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Doctrinal Dualism
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The Proposal

As a metaphysical doctrine, materialism is no longer a favoured view in philosophy; one might even hold that the doctrine is incoherent. Thus, concerning the doctrine of eliminative materialism, Noam Chomsky (1994:84-5) holds that:

Until somebody tells us what materialism is, there can't be any such thing as eliminative materialism, and *nobody* can tell you what matter is. For example, take fields. Well, they are basically mathematical objects, but physicists treat them as real because they 'push each other around' as Roger Penrose put it. Is that consistent with materialism? Every physicist says it is, but since we have no concept of matter, there is no way of answering that question.

Adopting Chomsky's position, it follows that the very distinction between materialism and immaterialism loses substance since one arm of the distinction can no longer be made sense of.

Interestingly, Chomsky criticizes Cartesian dualism – a substantive distinction between mind and body – roughly on the same ground. According to Chomsky, developments in physics – such as (gravitational) action at a distance – rendered untenable the Cartesian conception of body; hence, there is no meaningful contrast

between mind and body. Descartes' notion of a body, Chomsky suggests, was essentially rooted in 'mechanistic' philosophy according to which all physical motion is to be explained in terms of mechanical forces acting on bodies in contact. Descartes held that mechanistic philosophy can be used to explain much of natural phenomena: all of the inorganic world, and much of the organic world, 'including everything about plants and animals and much of the functioning of humans, up to elements of sensation and perception' (Chomsky 1994:37). In contrast, Descartes held that the phenomenon of unbounded and stimulus-free use of 'signs' falls beyond the scope of mechanistic philosophy (Descartes 1637; Chomsky 1966; Leiber 1991); hence, the need for postulating the novel substance of mind to account for the use of signs which are 'the only marks of thoughts hidden and wrapped up in the body'.

Developments in post-Cartesian science, especially Newtonian science, Chomsky holds, 'not only effectively destroyed the entire materialist, physicalist conception of the universe, but also the standards of intelligibility that were based on it' (Chomsky 2001; also, Hinzen 2006). Since the force of the Cartesian dualism between mind and body depended on the salience of 'the materialist, physicalist conception of the universe', the dualism can no longer be held once the conception became untenable.

Does the rejection of Cartesian dualism mean that we now have a unified account of 'sensations' and 'free use of signs'? As we will see recent work suggests that the problem of unification between biological sciences and linguistics virtually remains where it was two centuries ago (Chomsky 2001; Mukherji, 2010). Thus, commenting on Edward Wilson's optimism about a 'coming solution to the brain-mind problem,' Chomsky

(2001) remarks that the ‘grounds for the general optimism’ regarding ‘the question of emergence of mental aspects of the world’ are at best ‘dubious.’ In this light, the puzzle is that, even though the mind-body dualism that was postulated to account for the explanatory gap between physical motion and language turned out to be untenable, the subsequent history of science has furnished no optimism that the gap has been bridged. In that sense, the origins of Cartesian dualism remain unaddressed.

In what follows, I will propose that the distinction between materialism (the realm of the ‘body’) and immaterialism (the realm of the ‘mind’) be re-interpreted as a divide between bodies of doctrines awaiting scientific unification.

From substances to doctrines

The doctrine of mind advanced by the seventeenth-century French philosopher Rene Descartes is a natural starting point for inquiring into relevant notions of mind in the context of linguistic inquiry because the broad research programme of linguistics is often viewed as a revival of the Cartesian tradition in the study of human ‘cognoscitive’ powers (Chomsky 1966; Leiber 1991). Appealing to the long tradition from Descartes (1637; 1641) to Wilhelm von Humboldt (1836), Chomsky suggested that ‘linguistics and cognitive psychology are now turning attention to approaches to the study of language structure and mental processes which in part originated and in part was revitalized in the "century of genius" and which were fruitfully developed until well into the nineteenth century’ (Chomsky 1966:72). This is because, although ‘Descartes himself devoted little attention to language,’ the Cartesian tradition on the whole offered ‘a coherent and

fruitful development of a body of ideas and conclusions regarding the nature of language in association with a certain theory of mind' (Chomsky 1966:2; Hinzen 2006:Chapter 1).

As these remarks suggest, the tradition was invoked essentially for its general programmatic ideas ('approaches'), and *not* for extracting any specific theory of language or of mind. Chomsky did point out some interesting theoretical moves made in the tradition: for example, the distinction between deep and surface structures and the implicit notion of grammatical transformation (Chomsky 1966:97, notes 67, 68). Still, Chomsky's basic concern was to draw attention to the 'internalist perspective' explicitly proposed in the Cartesian tradition, especially those that underlie the rich expressive capacity of human language (Chomsky 1997).

Insofar as the specific philosophical claims of Descartes are concerned, Chomsky has always rejected what is perhaps the most influential legacy of the Cartesian tradition: the doctrine of mind-body dualism. According to Chomsky, Similar remarks apply to Descartes' distinction between Thought and Extension as separate attributes of mind and body, his claim that the mind is a 'unity,' and that consciousness is a defining property of the mind (Mukherji 2000). Chomsky holds, as we saw, that these ideas originated from mechanistic philosophy and the limited conception of body that follow from it. As noted, Newtonian physics effectively put an end to mechanistic philosophy (Chomsky 1980; Chomsky 1994).

In recent years, Chomsky has been even more emphatic in rejecting any form of dualism in rational inquiry (Chomsky 2000b:Chapter 4). Science is viewed as a unified enterprise which seeks to develop bodies of doctrines wherever rational inquiry is granted

an entry. These ‘bodies of doctrines’ do not affect the assumption of the fundamental unity of nature: ‘Certain phenomena, events, processes, and states are called "chemical" (etc.), but no metaphysical divide is suggested by that usage. These are just various aspects of the world that we select as a focus of attention for the purposes of inquiry and exposition’ (Chomsky 2000b:75).¹

There is no tension between Chomsky’s description of the Cartesian tradition as the ‘first cognitive revolution’ and his rejection of what are perceived to be the central doctrines of that tradition. This is because, even though the ‘Cartesian programme collapsed within a generation,’ the approach of the tradition is ‘basically that of the natural sciences, and the reasoning is unaffected when we move from the complex artifacts that fascinated the 17th century imagination to those that excite many of the same questions and speculations today.’ For example, Descartes held that mechanistic philosophy can be used to explain much of natural phenomena: all of the inorganic world, and much of the organic world, ‘including everything about plants and animals and much of the functioning of humans, up to elements of sensation and perception’ (Chomsky 1994:37).

But Descartes also held that ‘no artifact could exhibit the normal properties of language use’ (Chomsky 1994:35-6). This led to the problems of ‘determining the nature of this *res cogitans*’ and of unification familiar in the natural sciences (37). In other words, the core problem for Descartes was that some central aspects of human nature did not fall under current scientific doctrines (=mechanistic philosophy); hence, there was the need to postulate a new aspect of nature, a substance called ‘the mind.’ In this light, even

if we set aside the philosophical categories Descartes used to characterize this aspect of nature, his basic reasoning remains unaffected since, as Chomsky has repeatedly pointed out, the problem of unification between psychological studies – especially, linguistics – and current biology is as unresolved today as it was centuries ago. More of that later.

This independence of linguistics from the rest of human inquiry constitutes our basic interest in the Cartesian framework. The unsolved problem of unification between linguistics and biology essentially means that the constructs of linguistics, especially the postulation of C_{HL} , *the single computational system of human language*, cannot currently be understood in terms of the constructs of biology; that is, the constructs of linguistics are to be understood in their own terms. If we adopt the intuitive idea that what there is is basically what a true theory postulates (Quine 1969), then assuming the truth of linguistics, it follows that linguistics has unearthed a new aspect of nature.

Whatever be the merits (or pitfalls) of the classical notion of a substance, I am assuming that Descartes' notion of a (new) substance has just this much force: the notion of a substance captures the fact that, pending unification, the postulates of a body of doctrine cannot be understood in terms of some other body of doctrine. In this restricted sense, Descartes' substance dualism basically amounts to a *doctrinal dualism*.

I am not suggesting that whatever (current) science doesn't explain constitutes a new joint of nature. It is obvious that science, at any given stage, explains very little in any case. Physicist currently hold that 90% of the Universe consists of 'dark matter,' meaning that current physics explains about 10% of what constitutes the Universe, according to Chomsky (2002). If Chomsky is right, dark matter is not a joint of nature at all; it is an

expression of ignorance. In contrast, the central discovery of linguistics, C_{HL} , is a postulation based on rigorous scientific reasoning from a variety of directions. As Chomsky has emphasised (Chomsky 2001; Hinzen 2006; Boeckx 2006), the situation between linguistics and the rest of current science, especially biology, is more akin to the relation between chemistry and physics in the 19th century than between current physics and studies on dark matter.

Focusing on the unification problem, which still persists in much the same form even today, it is interesting to see why Descartes raised the problem specifically for language. In other words, even when we set aside the general categories of mind, body, thought, extension, consciousness, etc., that Descartes invoked to explain where mechanistic philosophy did or didn't apply, it could be that much of the *spirit* of his explanatory scheme may be resurrected when we restrict attention to language. So I will argue.

Uniqueness of signs

In fact, another of Descartes' basic concerns squarely involved language. Both Chomsky (1966) and Leiber (1991), authors who vigorously advocate the suggested link between the Cartesian tradition and linguistics, begin their discussion with Descartes' interest in explaining some fundamental difference between humans and animals. In that sense, we may take this to be Descartes' basic interest; his philosophical doctrines may then be viewed as unsuccessful attempts to give some conceptual shape to it (Mukherji 2000 for more).

In his oft-cited letter to Henry More, Descartes formulated his interest as follows: 'now, all men, the most stupid and the most foolish, those even who are deprived of the

organs of speech, make use of signs, whereas the brutes never do anything of the kind; which may be taken for the true distinction between man and brute' (cited in Chomsky 1966:6). In the same paragraph, Descartes explained the specific notion of sign he had in mind; by 'signs' he meant 'anything which could be referred to thought alone, rather than to a movement of mere nature ... *the only certain mark of the presence of thought hidden and wrapped up in the body*' (emphasis added); in what follows, we will repeatedly return to this crucial remark.²

Descartes did not miss the fact that some nonhuman species have the ability to 'make us clearly understand their natural movements of anger, of fear, of hunger, and others of like kind, either by the voice or by other bodily motions.' Nonetheless, 'it has never yet been observed that any animal has arrived at such a degree of perfection as to make use of a true language.' Although direct citation is difficult to locate in Descartes, these remarks lead to the plausible inference that Descartes was referring to a species-specific capacity – 'a unique type of intellectual organization' – such that 'ordinary language use [is] both unbounded in scope and stimulus-free' (Chomsky 1966:4-5). Later, von Humboldt explicitly mentioned the capacity that 'involves infinite use of finite means' (Chomsky 2000b:6).

A uniqueness thesis by itself holds little scientific interest; every species must have some unique features that commonly distinguish the species: elephant's trunk, giraffe's neck, panda's thumb. We need to make sure (a) that the parts that constitute the unique feature are not available outside the species; (b) the suggested feature cannot be traced to some other core feature of the species; and perhaps (c), we have something interesting to

say about the feature under consideration. Let us suppose that condition (a) rules out each of the cases of trunk, long neck and thumb, for these could be just exaggerated forms of what is found in parts elsewhere. For (b), consider the broad system of language. It could be argued that, apart from C_{HL} , some other features of human phonological and conceptual systems are also unique to the species (Pinker and Jackendoff 2005). Supposing these features to have satisfied (a), we could still ask if these features could have been available to humans without the resources of the narrow language faculty (Hauser, Chomsky, Fitch 2002). As widely believed, recursive arithmetic and logic are also unique to humans; hence they satisfy (a). But assuming the wide-spread view that they are ‘off-shoots’ of language, they fail to satisfy (b). Thus, as Fitch et al. (2005) suggest, Pinker and Jackendoff need to show that the unique conceptual and phonological features mentioned by them are in fact available *only* to humans *independently* of the faculty of language; in other words, they need to pass (b). So far it is not obvious that they do.³

Returning to Descartes, the reason I cited his familiar remarks at length is that they bring out a feature of Descartes’ concerns that is not exhausted by his specific mention of human language. Descartes’ formulation of ‘the true distinction between man and brute’ involved unbounded ‘use of signs,’ which are ‘the only certain mark of the presence of thought hidden and wrapped up in the body.’ Human language, no doubt, is the most ubiquitous – perhaps, the paradigmatic – example of this distinction, and Descartes himself might not have thought of anything else. But the general properties of language – especially, unboundedness and stimulus-freedom, as noted – apply to a variety of

cognitive systems other than language: music, arithmetic, logical thinking, among others (Mukherji 2000; Mukherji 2003; Mukherji forthcoming). This leads to the general picture in which C_{HL} is viewed as centrally involved in all these systems. Descartes' formulation of the 'true distinction' seems to apply to these systems also insofar as the distinction draws attention to these (general) properties of language.

In any case, as noted, Descartes did not have anything very specific to say on language itself. So his interest in language could only have been of a general nature: the use of signs to mark the presence of thought. Furthermore, it is well known that, apart from language, Descartes thought that humans are distinct from other organisms in respect of broad categories such as thinking and consciousness. Given his basic interest in thinking, and in language as a 'vehicle of thought,' it was natural for Descartes to entertain a general notion of signs, beginning with his limited interest in the study of language *per se*. In that sense, the suggested coverage of the modest mind captures Descartes' basic interest, even if Descartes failed to mention music or arithmetic.

The convergence between Descartes and the object of current linguistic inquiry could be even closer if we set aside the 'perishable' parts of Descartes' interest (assuming that he held them). For example, Descartes could not be right in holding that nonhuman animals do not think. Contemporary research has definitely established that major aspects of conceptual organization, 'theory of mind,' numerical cognition, social organization, self-awareness, elaborate sexual behaviour, etc., that were previously supposed to be unique to humans, are located in a variety of nonhuman species. We will look at some of these.

Broad and narrow faculty of language

For now, Descartes' uniqueness doctrine does not even apply to the *broad* categories of language, arithmetic and music (Ramus et al. 2000; Marler 2000; Geismann 2000; Hauser et al. 2002; Premack and Premack 2003, and references). Consider the cognitive system of language, the overall system that is responsible for the generation of linguistic signs as they appear in utterance tokens. Notice that this broad conception of the cognitive system is an idealization in that the conception excludes social, cultural, and other normative factors that are certainly involved in the making and interpretation of utterances. In that sense, the conception of the cognitive system is restricted to organism-internal factors. But even there the conception excludes other organism-internal systems that are necessary but not sufficient for language (e.g. memory, respiration, digestion, circulation, etc.; Hauser et al. 2002). How does this restricted conception of the cognitive system of language fare with respect to Descartes' criterion?

It was widely believed that the properties of vocalization that enter into human speech are uniquely human. Almost each aspect of this belief can now be questioned (Hauser 2001, for review). Consider the structure of the vocal tract and the descended larynx of humans, earlier thought to be unique to the species. Many nonhuman mammalian species that lack speech also possess a descended larynx, suggesting that a descended larynx has non-phonetic functions. As for the rhythmic and prosodic properties of speech, the language system shares some of these with the system of musical cognition (Lerdahl and Jackendoff 1983). Recent experiments suggest that not only newborn human infants but also cotton top tamarin monkeys can discriminate the

rhythmic and prosodic differences between, say, Dutch and Japanese: ‘this suggests that the human newborns’ tuning to certain properties of speech relies on general processes of the primate auditory system’ (Ramus et al. 2000). Furthermore, chinchillas, macaques, and birds display categorical perception which was thought to be a unique property for the development of human speech.⁴ It follows that ‘the perceptual basis for categorical perception is a primitive vertebrate characteristic that evolved for general auditory processing as opposed to specific speech processing’ (Hauser et al. 2002; Hauser 1996:7.3.2 for details).

These considerations extend to related properties of acquisition of speech. For example, human infants undergo a phase, called ‘babbling,’ when they produce long monologues consisting of speech-like elements. Young songbirds produce ‘subsongs’ that are structurally different from adult songs, but they contain similar elements (Hauser 1996:13). Similarly, just like humans and unlike primates, most songbirds learn their species-specific song by listening to conspecifics, and develop highly aberrant song if deprived of such experience in their infancy.⁵

Descartes might have aimed, in general, to abstract away from such physical properties of speech. Recall that he granted that animals can ‘make us clearly understand their natural movements ... either by the voice or by other bodily motions.’ Also, there is no clear evidence that Descartes wanted to trace the uniqueness of human language to some unique feature of human voice or ‘other bodily motions.’ Instead, he traced the uniqueness to the fact that ‘all men, the most stupid and the most foolish, *those even who are deprived of the organs of speech*, make use of signs’ (emphasis added).

Suppose that, in the emphasized part of the cited remark, Descartes was just drawing attention to the human use of multiple modalities. Even then the shift is interesting. It is well known that the use of multiple modalities is rare in organic systems. Only humans and dolphins are known to use multiple modalities for imitation, although many species such as parrots and songbirds display widespread ability of vocal imitation; strikingly, vocal imitation, as well as visuomanual imitation, is nearly non-existent in the case of primates. However, only humans have the ability to lose one modality (hearing) and transfer the competence without loss to another one (signing gestures). This suggests that human linguistic competence constructs *abstract* inner representations that remain invariant across modalities.⁶ In other words, in humans, there is a modality-independent ‘inner speech’ marking the ‘presence of thoughts hidden,’ as Descartes put it. This conclusion follows directly if the cited remark meant that humans retain the ability to use signs even in the absence of any mode of articulation. In abstracting away from the physical/perceptual aspects of vocalization, Descartes might have been looking for this underlying system of inner representations – signs – without the advantage of discriminating evidence that we can now marshal.

The preceding picture for the sound-part of the cognitive system of language extends to the thought-part – the conceptual-intentional systems – as well, although the evidence for this part is not as rich. From the little that is known, the most interesting general conclusion is that, as Hauser et al. (2002) point out emphatically, there is little correlation between conceptual abilities and articulatory abilities of nonhuman species.

Recent work suggests that some animals have fairly rich conceptual representations including abstract concepts such as tool, color, causality, geometric relationships, food, and number. Furthermore, a wide variety of animals have knowledge of social hierarchy, relationship of dominance, etc. In an earlier work, David Premack suggested that some primates can distinguish and make use of thematic roles such as agent, object, goal, and patient (Premack 1986). Recent work suggests that chimpanzees seem to possess a sense of self; they may have a rudimentary theory of mind in that they are able to attribute preferences, goals and intentions to others (Premack and Premack 2003:151-2). Perhaps they can distinguish between true and false beliefs and are able to cause false beliefs in conspecifics. Hauser (1999:667) reports that a low-ranked chimpanzee, about to mate, covered his erect penis as a more dominant male walked by. Yet, this rich conceptual repertoire is not reflected in the rather limited vocalization abilities of these animals. Thus, 'the best evidence of referential communication in animals comes not from chimpanzees, but from a variety of monkeys and birds, species for which there is little convincing evidence for a theory of mind' (Hauser et. al. 2002).

For vocalizing animals on the other hand, it is unclear how much of their (limited) conceptual repertoire is indeed reflected in their vocalization abilities: 'Birds sing, chimps grunt, and whales whistle, but those sounds fall far short of expressing the richness of their experiences' (Cromie 2002). Summarising a large body of research on vervet monkeys, macaques, Diana monkeys, meerkats, prairie dogs, and chickens in varied communicative contexts, Hauser et al. (2002) suggest that the communicative ability of animals is restricted to a limited, fixed, and context-bound set of calls and

signals that are typically used non-intentionally, namely, without taking into account the beliefs of others: ‘The information they provide doesn’t go beyond “I’m the dominant animal in this territory,” “Here’s food,” or “I’m a female/male looking for a mate”’ (Cromie 2002), plus ‘danger, run.’ Extensive research on communicative ability of nonhuman species generally ratifies what was held to be a truism in the Cartesian tradition: animal communication is restricted to ‘natural movements of anger, of fear, of hunger, and others of like kind.’

However, this research also brings out an interesting aspect that is apparently in conflict with the tradition. We saw that, although animals vocalize in limited ways, they do have access to many, if not all, *elements* of the human conceptual-intentional systems; the distribution of these elements varies widely across species, though they seem to cluster in primates. It seems that Descartes was generally aware of this obvious fact, but he did not know what to make of it. His worry was that ‘there is no reason to believe it of some animals without believing it of all, and many of them such as oysters and sponges are too imperfect for this to be credible’ (cited in Leiber 1991). Although there are wide differences in the scale and mode of acquisition of conceptual representations between humans and nonhuman species, it is undeniable that these representations are not restricted to humans. Hence, Descartes must be wrong if he held that thought and consciousness mark the ‘true distinction.’ So far, the evidence suggests that his ‘true distinction’ is restricted to the non-phonetic, non-conceptual aspects of language: roughly, the domain of syntax/ C_{HL} . This is certainly what we desire, but is there a way of

holding on to *this* restricted uniqueness thesis consistently within Descartes' framework so that we can borrow his concept of mind?

A related conceptual problem arises from the way in which I have so far interpreted Descartes' uniqueness condition. It seems that, for Descartes, the condition of uniqueness of signs squarely involves the notion of thoughts since signs are viewed as 'marks' of hidden thoughts. It creates two problems for us. First, as noted, Descartes is compelled to treat thought itself as unique to humans which is empirically implausible. Second, Descartes' formulation leaves little room for *separating* signs (=language) from thoughts: to repeat, for Descartes, uniqueness of signs follows from the unique presence of thoughts in humans. In contrast, C_{HL} , in our construal, is (just) a generative device that is embedded *between* the lexical and the thought systems; that is, C_{HL} itself is separated from the thought systems. No doubt, this way of looking at C_{HL} makes it, by itself, 'useless' since it is activated only when it interacts with the two systems at two of its ends.⁷ Nonetheless, the *description* of C_{HL} does not require any reference to the thought systems. It appears that C_{HL} cannot meet Descartes' uniqueness condition; hence, it is implausible to think of C_{HL} as the Cartesian mind.

To probe, let us inquire if it is necessary for Descartes that animals do not think at all. Could it be that, contrary to popular opinion (Singer 1976; Midgley 1980, reviewed in Mukherji 2000), he could have held a somewhat different view on this topic? Consider again his view that the brutes cannot mark the presence of hidden thoughts. In an uninteresting sense, thoughts are always 'hidden' until they are articulated. In that sense, thoughts which are directly related to current external stimuli are also hidden. But there is

a vast realm of what Chomsky calls ‘inner thoughts’ which may not be linked directly to current stimuli; they have to do with reflections on the past, planning for the future, etc. As they are not directly linked to current stimuli, these thoughts may be viewed as products of the mind alone. These thoughts will then amount to the ‘creation of possible worlds’ and ‘cognitive images.’

Descartes could be suggesting that these are missing in animals even if stimulus-bound thoughts are not. Premack and Premack (2003:121) report that the San tribe of Kalahari narrate their recent hunt in great detail in the evening: ‘Hunter-gatherers hunt twice: once in the field and a second time around the campfire’ – ‘chimpanzees, having caught a monkey and eaten it, simply digest their meal.’ Such productive thoughts are available to humans because they are signed, since signs have productivity. Some of these thoughts may also be externalized. In fact, externalized thoughts are the best evidence for hidden thoughts; only a creature who has productive thoughts can ‘mark’ them.

From this perspective, evidence that nonhuman species have *un*productive thoughts – that is, some finite arrangement of concepts, tones, and numbers – will not affect the uniqueness claim. To emphasize, Descartes’ claim could be viewed as centered on the *productivity* of thoughts, rather than on thoughts themselves. And the difference between productive and unproductive thoughts, in the sense outlined, is exactly the difference between having and not having C_{HL}. Also, if the mechanism of externalization, that is, the sensory-motor system, is ‘ancillary’ to the language system (as Chomsky seems to be thinking currently as noted), the presence of even some of its central parts in nonhuman

species – human speech categories, prosodic and rhythmic structures, and anatomical features such as descended larynx – will not affect the claim as well.⁸

As noted, the rephrased uniqueness thesis allows that nonhuman species may share some, may be all, of the conceptual-intentional parts with humans. However, when the shared part is fed into the computational system only humans are endowed with, a qualitatively different productive system results. Arithmetic is a clear case in point. Hauser et al. (2002) report interesting evidence that humans and chimpanzees seem to share two mechanisms for representing numbers. The first can accurately discriminate between numbers upto 4 in a block: subitization. The second mechanism gives rise to an approximate number sense in accordance with Weber's law, with greater discriminability among small than large numbers, and between numbers that are further apart (but see Hauser 2006). Thus, animals can 'count' small numbers and discriminate between unequal quantities.

Chimpanzees have been trained to recognize numbers upto 9 to the point that they can understand the meaning of number words, and even Arabic numeral signs. But as with language, music and everything else, the total repertoire is rather small and fixed, and it takes thousands of trials spread over many years in carefully-controlled environments to train human-reared animals to extend this repertoire in small doses. Most importantly, Hauser et al. (2002) observe that while chimpanzees learn each number in the small set of numbers *afresh*, human children basically take off after learning the first few. It will be surprising if a very similar picture does not obtain for the human musical system.

If this way of looking at Descartes holds, then a variety of Descartes' views fall in place: the (general) notion of signs, true distinction between humans and animals, and the postulation of a separate substance. Also there is a growing intuition that the (rephrased) Cartesian picture is likely to apply narrowly to C_{HL} and to nothing else. The thrust of the argument so far is that this narrow Cartesian picture is currently isolated from the rest of science; hence, pending unification, the picture promotes a strong doctrinal dualism.

Biological isolation of C_{HL}

The idea of doctrinal dualism between linguistics and biology – on par with the earlier dualism between pre-unified physics and chemistry – will be substantiated if current scientific knowledge of living systems cannot be viewed as accommodating the scientific advances in linguistic inquiry. In his recent writings, Chomsky has drawn attention to the view that biological systems are optimally designed. If valid, the suggestion would begin to bridge the explanatory gap between linguistics and biology, since one of the central results of current linguistic inquiry is that the language system is optimally designed (Chomsky 1995). From what I can follow, this suggestion has been advanced along the following steps.

The first step is methodological: the 'Galilean style' of explanation in science begins by assuming that nature – or, at least, the aspects of nature we can fruitfully study – is perfect. The second step consists in showing that general principles such as least energy requirement (least effort principles) have played a major role in formulation of scientific theories, including reflections on biological phenomena. A variety of natural phenomena seems to require essentially the same form of explanation to the effect that nature

functions under optimal conditions. This include phenomena such as the structure of snowflakes, icosahedral form of poliovirus shells, dynamics of lattice in superconductors, minimal search operations in insect navigation, stripes on a zebra, location of brains at the front of the body-axis, and so on. The third step shows that principles of computational efficiency of human languages (PCEs) are optimal conditions of nature, given that language is a natural object.

On the basis of this evidence, I will assume that nature, including the biological part of nature, is perfect; therefore, human language, also a part of nature, has a perfect design. I can afford to assume all this because it still will not follow that PCEs are general properties of organic systems such as insects, not to speak of inorganic systems such as snowflakes. For that ultimate step, we need to shift from historical parallels and analogies, however plausible, to theory.

Basically, Chomsky's idea conflates the distinction between a (general) *form* of explanation and an explanation of a specific (range of) phenomena. Consider the idea that the 'innate organizing principles [of UG, the Universal Grammar] determine the class of possible languages just as the *Urform* of Goethe's biological theories defines the class of possible plants and animals' (Chomsky, cited in Jenkins 2000:147). If the parallel between UG and *Urform* of plants is intended to highlight the general scientific goal of looking for generative principles in each domain, it satisfies the first step. It is totally implausible if the suggestion is that a given *Urform* applies across domains: UG does not determine the class of plants just as Goethe's *Urform* fails to specify the class of languages. Similarly, the very interesting discovery of homeotic transformations of floral

organs into one another in the weed *Arabidopsis thaliana* (Jenkins 2000:150) does not have any effect on *wh*-fronting.⁹ In order to play a role in theoretical explanation of phenomena, the general conceptions of *Urform* and transformation need to be specifically formulated in terms of principles operating in distinct domains, pending unification.

Turning to the issue of whether a particular least effort principle of language, say, the Minimal Link Condition might apply in other domains and organisms. Hauser et al. (2002) suggest that ‘comparative studies might look for evidence of such computations outside of the domain of communication (e.g., number, navigation, social relations).’ Elaborating, the authors observe that ‘(e)legant studies of insects, birds and primates reveal that individuals often search for food using an optimal strategy, one involving minimal distances, recall of locations searched and kinds of objects retrieved.’

Following the Galilean assumption that nature is perfect, optimal search could well be a general property of every process in nature, including the functioning of organisms. As such, principles of optimal search could be present from collision of particles and flow of water to formation of syntactic structures in humans. However, it requires a giant leap of faith to assume that the *same* principles of optimal search hold everywhere. Plainly, we do not wish to ascribe ‘recall of locations searched’ to colliding particles or to the trajectory of a comet. In the reverse direction, (currently) there is no meaningful sense in which principles of optimal water-flow are involved in insect navigation, not to speak of syntactic structures in humans.

As far as we can see, this (linguistic) aspect of nature is somehow located in the human brain and not in the joints of the knee; it is also conceivable that laws of physics

(ultimately) apply to the human brain. Thus, one is perfectly justified to use the ‘bio’ in ‘biolinguistics’. Nonetheless, currently, there is nothing in the *formulation* of C_{HL} that requires that C_{HL} can not be located in knee-joints. Therefore, even if narrow physical channels have influenced the evolution of the structure of the brain as with much else in nature (Cherniak 2005; Carroll 2005), it has not been shown that the influence extends to the design of the language faculty. In fact, it is unclear what is there to show:

What do we mean for example when we say that the brain really does have rules of grammar in it? We do not know exactly what we mean when we say that. We do not think there is a neuron that corresponds to ‘move alpha’ (Chomsky et al. 1982:32).

Over a decade later, Chomsky observed that ‘the belief that neurophysiology is even relevant to the functioning of the mind is just a hypothesis’ (1994:85). Several years later, he continued to hold, after an extensive review of the literature, that ‘I suspect it may be fair to say that current understanding falls well short of laying the basis for the unification of the sciences of the brain and higher mental faculties, language among them, and that many surprises may lie along the way to what seems a distant goal’ (Chomsky 2002). In general, the problem of unification between ‘psychological studies’ such as linguistics and biology is as unresolved today as it was two centuries ago (Chomsky 2001). The ‘locus’ of the problem continues to be on biology and the brain sciences (Chomsky 1995:2). To insist on some unknown biological basis to the actual operations and principles contained in C_{HL} is to miss the fact that, with or without biology, the theory of C_{HL} already uncovers an aspect of nature in its own terms.

Notes

¹However, Chomsky also holds that cognitive science is the study of cognitive capacities such as vision, language, reasoning etc. Keeping to the human mind, these mental capacities, according to Chomsky, fall under something like ‘traditional coverage’ (2000b:75). However, at least one traditional coverage along similar lines, namely, the one proposed by René Descartes (1637; 1641) was in fact based on a rather sharp metaphysical boundary of the mental. Similar remarks apply to the closely related non-materialist tradition inaugurated by Franz Brentano to identify Intentionality as ‘the mark of the mental’ (Brentano 1874; Haugeland 1997:4). If we wish to hold on to the coverage without accepting the proposed boundary, we need to find out if there is some independent justification for this particular coverage. Otherwise, it is unclear if lessons from established terms like ‘chemical,’ ‘physical,’ ‘electrical,’ etc. are appropriate for evaluating ‘mental’ in the intended *non*-established sense, that is, the sense in which the term is delinked from its traditional, unity-enforcing usage. Cognitive science cannot have it both ways.

²See the interesting distinction between signals and cues on the one hand, and signs on the other in Hauser (1996:9). However, Hauser's notion of signs is still too broad for Descartes since Hauser's notion applies – sometimes in a cross-species manner – to, say, advertisement calls produced by male frogs which are signs from the perspective of a predatory bat (1996:9, note 13).

³The idol of *Ganesha*, widely worshipped in India, has an elephant's head grafted on a human body (just the reverse of the structure of Sphinx in which the head of a pharao is

grafted on to the body of a lion). Apparently, productive construction of these ‘possible worlds’ has nothing to do with language, but it is hard to conceive that a non-linguistic creature can form these ‘cognitive images.’

⁴This refers to categorical perception of *human* speech. Categorical perception in species-typical vocalizations are found in field crickets, swamp sparrows, mice, pygmy marmosets and Japanese macaques, among others (Hauser 2001).

⁵It is curious that these experiments compare properties of human *language* with bird *songs*.

⁶This is empirically controversial; see Hauser (1996:5.4.3, especially 344-6).

⁷This follows from Chomsky’s view (1980) that grammar is real but useless.

⁸ The notion of sign is used with systematic ambiguity. We distinguish between inner representations (=symbols) that constitute the form of thoughts and which may be entertained even when ‘deprived of the organs of speech,’ and signs as externalized marks. Externalized signs do supply the initial evidence for inner representations, but are not necessary for the existence of these representations.

⁹ English and other languages have the property that *wh*-phrases – *which man, what book, where, when, whether*, etc. – often move to the clause-front: *which man did you see, what book will you read*. The *wh*-element originally occurs at the base – *you will read what* – and then moves/transforms to a higher syntactic position to meet conditions of interpretation. In Chinese and other languages, in contrast, these elements stay at the base in sound; they move up only covertly for meaning/interpretation. The phenomenon

animates much discussion in generative linguistics (Lasnik and Uriagereka 2005; Boeckx 2006 for recent reviews).

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