoints into a coherent whole. No individual designed this the system; and because it organizes a totality of distinct individual perspectives, it cannot be a projection of any individual's 'innate ideas'. Rather, it is the product of cultural evolution, which has evolved over thousands of years to fit the society it is used in (and in fact many variants of the Dravidian system exist, each finely attuned to the social structure of different castes). But at the same time it organizes biological reproduction: it embodies a marriage rule on the one hand, and on the other, it militates against incestuous unions through its classification of nuclear family members as always in the unmarriageable category. So once again, we have a bio-social system, here one which is tuned to both local cultural conditions and general outbreeding conditions. How can we get design without a designer? Darwin showed us the only way: transmission with slow modification, but the kind of theory we need is a theory of the co-evolution of culture and biology.

3.3. Spatial categories in language and cognition

Presumptions of universality

There are good reasons to think that if there are such things as innate ideas, then spatial concepts should be prime candidates. Spatial thinking is an adaptive necessity for any higher animal species, and is thus likely to constitute an ancient, modular or domain-specific process shared across many mammalian species. Indeed there is good evidence for phylogenetic continuity across the primates in the neural architecture for spatial cognition. So this is the very last area in which we would expect to find significant cultural variation. Indeed, many philosophers, linguists and psychologists have confidently spelt out universals of spatial language and cognition - for example, they have posited the following properties of naive human spatial *coordinate systems*:

- naive human spatial cognition is primarily egocentric in character (Piaget and Inhelder 1956, Clark 1973, Lyons 1977, Miller and Johnson-Laird 1976, etc.)
- it is anthropomorphic: coordinates are established through the planes of our body (left/right; front/back; up/down) (Kant, 1768; Cassirer, 1923; Poincaré, 1946; Clark, 1973; Miller and Johnson-Laird, 1976, etc.)
- it makes no use of 'absolute' or geocentrically fixed angles (Talmy, 1983; Miller and Johnson-Laird, 1976).

The presumption has been that these properties are fixed biases in human cognition, and will thus project directly into universals of semantics. Indeed, it has been presumed that simply by looking at the spatial system in any language, one obtains a good picture of our universal language of thought (cf. "Space and force pervade language .... these concepts and relations appear to be the vocabulary and syntax of mentalese, the language of thought" Pinker 1997:355).

Recent work by myself and colleagues has shown that these confident predictions are false (Levinson, 1996, Pederson *et al.*, 1998). Once one turns away from the familiar, written

languages the diversity of spatial systems in languages becomes rapidly manifest. There are many languages in the world where the primary system of spatial coordinates is not egocentric (or *relative* as I shall say) but is rather based on fixed, arbitrary external coordinates, a bit like our north/south/east/west system of cardinal directions (systems I will call *absolute*). A vignette of such an absolute system will help to make vivid how such a system works.

Guugu Yimithirr

Guugu Yimithirr (GY) is an Aboriginal language spoken at Hopevale, in Northern Queensland, by the descendants of a hunting-gathering group (see Haviland, 1979). Central to linguistic competence in this language is the ability to use the cardinal direction system and the underlying orientation it requires. There are four named cardinal directions, thought of as edges of the horizon, with the northern quadrant skewed about fifteen degrees from our north, as illustrated in Figure 7.

- Figure 7 about here -

The four root terms can be further inflected to yield about 50 terms indicating motion towards a direction vs. motion from it, location at it, or vectors in a direction with focussed start and end points, etc. (see Haviland, 1993, Levinson, 1997a). The language has no locutions glossing 'to the left of', 'to the right of', 'in front of', 'behind', etc., comparable in use to the English terms. Thus instead of saying "the boy is left of/behind the tree" or "Take the first turning to the left", one is always forced into locutions of the kind 'The boy is to the north/east etc. of the tree', or 'take the first turning to the north' etc. (Levinson, 1997a). The system is applied also in small-scale space, as in 'pass me the northern cup' or 'there's an ant on your eastern leg', and even in virtual space, to describe, e.g., events on a television, or in a dream (in fact I am happy to be able to report that to enter heaven you must head north).

It is customary to describe all motions with directional terms ('John went west' rather than just 'John's gone'), often supplemented with gesture. Gesture gives analog accuracy to

crude digital lexical specification of direction, and thus plays an important part in communication.

Such a system obviously requires that all speakers of the language are correctly oriented at all times and (less obviously) know or can calculate the absolute bearings of any place from any other (because if they are to describe a journey they will need to describe the direction). We have directly spot-tested subjects' abilities to point to any location from novel locations deep in the bush. The results show extraordinary dead-reckoning skills, more accurate than those achieved by homing pigeons, making it clear that what some species do by slow-evolved dedicated hardware, humans can do by culturally-developed software (Levinson, 1997a; in prep). Figure 8 compares the performance between 15 pigeons released about 70 km from home base and their bearings on the horizon, and 11 Guugu Yimithirr speakers similarly displaced to an unfamiliar location in forest surroundings, estimating a location by pointing.[16]

- Figure 8 about here -

The findings are interesting: they show that speakers of this language are running a constant background calculation of their location with respect to other locations, maintaining their location on an accurate, oriented mental map. This is the necessary overhead of using a system otherwise so elegant in its utility and simplicity. By contrast, Dutch or English speakers under comparable conditions approximate to random, or at best weakly systematic, estimates of direction. It is clear then that Guugu Yimithirr speakers are at least doing some *additional* computation to say Dutch speakers, namely, running a mental compass and positioning system.

But do they *really* think about small-scale spatial relationships fundamentally differently from you and me? We need a simple method of probing for their non-linguistic "coding" or internal representations, their 'Language of Thought' as it were. Here is a simple

method. We can get subjects to memorize a spatial array and then get them to select from a set of alternatives the one they saw previously, as illustrated in Figure 9.

- Figure 9 about here -

The subject facing one direction, say south, is trained to memorize the top card in Figure 9. Then he is rotated 180 degrees, so that he is facing the other way (north) and his task is to choose the same card that he saw before. If, like us, he rotates his coordinate system with himself, he will chose the bottom card to the right of the diagram (he has, say, thought about the red square as to his left). If he employs co-ordinates located in the environment, these coordinates will not rotate with him, and he will chose the card at the bottom left.

What we find is that in any task based on this kind of rotation, the Guugu Yimithirr speaker will select the solution that relies on 'absolute' external coordinates and the Dutch speaker will select the solution based on egocentric 'relative' coordinates. In fact, we get a systematic picture over a range of experiments that explore non-linguistic memory of various kinds and reasoning over spatial relations.

We have gone on to elaborate these methods and with a number of collaborators have tested the replicability of these results in a good sample of languages and cultures. The finding is that wherever a subject speaks a language with a relative (left/right/front/back) system and no absolute system of co-ordinates, there is a corresponding use of relative coordinates in non-linguistic tasks, and vice-versa, where a language only uses absolute co-ordinates, non-linguistic coding is in absolute terms (Levinson, 1996; Pederson *et al.*, 1998). We have also gone on to do detailed work on child language, to explore when children master these absolute coordinate systems. Contrary to the claims of Piaget that abstract 'Euclidean' concepts would be universally late acquired, such systems are mastered by children as young as four years old (Brown and Levinson, in press). This is important, because it shows that, just as in the case of the infant's recalibration of acoustic space, the child is so cognitively equipped that it can adapt relatively rapidly - as its cognitive processes mature - to the locally predominant semantical concepts.

In summary, what these studies show is the following. First, languages can vary fundamentally even in the core of this domain, the coordinate systems underlying spatial description. Secondly, such linguistic differences imply cognitive differences. The reason is simple enough: *since you may want to describe arbitrary spatial experiences in the future, you must remember them in terms which will support that later linguistic description.* If you remember a spatial array in terms of left and right, you cannot later describe it in terms of north and south, and vice-versa. Language and cognitive style have to be congruent.

Clearly, these facts are not in line with the expectations of Simple Nativism, whereby when we learn a language all we do is map inner Language of Thought concepts onto outer language words. But nor do they necessarily imply the opposite extreme, in which the inner codings are an 'introjection' of an *arbitrarily variable* cultural tradition. For the linguistic traditions seem to build on one of three kinds of coordinate system, egocentric, object-centered and environmentally fixed, which in turn can be seen to play a role in our neurophysiology of spatial orientation (Levinson, 1996). Such an interplay between the architecture of our bodies and the elaborations of cultural traditions is parallel to the much simpler picture in the color domain (or acoustic space). There, too, we had innate color foci (or acoustic foci), given to us by our psychophysics, which bias the cultural transmission so that they form the focus of color terms (or language-specific acoustic categories). So here in the spatial domain we see the interplay of native propensities and cultural factors, perhaps suggesting a general model. The suggestion would be that rather than thinking primarily in terms of 'innate ideas' – what Elman *et al*., 1996 call 'representational nativism' – we should think in terms of architectural biases in perception, and specific neurophysiological systems for, e.g., keeping us aware of our position in space.[17] These pre-existing systems bias the transmission of language as a cultural tradition, giving us the regularities and near universals to be found in semantic and conceptual systems.[18] There is no innate notion of 'north', but there is a pre-existing system for orienting ourselves in a larger environment, on which a notion of 'north' can be built. Thus the burden of explanation for the regularities and

learnability of languages can be spread across the two tracks of self-replicating information, closely bound as they are in the coevolutionary perspective.

Conclusions

I have suggested that the currently favoured strategy for naturalizing language, Simple Nativism, is misguided in emphasis. The strategy locates all the central generalizations in an invariant mental endowment fixed by natural selection far back in the history of the species. In short, "language is just a biological system" (Chomsky, quoted in Campbell, 1983:97). What is wrong with such a view is that it not only minimizes the essential facts of variation, but that it views the variation as 'noise'.[19] Instead, a strategy that views human nature as built to *expect* cultural patterning, as evolved hand in hand with culture, seems a better direction to look for a theory that will supercede the old Nature:Nurture dichotomy. Coevolutionary or dual-track inheritance models are much better adjusted to the essential nature of language, a sustained and complex interaction between biology and culture. In turn, language, which has on the whole played a minor role in these models, may prove to be crucial to their proper development.

In sum I have argued that:

- human nature, our mental constitution, is equipped for variation, in language as elsewhere (as illustrated by infants reactions to phonetic experience),
- the variation is embodied in cultural and linguistic traditions (cf. kinship, color, space),
- traditions are supra-individual (cf. kinship), organizing a shared linguistic and cognitive coding essential to communication (cf. space),
- traditions exploit neurophysiological biases and processes, neglecting some of them, while amplifying others and building elaborate conceptual structures on top of them.

I took as my first example of the nativist provision for culture the human infant's system for 'tuning in' to the locally significant speech sounds. Let me take as my final example the amazing phenomenon of sign language. Children raised to deaf parents switch the modality of the entire language system from the auditory-vocal channel to the gestural-visual one. (The modality independence of language is already evident from reading and writing of course, but that is presumably a secondary and parasitic phenomenon.) Sign-languages are now known to share many structural properties with spoken languages and like spoken-languages are processed largely in the left-hemisphere despite the visuo-spatial nature of the system (which might bias it to right-hemisphere processing). Some researchers conclude that we must be built *in advance* for just one of two modalities (Hauser, 1997:245). But children born deaf *and* blind shift the system to touch, although we currently know very little about such language systems. In any case, sign languages again illustrate the need for a coevolutionary perspective: sign language traditions have emerged only in the context of recessive hereditary deafness, and transgenerational maintenance of sign languages in turn depends on this genetic trait's maintaining a community of signers (Aoki and Feldman, 1991).

There will be skeptics who doubt the need or efficacy of any strategy for naturalizing language: would it make a difference to how the language sciences actually proceed? The answer is affirmative: co-evolutionary models redirect attention, for example, to the flexibilities and inflexibilities of learning mechanisms (issues finessed by the Simple Nativists, but essential as we saw to infants' initial relationships to linguistic sounds).[20] But the main reasons to situate language in the natural landscape are two. First, there is the perennial hope that we may supercede the ideological trivialities of the current level of Nature:Nurture controversies. Secondly, and more importantly, one simply wishes to understand where language fits in with the rest of natural history. It is the big picture that suffers most under the current rule of Simple Nativism or its radical alternative, extreme cultural relativism.

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Endnotes

[1] "Among scholastic theoreticians of language the renowned Paris savant of the twelfth century, Pierre Hélie, declared that there are as many kinds of grammar as their are languages; whereas in the thirteenth century, *grammatica universalis* was considered indispensable to give grammar a scientific status. Roger Bacon taught: 'Grammatica una et eadem est secundum substantiam in omnibus linguis, licet accidentaliter varietur'" (Jakobson, 1961:264).

[2] The history of the opposition in our own cultural tradition is explored in e.g. Collingwood, 1945, and the papers by Mittelstrass and Bredekamp, this volume. The corresponding contrasts in other cultural traditions can be strikingly different; see, e.g., Descola and Pálsson, 1996; Ellen and Fukui, 1996.

[3] Chomsky (1982:321) suggests that Universal Grammar may in some way be a side effect of laws of growth or form applied to the massive human cortex. Elsewhere he admits to general skepticism about the theory of natural selection: "In my view (in this respect I may be a little more heretical), natural selection in itself does not provide anywhere near enough structure to account for what happens in evolution" (cited in Campbell, 1983:97).

[4] There is much talk in linguistics of 'language universals', so that outsiders to the field may well be forgiven for thinking that there is a large body of properties that all languages are known to share. This is not the case. On the one hand, Chomsky and followers have posited highly abstract properties, constantly varied under changes of theory, which are difficult to test and hence never demonstrated for more than a handful of languages. On the other hand, Greenberg (1961) and followers have searched for more superficial, empirical generalizations over a few hundred languages; these generalizations turn out almost invariably to be statistical tendencies in conditional form (e.g., if a language has verb-last word order, the chances are high it has relative clauses in front of the nouns they modify). It may come as a surprise to the general reader to know that we have good information on only perhaps 7% of the 7-8000 odd languages of the world (the higher estimate is probably correct, but even that we do not know).

[5] There are many problems with the idea that the culture track is similar to the genetic track – it clearly lacks Mendelian segregates and recombination, and it supplements vertical transmission with horizontal transmission more like viral infections than genealogical descent (see Sperber, 1996). One eminent biologist has even stated that the idea of a parallel between biological and cultural evolution has done much more harm than good (Gould, 1991:63, cited in Dennett, 1995:342). But as Dennett

(1995:345) remarks, the truth about whether cultural replicators are really like biological ones will turn out to lie somewhere in the fertile ground between the possible extremes. The study of language, a human ability midway between biology and culture, is the best possible place to try and get a little further.

[6] Simple nativism holds that "the rich computational architecture of the human mind" is "where sufficiently powerful ordering processes – ones capable of explaining the phenomena - are primarily to be found"; and the approach criticizes the coevolutionary perspective as sharing, along with the 'social science model', a vague or even mystical ontology: "attempting to locate in these population-level processes the primary generator of significant organization has caused these processes to be fundamentally misunderstood" (Tooby and Cosmides, 1992:47). Biologists on the whole will find this unconvincing: the function of culture is its ability for swift change: "it should follow that the fittest genotypes are those that least restrain tradigenetic [cultural] rule flexibility" (Markl, 1982:19).

[7] Within linguistics there has been considerable debate about two versions of this doctrine. Fodor's version is that every word meaning corresponds to an antecedently existing native concept, no matter whether we are considering the meaning of *tree* or *logarithm*. Others imagine that there is a role for constructivism: complex cultural concepts can be built out of simpler native concepts – see Levinson, 1997b for discussion.

[8] See, e.g., Leech, 1981:Ch 12, Miller and Johnson-Laird, 1976.

[9] Color in human psychophysics varies on three dimensions (usually denoted hue, saturation and brightness). The figure shows an approximation to the Munsell color chart (exact reproduction of colors is not possible in such a print), which is a Mercator-style projection, as it were, of the three-dimensional color solid. There are many intriguing discrepancies between the physics and the psychophysics, most notable here the 'color circle', whereby the shortest perceptible wavelengths are closest to the longest. On why human color vision is psychophysically tridimensional, see Shepard, 1992, who claims that it is an adaptation to the need for color constancy under the varying illuminations on our planet.

[10] Despite warnings from Berlin, Kay and Merrifield, 1991:24 against "sweeping conclusions". It is clear that color may be unusual, in that it is not often that the peripheral nervous system may be involved in the structuring of semantic fields.

[11] Kay & Maffi consider that the three Yélî Dnye expressions used to describe black, white and red are Basic Color Words, notwithstanding their complex form and derivation from object names. But they acknowledge that the expressions fail to have the expected composite semantics, and fail to partition the color space.

[12] Co-evolutionary theorists have in fact seized on the example from the beginning. Lumsden and Wilson (1981:43ff) point out that (in a way similar to my example from auditory space) four-month old infants already show a (presumably innate) color categorization for the Hering opponent hues. See also Durham, 1991:213-23, who recounts the experiment by Rosch (1973), who showed that peoples whose language has few color terms can more easily be taught terms conforming to the landmark colors. But it is Deacon (1997) who most explicitly makes the point being made here, which is strongly reinforced by the newly established fact that color is not strictly a universal semantic domain.

[13] In matrilineal systems of kinship, the official ideology may even deny the role of the male in reproduction (Fathauer, 1962). For a classic case of such a system where there is no nuclear family and no exclusive sexual rights in marriage see Gough, 1962.

[14] This system exists in myriad variants: many of the countless sub-castes of South India have distinctive variants of their own; see e.g. Beck, 1972.

[15] I shall use the following customary abbreviations for the nuclear family kin-types: M (mother), F (father), B (brother), Z (sister), H (husband), W (wife), Son (son), D (daughter), so that e.g. MBD is read as 'mother's brother's daughter'.

[16] However, the Guugu Yimithirr estimates are to a location *other* than home-base and one in fact rarely visited, a considerably harder task.

[17] The doctrine of "innate ideas" has of course a distinguished history from Plato through Descartes, Leibniz and Kant to modern thinkers like Chomsky (Stich, 1975). But from the point of view of current neuroscience, it is hard to see how innate *representations* (as opposed to architectural biases of various kinds) could actually be instantiated (see Elman *et al*., 1996:Ch. 5). Singer (this volume) points out how architectural biases create expectancies in the visual system, which then interact with experience to give the Gestalt constancies of interpretation.

[18] Similarly, coevolutionary perspectives suggest that the kind of strong (but not absolute) tendencies found in language typology of the Greenbergian school (see, e.g., Greenberg, 1961; Croft,1993) might be related to cognitive biases of various kinds. See Hawkins (1994) for suggestions.

[19] As mentioned in an earlier footnote, the degree of variation in the existing 8000 or so languages is currently unknown, since well under 10% have been properly studied. Of these 8000 languages, about half are spoken by less than 10,000 speakers, and of these, half again by groups of less than 1000 (Harmon, 1995). Thus much of the variation lies in ancient traditions maintained by very small human groups. Just as we are losing much of the biodiversity of the world in a massive extinction event similar to the loss of the dinosaurs (see papers by Raven and Markl, this volume), so we are losing most of the human diversity (some estimates suggest loss of 90% of the languages of the world by the end of next century). The two great extinctions, biological and cultural, are linked of course, since they are due to the loss of the ecological niches that support small, specialized populations. Just like biological adaptations, these languages and cultures are ancient adaptations, the loss of which not only reduces human experience and knowledge (including knowledge about the natural world), but also our awareness of the many different, viable ways of arranging human affairs. Such loss will enormously impoverish the scientific study of human language and culture, which still lacks its Darwin, has already lost its Galapagos, and will soon lose its continents of variation, as it were.

[20] See, e.g., Tomasello *et al*., 1993, Elman *et al.,* 1996.