

If LEFT and RIGHT happen to be concepts adult chimps acquire, they may be able to solve the task. Perhaps, if apes can learn symbols for "left" and "right", this experiment might be best conducted by one of the ape-language labs. If my indexical argument holds, then it may be that only apes who have learned symbols for these concepts can successfully complete the task. If it is in fact the phonological loop that is critical, then it may be that only the chimps who are able to carry or gesture the symbol will be able to navigate successfully.

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### Is LF really a linguistic level?

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**Abstract:** Carruthers's argument depends on viewing logical form as a linguistic level. But logical form is typically viewed as underpinning general purpose inference, and hence as having no particular connection to language processing. If logical form is tied directly to language, two problems arise: a logical problem concerning language acquisition and the empirical problem that aphasics appear capable of cross-modular reasoning.

Let us assume, with Carruthers, that there is an internal language in terms of which domain-general reasoning is conducted (following Fodor [1975], call it the language of thought – LOT). Natural language must clearly interface with such an internal language: That is, language understanding must involve translating from natural language to LOT, and language production must involve the reverse.

What might LOT be like? The standard assumption is that LOT must be a logical language, that is, a language over which logical (or more precisely proof-theoretic) operations can be defined (see Fodor 1975; Fodor & Pylyshyn 1988). Accordingly, for each natural language sentence, there will be a corresponding "logical form" – in the traditional formal semantic sense. (Typically, there will be several such logical forms, because of ambiguities in natural language; and the picture is further complicated by anaphora, deixis, etc., but in ways irrelevant to the present argument.) The project of formal semantics (Dowty et al. 1981) seeks to explicate the relationship between natural sentences and their putative logical forms; and logical form has, of course, been a central notion in analytic philosophy and linguistics. The advocate of LOT typically takes a "psychologistic" view of logical form – logical forms correspond to representations of sentences in LOT. (One might query whether inference can be captured by logical reasoning alone – but this is another issue; see Oaksford & Chater [1991; 1998].)

Carruthers points out that Chomsky (1995) argues that there is a level of linguistic representation (called *logical form*, or LF). He then claims that all domain-general propositional thought is framed in terms of these LF representations. It is in this sense, he argues, that language has a cognitive function: a *linguistic* level of representation, LF, that plays an essential role in domain-general thought.

The interest of this claim seems to hinge on terminology: It seems to be crucial that logical form is viewed as a *linguistic* level of representation. Then, one may say that thought has, in a sense, a linguistic basis, and therefore that language has a cognitive function. If, however, we described LF as, say, a logical level of representation, then there would be no tendency to claim that thoughts (framed in LF) have a linguistic basis; or that language thereby has a cognitive function.

Carruthers's assumptions concerning LF are, as far as I can see, precisely the standard ones described above – natural language is

translated in and out of LF; and LF is the representation over which domain-general inferences are defined. Thus, LF seems not to serve as a linguistic level of representation – but as a level of representation for general cognition; although one that must interface with natural language, as it must with perceptual input systems and motor output systems. In particular, from what Carruthers says about LF, it seems quite conceivable that, for example, LF developmentally and evolutionarily precedes the development of external natural language. As it happens, Chomsky (1995) has a specific theory of LF, which differs in a number of ways from standard views of logical form, but features specific to Chomsky's notion are not discussed in, and are therefore presumably not critical to, Carruthers's argument.

In a nutshell, advocates of LOT typically think of LOT as expressing the logical form of natural language sentences and thereby serving as a basis for inference. Carruthers does not appear to add substantive assumptions that establish any further sense in which logical form is fundamentally a linguistic style of representation. But without such assumptions, it seems inappropriate to draw conclusions about the putative cognitive function of language, which might more neutrally be viewed as concerning the putative cognitive functions of LOT.

One could imagine strengthening Carruthers's claim in the following way: Suppose that logical form representations can only be entertained if (at least in principle) the cognitive system can derive syntactic and phonological representations corresponding to the logical form representation (which, in principle, might mean something like "given appropriate cognitive resources"). Then the linguistic abilities of language users (their phonological and syntactic capacities) will strikingly constrain their powers of domain general reasoning. According to this view, logical form representations will necessarily be constrained, in evolution and development, by the development of language abilities; people with impaired linguistic abilities will necessarily have impaired general reasoning abilities; and so on. By making this strong connection with other levels of linguistic representation, the linguistic character of logical form representation is given real substance.

But this viewpoint, though substantive, seems difficult to defend. One problem is logical. As Fodor (1980; 1981) points out, if thought is bounded by language, then language learning is impossible. This is because language learning requires framing hypotheses about the meaning of linguistic forms that have not yet been mastered – and this requires being able to entertain meanings for which a current linguistic representation is not available. But this is precisely what is precluded on the view just described: that logical form representations are only available where the corresponding phonological and syntactic representations can be constructed. A second empirical problem is presented by patients with severe aphasia, who can carry out numerous complex tasks. For example, as Carruthers notes, an aphasic studied by Varley (1998; 2002) can, among many other things, pass the false belief task. From a modularist perspective, this requires at least the integration of visual modules (viewing and understanding the experimental setting) and social reasoning modules (concerning beliefs and related notions) and hence is a paradigm example of cross-modal reasoning.

One might, though, defend the claim that *conscious* propositional thought necessarily implicates language. Indeed, it seems to me that this claim is almost certainly right. Conscious awareness seems to be limited to perceptual inputs (broadly construed to include awareness of bodily state, motor activity, pain, etc.) and their imagistic analogues (visual, auditory images). The only way of turning propositional thought into a form that allows it to be perceived (or imaged) appears to be to turn it into a linguistic form. Natural language is arguably the only means we have of externally representing propositional thought; if we can only be conscious of that which can (potentially) be externally represented (i.e., perceived and imaged), then natural language must inevitably underpin conscious thought.