ory of mind terms highlights its two main components: the difference in states of knowledge of two parties as a prerequisite for teaching, and the intention to reduce the difference in knowledge by enhancing the knowledge of understanding the learner. Already at the age of 3 years, children can recognize that in order for teaching to occur there is a need for a knowledge gap between teacher and learner, or, in other words, that a knowledgeable person accompanied by an ignorant learner are the prerequisites for teaching. Several recent studies have investigated preschoolers’ teaching strategies and suggested that children’s teaching was related to their theory of mind understanding (Astington & Pelletier 1996; Wood et al. 1995). It wouldn’t be surprising to hear a 3-year-old child say: “Dad, teach me (or show me) how to put this toy together.”

There may be a possibility that a year earlier, toddlers at the age of 2 begin to realize that they can produce object naming on the part of others and, thus, have some understanding of the prerequisites of teaching. They may, for example, have some sensitivity to their own lack of knowledge and to the adult’s different knowledge status that enables satisfying their request. According to this interpretation, the child may also have implicit knowledge that his/her request may result, on the adult’s part, in an intentional reference to the specific object the child herself pointed, or referred to.

Another possibility is in line with what Bloom claims about the implicit reasoning stages underlying children’s inferences about thoughts of others. Here the implicit reasoning process involved in a request for intentional teaching of objects’ names may be the following:

1. Objects have names, or words that refer to them (based on previous experience/knowledge about words).
2. I don’t know the word referring to this object.
3. Adults know the word referring to this object (2 + 3 – awareness of the knowledge gap).
4. If I point to this object the adult will pay attention to it, too (joint attention, social referencing).
5. If I ask “What’s that?”, the adult will name it (initiating someone else’s intentional teaching).

This analysis suggests that the origins of understanding teaching as a natural cognition, specifically, beginning to appreciate the knowledge gap between the self and others, should be empirically investigated already in toddlers, and that requests for objects’ names may provide a natural context for this exploration. Furthermore, exploring toddlers’ emerging awareness of their own and others’ knowledge may contribute to the understanding of the early developmental stages of what develops during the preschool years to children’s theory of mind.

### Could we please lose the mapping metaphor, please?

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**Abstract:** Although Bloom gives more credit to social cognition (mind reading) than do most other theorists of word learning, he does not go far enough. He still relies fundamentally on a learning process of association (or mapping), neglecting the joint attentional and cultural learning skills from which linguistic communication emerges at one year of age.

There are many things to like about this book. Most importantly, Bloom argues and presents evidence that learning words requires no special learning principles or specifically linguistic “constraints” but that, instead, it requires only general learning processes along with an understanding of other people’s minds. Coming from a confirmed linguistic nativist, this proposal will hopefully be the end of the misguided search for a priori, specifically linguistic word learning constraints and principles (see Nelson 1988 and Tomasello 1992 for earlier arguments along these lines).

However, the welcome focus on mind-reading (social cognition) as fundamental to the word learning process is not taken far enough. Bloom still retains the mapping metaphor – basically just associationism – as fundamental to word learning (as do the majority of word learning theorists). Here is Bloom’s summary (2000, p. 17).

To know the meaning of a word is to have
1. a certain mental representation or concept
2. that is associated with a certain form

Under this view, two things are involved in knowing the meaning of a word – having the concept, and mapping the concept onto the right form.

But what is the nature of this association or mapping? Where is the understanding of minds here? As with many word learning theorists, Bloom’s appeal to social “cues” from other persons or their minds is only on the surface – to help identify particular referents in particular circumstances. However, as I have argued in many places, a word is an intentional phenomenon through and through and this must be reflected in the fundamentals of the learning process itself, not just in “cues” (Tomasello 1992; 1995a; 1999, 2000b, 2001).

To see this most clearly, let us ask the question of why children start learning language at the specific age that they do, that is, at around one year of age. Could it be due to newly emerging skills of associative learning or mapping? No, because human infants are very good at associative learning from several months of age onwards (Haith & Benson 1997). Could it be due to word learning constraints or principles that emerge at one year of age? The problem here is that there is no independent way to observe or measure constraints; they are only inferred from the child’s linguistic behavior, after the fact (this is why Smith [2000] refers to word learning constraints and principles as “skyhooks”). Could it be due to newly emerging skills of speech perception? Not really, because, although infants are gaining speech skills during this age period, they are clearly able to perceive and recognize particular isolated words from at least six months of age onwards ( juszyk 1999). Other hypotheses that Bloom considers and rejects include: syntactic knowledge, changes in parental speech, the motor control required for speech, phonological knowledge, memory, conceptual abilities, and theory of mind. His conclusion is that “In the end, nobody knows why word learning starts at about 12 months and not at six months or three years” (p. 45).

But I know why. Word learning begins when it does because it depends on a more fundamental social-cognitive skill, namely, the ability to share attention with other human beings – which emerges in nonlinguistic form near the end of the first year of life. Thus, many different studies have found that infants begin to develop joint attentional skills at around 9 to 12 months of age, including such things as following the gaze direction and gestures of adults, imitating adult actions on objects, and directing adult attention to outside objects using various kinds of gestural signals (see Tomasello 1995b, for a review). Children also show their first signs of comprehending language at around the same age, with the first linguistic productions coming soon after (Fenson et al. 1994).

Most importantly, Carpenter et al. (1998) found that children’s initial comprehension and production of language correlated highly with their skills of joint attentional engagement with their mothers (i.e., their ability to engage in relatively extended bouts of attention directing and sharing). Indeed, they found that roughly half of the variability in the sizes of infants’ word comprehension and production vocabularies was predicted by the amount of time (and style with which) infants spent in joint attentional interaction with their mothers during a 10-minute observation session (see Tomasello 1988, for a review of similar findings).
at older ages). The reason that linguistic skills are so highly correlated with joint attentional skills is simply that language itself is one type—albeit a very special type—of joint attentional skill. A language is a set of historically evolved social conventions by means of which intentional agents attempt to manipulate one another’s attention.

Appeals to association or mapping do not help us to understand how children learn to use these social conventions. For instance, if we suppose that the child “maps” a novel word onto an external object, it is difficult to explain how she can then learn different words for the same object, such as Fido, dog, animal, pet, or pest. Perhaps one might say, as Bloom does in some places, that the child “maps” the word onto a concept. But not all word learning involves pre-existing concepts; much recent work shows that children sometimes learn concepts as a result of being exposed to words (Bowerman & Choi 2001). What would the mapping process look like in these cases?

In my opinion, the process is best conceived as one of establishing joint attention, in which the child must understand not just the adult’s intentions to some outside entity but rather his intentions toward her attention to some outside entity; that is, the child must understand the adult’s communicative intentions and then engage in a process of cultural learning in which she aligns herself with these intentions (Tomasello 1999a; 1999b; 2001). A dog (or 6-month-old infant) may associate or map the sound “dinner” onto the object “food,” but this does not constitute an intersubjectively understood linguistic symbol used to direct and share attention with other persons—so it is not word learning.

Thus, suppose that I am a one-year-old child encountering an adult making funny noises at me. What am I to make of this odd behavior? Perhaps nothing—it is just noise. But given that I have previous experience interpreting the adult’s nonlinguistically expressed communicative intentions—in her behaviors such as pointing to and showing me things and events—I might decide that she is making these funny noises in an attempt to direct my attention to something. If I am lucky, I may figure out precisely what entity or event in the world she is attempting to direct my attention to. How is this mapping?

What we have here are not two things—a word and an object—being associated or mapped, but one person using a symbol (signifier) to indicate for another person some entity, situation, or activity (signified). Until word learning theorists understand this fundamental point and incorporate it into their theories—rather than effacing it with associativistic metaphors—their theories will continue to confuse processes of intention reading and cultural learning with those of association and mapping, and they will not be able to explain, among other things, why language emerges at the age that it does.

Could we please lose the mapping metaphor, please?

Words, grammar, and number concepts: Evidence from development and aphasia

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Abstract: Bloom’s book underscores the importance of specifying the role of words and grammar in cognition. We propose that the cognitive power of language lies in the lexicon rather than grammar. We suggest ways in which studies involving children and patients with aphasia can provide insights into the basis of abstract cognition in the domain of number and mathematics.

Writing in the tradition of Brown (1973) and Macnamara (1982), Bloom provides a thorough review of research on how children learn the meanings of words. The rich texture of his book testifies to the diversity and depth of research in this area, and its implications for our understanding of how the mind of the young child works. Bloom claims that there is no mechanism that is uniquely dedicated to children’s word acquisition, but that it is built on abilities that exist for other purposes such as theory of mind. He proceeds to address the impact of words and concepts in domains such as numerical reasoning, and draws upon the evidence from a range of aphasia subtypes such as aphasia and deafness to examine the interplay between language and cognition. In this commentary, we examine the issues of words, grammar, and concepts and how they might reconfigure the human mind.

In the cognitive sciences, there are increasingly frequent claims that certain forms of reasoning can only be performed though access to the resources of the language faculty. In the recent research of Spelke and her colleagues, a link between language and cognition (e.g., in the form of numerical and spatial reasoning) has been demonstrated. For example, the ability to combine sources of visuo-spatial information has been reported to depend on language (Hermer-Vasquez et al. 1999). Moreover, exact arithmetic addition calculations have been shown to be associated with a language representational format, whereas estimations of magnitude are language independent (Dehaene et al. 1999).

From a critical perspective, there remains a critical need to establish the relative contributions of the components of language—the grammar and the lexicon—to cognitive operations. Some take the view that grammar is crucial in many sophisticated cognitive capacities such as theory of mind reasoning (e.g., Carruthers 1996; de Villiers & de Villiers 2000), whereas others maintain it is the lexicon—the pairing of concepts with linguistic forms—that configures some aspects of human cognition. Bloom describes two competing claims in the domain of numerical cognition: that of Chomsky (1988), who maintains that grammar provides a rule-based blueprint for the potentially recursive combination of individual units with potentially infinite outputs, and the alternative claim that number words create the potential to develop a mathematical faculty that extends beyond the numerical capacity apparent in preverbal infants and some non-human species (Sulikowski & Hauser 2001; Wynn 1998).

Evidence from aphasia provides important insights on the role of language in cognition, although the evidence is limited to the role of language in a mature cognitive system rather than in the initial configuring of the system. The relation of grammar to cognition can be determined from the performances of people with severe agrammatic aphasia on behavioural tasks, while the role of lexical knowledge can be established through cases of global aphasia where the system of word forms and meanings is itself profoundly impaired. Studies on theory of mind and causal reasoning in severe agrammatic aphasia have shown that the cognitive power of language lies not in the grammar (Varley 2002; Varley & Siegal 2000; Varley et al. 2001) as reasoning is retained in such instances. These studies prompt a shift in the language and thought debate from the relation of thought to an undifferentiated language faculty, to the more specific relation of the role of the lexicon in thinking.

Bloom sets out an agenda for future investigation of the numerical and mathematical abilities of people with aphasia. The challenge is to demonstrate, first, the extent to which the number faculty is retained in the absence of grammar, much as is the case for theory of mind and causal reasoning, and, second, to determine whether patients with number word processing problems are capable of dealing with numerical problems beyond the ability to estimate and discriminate small numbers that lie within the capacity of preverbal infants. Bloom’s hypothesis of number words creating a capacity for mathematics is strictly developmental, with progression from small numerosities, to the acquisition of number words, leading in turn to increased mathematical understanding. In this respect, number concepts once acquired can be mapped to different surface symbolic representations. They can take the form of number words or other forms of numerical notation (such as Arabic or Roman numerals). In the established system, having...