

late the mental states of others. Indeed, this is what human communication seems to be mostly about. Although such communication is clearly mediated by a public language (the product of a language module), “the very development of public language is not the cause, but an effect of the development of communication made possible by the metarepresentational mode.”

Carruthers offers a similar solution to Fodor’s Paradox; only, he attributes evolved metamodular functions to the language faculty, not ToM. Carruthers’s insights about the role of language in thought are enlightening (at least to me); his suggestions for further experiments to test claims about how language integrates thoughts across domains are important and should be seriously pursued. But I see nothing here to allow a decision on whether language or ToM is ultimately responsible for cross-modular integration.

Like Sperber, Carruthers maintains that “mind reading (or ‘theory of mind’) . . . is vitally implicated in the processing and interpretation of speech, especially in its pragmatic aspects.” Moreover, “there is good reason to think that the evolution of the two faculties will have been intertwined in a kind of evolutionary ‘arms race.’” In sum, “meta-representational thought – will be crucial to the sorts of serial, conscious, language-using mentality” responsible for “non-domain-specific, cross-modular, propositional thought.” Carruthers harnesses new and compelling experimental evidence from Hermer, Spelke, and colleagues to support the claim that language is crucially involved in cross-modular thinking; however, he acknowledges such studies *cannot* distinguish between language and ToM as the ultimate source of domain integration because of their being so intertwined developmentally and, presumably, evolutionarily.

It’s difficult to decide for one source or the other. This is because the crucial structural aspect of the metarepresentational system, embedding of mental states (in ToM), may have coevolved with syntactic recursion (in language) (Atran 2002). Short-term memory limits iterated embedding of mental states (e.g., “Peter thinks that [Dan knows that] . . .”) to five or six levels (R. Dunbar); but as with center-embedding of linguistic clauses (also memory-limited to under seven levels, N. Chomsky), computational machinery allows for indefinitely many embeddings (to any apparent limit, add: “You really believe that . . .”). By giving a person more time and external memory, more embedding is interpretable in a unique and uniform way (not predicted by associationist models, connectionist or otherwise). Without this embedding process (whatever its source), whose surface product is *logical form*, there seems to be no way to build cross-modular representations in sentences or thoughts.

In the end, preference for one source over the other may depend on whose evolutionary stories one finds congenial. But these stories (so far) are *just* speculative tales consistent with natural selection, lacking evidentiary standards for eliminating indefinitely many alternative and even contrary explanations. Although Carruthers renders some of these stories as parenthetical remarks, his reasoning suggests more than there is. When he says “this makes perfectly good-ecological-evolutionary sense” and leads to “just what one might predict,” there remain indefinitely many other sensible stories compatible with the data. At best, these accounts retrodict findings. In no case do they predict surprising or significant discoveries unavailable before the “evolutionary” account was proposed (this is a frequent problem with evolutionary psychology explanation, however interesting).

Finally, Carruthers may be too kind to neo-Whorfians, who argue that *particular* languages sculpt culture-specific cognitive processes. Thus, evidence on Yukatek (as opposed to English) suggesting that subjects see similarities among objects based on material composition rather than shape or function carries no deep cognitive consequences (in reasoning, reference, pragmatic use, or categorization). Stimuli were routinely simple objects (cork, pieces of paper); when more complex objects were involved, differences between Yukatek and English disappeared. For example, our field team found Itza’ Maya (closely related to Yukatek) more

likely to group, say, a cedar canoe (*chem*) with an aluminum motorboat (*laanchaj*) than with a cedar tree (*k’uche*). Frequently cited differences in spatial reasoning (e.g., more cardinal than relative positioning because of lack of prepositions in the language) may not be much greater between languages and cultures than between, say, New Yorkers (lousy at cardinal positioning) and rural Midwesterners (who talk about “the north side of the barn”). Even a near-prepositionless Australian aboriginal wouldn’t likely refer to the mole on the right side of the nose only in cardinal terms (which would imply change of reference with every head movement).

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The collective invention of language to access the universe of possible ideas

Roy F. Baumeister^a and Kathleen D. Vohs^b

^aDepartment of Psychology, Florida State University, Tallahassee, FL 32306-1270; ^bDepartment of Psychology, University of Utah, Salt Lake City, UT 84112-0251. rfb2@po.cwru.edu kathleen.vohs@psych.utah.edu

Abstract: Thought uses meaning but not necessarily language. Meaning, in the form of a set of possible concepts and ideas, is a nonphysical reality that lay waiting for brains to become smart enough to represent these ideas. Thus, the brain evolved, whereas meaning was discovered, and language was invented – collectively – as a tool to help the brain use meaning.

Carruthers’s excellent, thought-provoking article clarifies the relationship between language and thought. It highlights important distinctions among language, meaning, cognition, and consciousness, none of which is entirely reducible to the other.

Baumeister (in press) proposes that natural selection shaped the human psyche specifically for participation in culture. Culture uses language and meaning to organize social life and accumulate knowledge, thereby improving success at the basic biological tasks of survival and reproduction. In this view, all living things must deal with the physical environment to satisfy basic needs. Many species use social life and social interaction as strategies for improving how they deal with the physical environment. A few species (ours, most extensively) use culture to improve how they deal with social life and with the physical environment.

Carruthers speaks of the “evolution of language,” but if one wishes to maintain the strict conceptual distinctions he promotes, it is misleading to speak of language as having evolved. The brain evolved; meaning was discovered; language was invented. Language is a tool to help process meaning. Carruthers is persuasive that some thought can occur without language, but of course the ability to process complex meanings, including combining multiple concepts into novel ideas, must remain quite limited without language.

In saying that meaning is discovered, we imply that a large set of concepts and their interrelationships lies “out there” independently of people or brains. This is in some ways a radical view that is at the opposite pole of the Sapir-Whorf (Whorf 1956) doctrine that language determines thought. Sapir and Whorf promoted the thesis that different languages produced fundamentally different ways of thinking and experiencing. But in fact, most languages express the same concepts and have similar grammars. (The order of words may vary, but the basic, underlying grammatical relationships are much the same. All languages denote things in the world and their activities, properties, and relationships.) Some writers, such as Pinker (2002), use this basic sameness to argue that grammatical structure derives from brain structure. We propose the opposite: Grammar is inherent in the basic, universal

structures of meaning, and the brain evolved to enable people to represent and make profitable use of it.

The argument can be appreciated most clearly with mathematics, which is a relatively pure form of meaning. Mathematical truths, such as $3 \times 8 = 24$, are true everywhere. Some cultures may not have mastered multiplication, but in all cultures that have mastered it, $3 \times 8 = 24$. Yet we do not see this as stemming from any accident of how the structure of the brain evolved. Indeed, if it becomes possible to travel across the galaxy and meet up with intelligent life in distant solar systems – intelligence that is based on brains that evolved quite independently of events on earth – we predict that 3 times 8 will still equal 24. We also predict that their languages, assuming they have developed them, will have grammars similar to those on earth, so as to express things in the world and their activities, properties, and relationships. Again, these are inherent to the nature of meaning, not a by-product of the how brain structure accidentally happened to evolve. Logical reasoning is yet another example: *Modus ponens* will still be true on the other side of the galaxy.

Thus, there is one very large set of concepts and ideas, and all languages use it. This universe of possible ideas is an important form of environment that needs to be appreciated. It is not a physical reality, although many concepts refer to things in the physical world. Thinking inevitably uses these ideas, but as Carruthers has persuasively shown, it does not necessarily use language to do so. Still, language is by far the best tool for processing meaning, which is presumably why all known human groups have developed language. Baumeister's (in press) argument is that the human brain evolved in part to enable people to make use of this universe of possible ideas, first in terms of social communication and then more profoundly by developing culture.

As Carruthers has persuasively argued, language is optional in the sense that many cognitive functions can be executed without it. But surely he would agree that language vastly facilitates these functions. Moreover, language is most valuable (and Carruthers suggests even indispensable) for the most complex and integrative mental operations. Precise mathematical calculation, logical reasoning, grammar and syntax, narrative story construction – these are among the uses of meaning that enable human culture to flourish, and they rely most heavily on language.

We have spoken as if language is a tool that individuals can invent and use, but this ascribes too much power to the individual. Language is invariably found to reside in groups. It is understandable that Carruthers neglected this aspect, because his focus was on the cognitive rather than the social functions of language, but in our view the social aspect is profoundly and perhaps inextricably intertwined with the cognitive.

On that basis, we object gently to Carruthers's phrase describing what happens when language "has done its developmental work of loading the mind with information." Putting it that way implies that language serves a one-time function. On the contrary, language's most profound use is how it continues to connect the individual to the culture. Many special features of human psychology, such as lifelong plasticity, seem particularly suited for enabling people to live in a cultural society. Language's "developmental work of loading the mind with information" is never fully done.

Language allows human culture to surpass what other species can accomplish, because it stores information in the collective. The bubonic plague may kill a third of the population, but the culture's knowledge survives, because it is held in common. Hence language should be understood as a tool used by the collective, not just of individuals. Language allows cognition to accomplish things that no individual mind could achieve, such as multigenerational accumulation and transmission of knowledge. That was probably one of the decisive advantages that led natural selection to favor it.

Domain-generality and the relative pronoun

José Luis Bermudez

University of Stirling, Stirling, FK9 4LA, UK. jb10@stir.ac.uk

Abstract: The hypothesis in the target paper is that the cognitive function of language lies in making possible the integration of different types of domain-specific information. The case for this hypothesis must consist, at least in part, of a constructive proposal as to what feature or features of natural language allows this integration to take place. This commentary suggests that the vital linguistic element is the relative pronoun and the possibility it affords of forming relative clauses.

Carruthers marshals an impressive array of evidence in support of the hypothesis that natural language has the highly important cognitive function of permitting the domain-general integration of different, domain-specific types of information. The hypothesis is put forward partly as a way of making sense of certain puzzling features of the archeological record, and partly as a way of interpreting some highly suggestive experiments carried out on the emergence of domain-specific thinking in early childhood (Hermer-Vazquez et al. 1999). As Carruthers himself admits, the power and plausibility of the hypothesis is a function, not just of the degree of correlation that can be established between language-use and domain-general thinking, but more importantly of how exactly it explains the way that language makes possible domain-general thinking. We need to know not just what language does, but how it does it. In particular, we need to know what aspects of language might plausibly be thought to make possible the transition from domain-specific to domain-general thinking.

The basic tenet of the hypothesis of domain specificity is that certain fundamental types of cognitive activity are carried out by modular systems that have evolved to deal with particular types of problems and particular types of situations. Popular candidates for domain-specific modules include the interpersonal competences involved in social interactions, the basic principles about objects and their interactions that are usually collectively labeled naïve physics, and an intuitive grasp of folk biology and natural history. These modules operate on a highly selective and domain-specific set of inputs with a fixed and limited amount of background information. There is integration of information within each module, but not across modules. An example of this failure of inter-modular (as opposed to intramodular) integration can be found in the archeological record. In the Middle Paleolithic, for example, we find what seem to be highly developed tool-making skills existing side by side with a subtle and advanced knowledge of the natural environment, but it is not until the Upper Paleolithic and the emergence of language that we see these two bodies of knowledge being integrated in the form of tools specially designed for dealing with different plants and animal, together with hunting strategies that are tailored to the habits of specific animals (Mithen 1996).

Let us suppose, with Mithen and Carruthers, that language is required for the integration of domain-specific modules. In line with our opening question, we need to ask what feature of language could make this integration possible? I will suggest that the crucial linguistic phenomenon is provided by the linguistic mechanisms of quantification and the relative pronoun (the natural language equivalent of the bound variable of quantification).

The crucial feature of the relative pronoun is that it permits the formation of relative clauses. One way of thinking about relative clauses is as a way of distinguishing within a sentence between the object that is the logical subject of the sentence (what the sentence is about) from what the sentence says about that object (Quine 1974, p. 24). In English, for example, from a sentence such as "the red deer comes to the water just before nightfall" we can extract the relative clause "that comes to the water just before nightfall." This relative clause can be used to characterize other animals, or be embedded in further sentences, and so forth. Once the relative clause has thus been constructed and detached from the original