Available online at www.sciencedirect.com
ScienceDirect
Lingua 117 (2007) 1858–1878
Lingua
www.elsevier.com/locate/lingua

The interface of language and Theory of Mind

Jill de Villiers

Departments of Psychology and Philosophy, Smith College, Northampton, MA 01063, United States

Received 8 May 2006; received in revised form 18 September 2006; accepted 13 November 2006
Available online 25 April 2007

Abstract

The proposal is made that the interface between language and Theory of Mind is bidirectional. It seems probable that the conceptual developments of early Theory of Mind form an essential basis for helping to fix at least word reference. In development from 2 to 4 years, no basis exists in research for conclusions about the direction of influence between language and Theory of Mind. At the stage of false belief reasoning, after age 4, the role of the mastery of syntactic complementation is highlighted as a representational tool, that is, language development assists reasoning. The paper presents a brief summary of Theory of Mind, ranging from its earliest beginnings in infancy to the appreciation around age 4 years that others might hold false beliefs and act according to them. For each development, the parallel language developments are described, and questions are raised about the interface between the two. In particular, research that might determine the direction of influence from one to the other is discussed. More work is called for, especially with nonverbal tasks, good experimental linguistic work and other special populations, that might allow a more precise delineation of how language and Theory of Mind interrelate at the interface.

Keywords: Theory of Mind; False belief; Interface; Evidentiality; Complements; Acquisition

1. Introduction

In this paper, I address the question of the interface between language, on the one hand, and the cognitive skills known as 'Theory of Mind' on the other. It has become a very popular form of explanation in the field of language acquisition to invoke Theory of Mind requirements for a range of achievements within language development, at least in the explanation of performance if not grammar itself. I will try to map out the steps in acquiring Theory of Mind skills, and where possible, the linguistic achievements they seem to interact with. There are many unanswered questions, but it is important to consider more closely the nature of this interface and its

E-mail address: jdevil@smith.edu.

0024-3841/$ – see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.lingua.2006.11.006

directionality, namely whether any language achievements are causally related to some aspects of Theory of Mind, or whether certain aspects of Theory of Mind are causally connected to some parts of language acquisition. This paper should not be mistaken for an introductory review of Theory of Mind, as the topic is too vast for a single paper (see Astington, 1993; Perner, 1991; Wellman, 1990; Gopnik, 1993). It is necessarily selective about the conceptual topics considered, for example, work on teasing (Reddy, 1991), deception (Sodian, 1991) and pretense (Garfield et al., 2001) are not discussed even though there are fascinating connections to be explored. Neither can it attempt to survey adequately the many theoretical positions on the relationship between language and Theory of Mind contained, for example, in Astington and Baird (2005). Instead, the paper is organized as follows: after a brief summary of the major stages in developing a Theory of Mind, the achievements in language development that parallel them will be described. Wherever there are relevant data on the causal relationship between the parallel cognitive and linguistic achievements, this will be discussed. The goals are to determine whether and when ToM is implicated in language acquisition, and conversely, whether and when language is implicated in ToM development.

2. What is Theory of Mind?

Theory of Mind refers to the folk psychological theory that we use to predict and explain others' behavior on the basis of their internal workings: their feelings, intentions, desires, attitudes, beliefs, knowledge and point of view. That is, we need to posit a mental state inside a person to accommodate the occasional disjunction between an external stimulus and a response. In the most minimal example, a person is seen doing something clearly foolish, such as using mouthwash to wash his hair. To explain the aberrant behavior, we say ''Oh, he thinks that bottle is the shampoo!'' The false belief that the bottle is the shampoo is the content of the mental state, and by invoking it we keep the world around us ''normal'', in which people do not randomly wash their hair with mouthwash. Much ink has been spilled and thousands of children have been tested to answer the question: when do children think like us in this respect?

Understanding false beliefs is the culmination of a long developmental path that begins in early infancy, and typically ends in at least the start of this understanding at around 4 or 5 years of age. Recent meta-analyses (Wellman et al., 2001) suggest astonishing convergence across the hundreds of studies, in which despite variations in wording, materials, testing conditions and, to a lesser extent, social class and culture, this seems to be the consensus on time course. Even more recent analyses suggest that success on certain types of Theory of Mind task reliably precedes success on others (Wellman and Liu, 2004). For this reason, it is important to consider the other types of conceptual understanding under the heading 'Theory of Mind', so as not to limit it to false belief understanding. In doing so, we will be better able to trace the possible connections to language phenomena that may call upon similar understandings.

2.1. Intention

Appreciation of the ''mental'' states of others may begin in infancy. For example, the acute attention given to the human voice and face by neonates may reflect an innate understanding that these are the keys to reading emotion and intent (Baron-Cohen, 1995). In experimental tasks, there is evidence that infants read the actions of meaningful animate objects, such as human hands, as intentional or purposive towards a given object, but they are not inclined to attribute intent to inanimate objects such as a stick or a tool (Woodward, 1998, 1999, 2005). Carpenter

et al. (1998) found that 14–18-month-old infants chose to imitate purposeful but not accidental actions, suggesting that they differentiate action by the intention of the actor (also Meltzoff, 1995; Gergely et al., 2002).

Also in the first year of life, infants learn to follow another's gaze or point to an object of interest, establishing ''triangulation'' of speaker, listener and object. Researchers have taken pains to differentiate head direction and eye direction. However, the extent to which gaze following can be regarded as a cognitive act is disputed (see Tomasello et al., 2005, and replies). For instance, there seems to be an important difference between *engagement*, for which it seems undeniable that infant gaze is entrained by that of another, and whether the infant has an understanding of gaze as *mental* (Doherty, 2006). With respect to the concept of seeing (or perceiving more generally), it may be important to distinguish the perceptual from the cognitive state. The following of another's gaze implies that humans can understand the line of sight in another at an early age, but perhaps not the content of the result of gaze. For example, Moll and Tomasello (2004) found that infants would shuffle to a new position to see what an adult was staring at behind a barrier. But in other studies, infants below 18 months do not seem to take into account when line of sight is interrupted by an opaque barrier for another person but not for them (Butler et al., 2000).

There are other findings implying that younger children may be sensitive to who saw something before. Tomasello and Haberl (2003) studied 12- and 18-month-old infants playing with an adult who said ''Oh, wow! That's so cool! Can you give it to me?'' while gesturing in the general direction of three objects. One of these objects was new to the adult but not the child, and two of the objects had been played with previously by the child and adult together. The 18 month olds reliably gave the adult the object that was new for the adult but not the child, suggesting that they had monitored the adult's previous experience. At the very least, they remembered their own experience of playing with the toy + adult combination, and then judged what was new. Two year olds can also apparently ''hide'' an object, oddly, not by moving something in front of it, only by putting it behind something! (Flavell et al., 1978; McGuigan and Doherty, 2002). Only at about age 3 do children begin making reliable *judgments* about what a person is looking at (Doherty, 2006).

2.2. *Different desires, different knowledge*

Investigators have derived very clever tests of whether preverbal infants, or apes, can ''read'' the desire of another (Tomasello et al., 2005). Given the work so far, it seems to be clear that an infant can recognize another's desires, in the sense at least of an intentional striving towards an *external* goal. For example, they understand persistent striving and movement around obstacles to achieve an object (Gergely et al., 1995; Behne et al., 2005). But whether the infant represents the other as holding an *internal* goal is more controversial. For example, 2 year olds are able to mimic an action that leads to a desirable result, such as using a stick to extract a toy from a tube containing a trap, but they fail to appreciate the causal understanding that the adult has manifested in choosing a solution. Even though the adult modeled changing strategies based on a mental model of where the 'trap' was in the tube, the 2 year olds failed to pick up on this and mimicked only the overt behavior (see Want and Harris, 2001).

By the second to third year, toddlers seem to appreciate that others may have different likes and dislikes (Repacholi and Gopnik, 1997), and in a task conveyed nonverbally, will ''feed'' an experimenter with a food she has expressed a liking for, even though the toddlers have rejected that food themselves. By three and a half, children understand something of the representational

nature of desire, for example, appreciating that if a desire was thwarted, the desire still exists, but not if it was already achieved, or proved to be an undesirable thing. Three year olds can appreciate that others' desires may differ from theirs (Wellman and Woolley, 1990; Witt and de Villiers, 2001; Tomasello et al., 2005).

Most agree that it is in the third year that children begin to pay attention to which person saw something happen and which person did not, and use that to judge, for example, who knows what is inside a box (O'Neill and Gopnik, 1991; O'Neill et al., 1992). This has been called the insight that ''seeing leads to knowing''. To some extent, children believe the same thing is true of other sense modalities, e.g. hearing or touch, though these have been less explored (O'Neill and Chong, 2001). When it comes to these tasks, experimenters have usually asked verbal questions of the child, so nonverbal analogues are not tried. That is, questions such as ''Who knows what is in the box?'' are assumed to be fully understood as sentences, and only the conceptual understanding is supposed to be at issue (Pratt and Bryant, 1990). It is crucial therefore to look at work on whether children understand that ''seeing leads to knowing'' without asking them direct verbal questions.

One such study was conducted by O'Neill (1996), using a naturalistic index of whether the child monitors if another person sees something happen or not. One task involved an experimenter who dropped stickers in one of two unreachable containers that the mother had to retrieve in order for the child to complete a picture. The mother sometimes watched and sometimes had her eyes shut. The test of the children's awareness of the implication of this state was whether the children used more eye-gaze and pointing gestures to direct their mother to the right container on those trials on which her eyes had been closed. In fact, 2–3 year olds did differentiate their gestures contingent on whether their mother's eyes had been closed.

Another nonverbal seeing and knowing task has been used by Povinelli and DeBlois (1992) with chimpanzees and young children, and also with deaf children (Gale et al., 1996; P.A. de Villiers, 2005). The task calls upon the participant to monitor which of two adult informants is watching while something gets hidden, and then to judge whose advice to take when the different individuals subsequently point to a search location. However, the task requires a bit more than judging ''who sees'', but rather using that as a computational step in a chain of decisions:

1. X saw where the object was hidden (based on line of sight and absence of blindfold on X.)
2. X knows where the object was hidden.
3. X and Y are pointing to possible locations.
4. X will be a better judge than Y because of (2).
5. I should use the information from X to find the object.

Perhaps as a result of these extra steps or reasoning, this task patterns more with false belief tasks than with simple seeing-knowing tasks, despite being nonverbal in form (de Villiers and de Villiers, 2000).

The concept of *seeing that p* may be even more demanding than understanding that *seeing leads to knowing*. For example, at what age can a child make an inference based on what is seen, such as drawing the conclusion that Daddy is home because his bicycle is on the porch? Evidence on this is quite lacking, yet this kind of indirect inference from perception plays a vital role in our daily lives.

At around three and a half, children can use verbal information about beliefs to decide where a character will look, in a so-called ''true belief task'' (Wellman and Woolley, 1990). In this task, children are asked to guess behind which door a candy is to be found. After their guess, they are told that another character, say a puppet, thinks the candy is behind the door not chosen. Then the

child is asked where the puppet will look. Younger children select the door they had chosen, but by three and a half, children recognize that the puppet's belief will lead him to open the other door. Notice in this case, there is no false belief, as the child has not been shown where the candy really is.

2.3. False beliefs

In the classic false belief task (Wimmer and Perner, 1983), the child does know where the candy really is, but the character in the story retains a belief that has not been updated since the object was moved from its earlier location. In the standard Maxi task, Maxi hides his chocolate in container A then leaves the scene. The candy gets moved from A to B in full view of the child, but not Maxi. Then Maxi returns, and the question is where will he look (or first look) for his chocolate? Children below age 4 reliably choose the place where the chocolate is now, namely B. But older children ''pass'' the task by choosing A, understanding that Maxi has a false belief that will dictate his actions.

Researchers also study *second-order* false beliefs, e.g. ''Mary thinks that John knows where the cake is.'' (Sullivan et al., 1994) For example, one character's knowledge about a second character is not updated when the second character finds out something new. The question asked is invariably verbal, such as ''Where does Mary think John will look?'' Typically, children are over 5 years old when they can successfully handle second-order false beliefs.

Experimenters have removed the confound of language and conceptualization in the first order false belief and true belief tasks by testing nonverbal variants that force the child to attend to ''who knows what'' in order to respond appropriately. Several such tasks have now been used but the results vary depending on the demands made for a *response* from the child. For example, some researchers have examined such behavior as looking time or direction of gaze, and then different results are achieved as discussed below.

If the response requirement is a *decision*, e.g. about where someone will look, then success has been proven to emerge at a very similar point to the success on the verbal variants. That is, there is a real development here in conceptualization that is not an artifact of the language used in the tasks themselves. Two examples are the thought-balloon task used by Woolfe et al. (2002), and the surprise face procedure adapted by de Villiers and de Villiers (2000) and de Villiers and Pyers (2001). In addition, the Povinelli task mentioned above has been considered roughly equivalent to a false belief task (see P.A. de Villiers, 2005), and there is also a procedure evolved from the Povinelli task, developed by Call and Tomasello (1999), that some laboratories have used with success (Figueras-Costas and Harris, 2001). In each case, the child has to recognize that one person is ignorant of something that the child knows, or believes something that the child knows to be false. The judgment is either to decide where the person will look, or what should be in a thought balloon, or when the truth is discovered, what facial expression (surprised or not-surprised) the person will have on their face. Nonverbal false belief tasks prove to be approximately equivalent in difficulty for children as the verbal variety, provided that a *decision* is the response that is counted.

What is the alternative to a *decision*? Onishi and Baillargeon (2005) report a study with 15 month olds that purports to show early false belief understanding, using an index of *looking time*. Infants saw a scene in which a person was looking at an object while it moved from one box to another. The person reaches in to the same box to find the object. After the person leaves the scene, the object returns to its original location (somewhat magically moving on its own). Then the person returns to the scene and either reaches into the location she last saw the object go, or

into the new location. The 15 month olds gazed for a longer time (about a second longer) when the person looked in the place the object now was, than when she reached in the place she last saw it go. This is interpreted as showing that infants retain an understanding of the person's (now false) beliefs about the object's location even when their own are updated. The result is consistent with the work of Tomasello and Haberl discussed above, in which the 18 month olds chose which toy to give the adult on the basis of his past experience. It is not consistent with the work by Clements and Perner (1994), who showed 2–3 year olds a short scene in which a mouse's cheese is hidden (by a cat) in another location while he has left the scene through one of two doors. In anticipation of the mouse's return, children were asked "I wonder where he is going to look?" Children as young as 2 years and 11 months, but not younger children, showed preferential eye gaze towards the door from which the mouse would emerge (adjacent to the container) if he still held his false belief. Both sets of results using looking measures are discrepant with the hundreds of studies in which false belief tasks require the child to predict, judge or explain what the person does, even when a nonverbal task presents the information and the child's prediction or decision can be nonverbal (Wellman et al., 2001).

How to resolve this discrepancy is highly debated. One question is whether the tasks involving say, eye gaze or direction, might be being solved by some lesser, more external, stimulus aspect of the event than the attribution of the others' mental state (see Povinelli and Vonk, 2004; Perner and Ruffman, 2005). On this view, it may look like false belief understanding, but in fact the child has no such understanding but is achieving the appearance of understanding by some other means, for example, having their attention drawn to some low level stimulus feature of the array. A second resolution allows that the child's attention has been captured by the right properties of the event, namely someone's false belief, but argues that their level of understanding is *implicit*, and thus not available for higher level decision making (Dienes and Perner, 2002). For example, in Clements and Perner (1994), the same children who looked preferentially at the right door from which the mouse would emerge, could not answer the question, "where will the mouse look for his cheese?" Their eye gaze was correct for anticipating the mouse's movements, but their ability to make a *decision* was not yet linked to their anticipation. The view about implicit knowledge echoes the broader developmental theory of Karmiloff-Smith (1992) that knowledge often undergoes *representational re-description*, or changes its format as it becomes consolidated. Another illustration of this gradual re-description of knowledge might be the steps in the child's understanding of others' eye gaze described earlier.

The whole account of representation of knowledge raises significant and difficult questions for any theorist trying to link conceptual and linguistic development to study the interface or causal links between them. Which level of representation is a sufficient conceptual basis for developing the associated language? Does the knowledge suffice if it is implicit? Could language play a role in the "representational re-description"?

3. The language interface

3.1. Intention and language

The question then arises, what is the interface of language with these emerging cognitive skills? In the area of *intention*, it seems clear that the early developments form a critical foundation for early word learning (Tomasello and Farrar, 1986; Baldwin, 1993, 1994). The triangulation between speaker, listener and object focuses the child's attention on an object to connect to a word, and allows the child to fix the referent for a word that is a name. Of course it

cannot solve the problem of *intension*, but it contributes to the fixing of reference, or *extension*. It is important to emphasize that this association is but the first step, and semantic processes internal to language must contribute massively to word learning in ways that are still poorly understood. Quine's (1960) objections about the indeterminacy of reference with respect to the larger issues of meaning still hold, though progress has been made on this matter too (Nimtz, 2005). It is also increasingly clear that the syntactic context of words, even at this tender age, is also used by the child to delimit the possible word class in which a new word resides (Golinkoff et al., 1994; Markman, 1994; Naigles, 1990). But St. Augustine's insight cited in Bloom (1999) is also borne out, that the human context of shared eye gaze and pointing helps delimit the possible meanings of a new word. And by this means, the information from the domain of Theory of Mind seeps into the process of simple word learning. The interface of language and Theory of Mind is thus early established.

With respect to children who lack early sensitivity to triangulation, it is noteworthy that their language learning is also severely compromised. Children with autism are by definition poor at responding to eye gaze and intentions, and often they have great difficulty learning even simple language (Baron-Cohen, 1995). In contrast, children who are born deaf and raised without access to Sign, are still highly tuned to others' intent. If they cannot access the words being used, they substitute gestures in their place that serve as linguistic items, with the same kinds of extensions as early words in spoken language (Goldin-Meadow and Mylander, 1990). Children who are born blind often learn language on a delayed timetable, and by hypothesis might have difficulty linking words to their referents without special assistance (Anderson et al., 1993).

What direction is this influence between intention and reference? Clearly, information about intention helps the fixing of reference. Could the influence be reversed? That is, do sounds, or words, ever influence the fixing of intent? This is a tantalizing question. Tomasello (1995) has shown that words such as ''uh-oh'' or ''oops'' that reveal a speaker's intent has gone awry, can cause 2 year olds to cancel an association between a new noun and an object or a new verb and an action. But reports of language having clear effects on the child's reading of others' intention do not seem to exist for children below age 2 years. Most importantly, we would need evidence from young profoundly deaf infants without access to Sign, to see if their milestone developments in intentional understanding are compromised by lack of a linguistic input.

3.2. Desire and language

One early-established word of great importance is the word *want* (Bartsch and Wellman, 1995; Shatz et al., 1993). *Want* is an intentional verb: it takes an irrealis complement that can be either a simple noun phrase or a proposition. In this way, it is quite unlike the other verbs the child has in the earliest repertoire: verbs like *fix*, *break*, *eat*, *help*, *drop*. These ordinary verbs take as objects something tangible and visible: the child says ''drop ball'' appropriately when the ball is right there. But *want ball* can occur in the absence of a ball, *want drink milk* occurs exactly when the child is not drinking milk. Of course desires occur before the words for them! Yet by some little-understood process, the child maps *want* onto that experience of desire. The only feasible way this could happen is if the child hears the use of *want* by others who are behaving in ways that the child behaves when desire is uppermost: reaching, moving barriers, stopping those activities once the object is achieved, revising plans of action when they fail and so forth. If the child can recognize the similarity in his own and others' behavioral manifestations of desire, the child could in principle map *want* onto that projected intentional state, and thus to his own. But there are multiple unexplored steps here, and it is possible that the verb *want* helps to organize the

behavioral observations coherently into a common concept of an intentional state. Without evidence on understanding desire/intentional action from children with language delay, the question cannot be addressed (see also Gergely and Csibra, 2003).

Want can also take a complement, such as

1. Harry wants to go home

Or:

2. Harry wants Sally to go home

In English, this is marked with an infinitival form marking the fact that it is irrealis, but in German, the form can be tensed, though still irrealis in meaning. Whether tensed or not, children use these forms considerably earlier, a year or more, than the corresponding belief verbs, and understand them earlier also (Bartsch and Wellman, 1995; Perner et al., 2003). This is interpreted as in keeping with the fact that the *concept* of desire seems to be mastered before the *concept* of belief (Wellman, 1990; Perner, 1991). J.G. de Villiers (2005) showed that irrealis think, e.g. ''Mom thinks Bella should play on the computer'' is also understood earlier than the tensed form: ''Mom thinks Bella is playing on the computer''. The truth conditions for irrealis forms are much easier to assess.

3.3. Language for seeing and perspective

With respect to seeing and perceiving, verbs relating to these matters are common words for 2 and 3 year olds, and even in the blind child studied by Landau and Gleitman (1986), who translated sight words such as *look*, *see* into the haptic modality. There are other indices in language of a sensitivity to the perspective of another individual, in particular, deictic terms. Words such as *I*/*you*, *here*/*there*, *this*/*that*, *come*/*go* all share the property that they switch reference according to the speaker. Does use of these terms entail understanding another's mind? Minimally, they seem to require recognition that the terms align with the spatial position of speaker and listener, and in a dialogue, their meaning changes with the speaker. Use of deixis begins early, and experimentation suggests that children are quite adept by age 3 or 4 at using the terms appropriately in well-defined circumstances such as across a barrier that defines ''here'' and 'there'' in a particular way (de Villiers and de Villiers, 1974; Clark and Sengul, 1978). More subtle uses that relativize space to the domain of talk, such as ''Here in my school'' (Fillmore, 1957/1997) are undoubtedly later, but less is known about their development. Children with autism have notorious difficulty with deixis, especially pronouns (Tager-Flusberg, 2005), though deaf children do not (Pettito, 1987). Blind children understandably have problems with the spatial deictic terms (Anderson et al., 1993; Mulford, 1983).

The most telling cases may in fact be the third spatial deictic forms that occur in some languages like Spanish and Japanese, in which there is a form for ''distal from both speaker and listener'', namely ''yonder''. Miyamoto (personal communication) has suggested that use of this term more so than the ordinary deictics reflects an understanding of the listener's perspective, because the speaker has to judge not only what is far from himself, but what is far from both of them.

Returning to the words for sensory experience, we do not know when children appreciate the distinction between *look at* and *look for*, and between *see* and *look at*. In addition, we do not yet know at what age children understand the distinction between *see* and *see that.* Consider also related distinctions, such as the epistemic meaning of the modal *must*, e.g. ''Daddy must be

home'' said because the child sees his bicycle on the porch. Acquisition evidence from Papafragou (1998), Fond (2003) and Heizmann (2006) found the epistemic ''must'' meaning emerging sometime around age 3.5–4.5 across several languages.

In terms of the directionality of the interface in this domain, it is generally assumed that the conceptual understanding precedes the linguistic mapping of the relevant forms, but there is no research that has correlated the two. We lack nonverbal tasks of the concepts, as well as careful linguistic work on the contrasts, done with the same children. Most importantly, we need work done with children who have language delay, to see if they are still on target developmentally with the concepts even when their associated language forms are delayed. Such work is missing at the moment for Theory of Mind accomplishments that emerge before the development of false belief.

3.4. Evidential markings

This need is particularly pertinent in the exciting domain of evidential research, which has attracted considerable attention because of its promise to show that children at an early age can attend to the sources of belief in others. In languages with evidentials, speakers mark the verb in the event by the source of information about it: was it witnessed directly or indirectly, was it by hearsay, was it by inference (Aikhenvald, 2004)? Reports by Choi (1995) suggest early emergence of the morphemes marking evidentiality in Korean in spontaneous speech, where they seem to be used correctly. However, experimental work with children in both Korean and Turkish suggests relatively late understanding of the implications of the morphemes for judgment and decision making about others' knowledge (Aksu-Koç, 1988; Aksu-Koç et al., 2005; Papafragou and Li, 2001).

The source of the disparity is unclear, if in order to use the forms correctly, children must somehow understand their conditions of use, which in principle involves knowing how someone has access to certain information. Nevertheless, it is easy to imagine conversational scenarios in which the child's knowledge and the speaker's knowledge are synchronized in their source, and when there are disparities in such information, the events may just not be spoken about. Spontaneous speech often seems to reflect what children are confident they can say.

Once again, to study the direction of influence, of epistemic understanding on the one hand and the language about evidence on the other, we need tasks that test knowledge independent of the language, and we need to test a population in which language delay might separate the developments.

3.5. Belief language

The most contentious arguments revolve around the interface between the concept of belief and the language of belief states. Language on one view provides only one of the multiple sources of evidence for the state of belief in others (Nelson, 2005; Perner, 1991; Perner et al., 1987). It has also been claimed that what develops is the skill to inhibit reality-based responses, as in the false belief tasks (Moses, 2001). Most researchers are now persuaded by the alternative view that language plays a significant role in the development of the concept of belief (Astington and Baird, 2005). Nevertheless, most argue that exposure to the language of the culture is the way that children grasp the content of the culture's theory about belief (Nelson, 2005; Harris, 2005). In the same way that children learn about folk physics, or biology, the content of what we call Theory of Mind is conveyed in language, through language. This position reflects the common view that

language is a means of transmitting cultural memes (Dennett, 1991) or world-views that have served us usefully in the past, and so we pass them along culturally to our children.

The literature on how children come to talk about the mind echoes that conception: children begin using words about mental states (*think*, *know*, *forget*, *remember*) in their third year of life, at first in rudimentary ways but increasingly in ways that adults talk, usually commenting occasionally on someone else's false belief late in the fourth year of life, roughly coincident with the understanding, verbal or nonverbal, of others' false beliefs in standard tasks (Shatz et al., 1983; Bartsch and Wellman, 1995).

Again, children with autism engage in conversations and discourse surprisingly devoid of mention of belief states, along with infrequent mention of emotions, desires or intentions (Tager-Flusberg, 2000, 2005). This is in keeping with the idea that the concepts themselves are less accessible to children with this disability (Baron-Cohen, 1995). Children who are language-delayed because of deafness have considerable difficulty discussing abstract topics with their minimal syntax, so they also have impoverished discourse about beliefs, but not necessarily limited about desires or emotions (P.A. de Villiers, 2005; de Villiers and Pyers, 2001; Peterson and Siegal, 1999, 2000). Understandably, their access to discourse is severely hampered by their lack of hearing, and perhaps especially lack of *overhearing*.

Since the false belief tasks can be done without language in the task, it is possible to explore what deaf children can understand about others' false beliefs independent of their reliance on language to talk about it. Testing this population has revealed that their language delays have a very significant impact on their false belief reasoning even when the tasks are nonverbal (de Villiers and de Villiers, 2000; Peterson and Siegal, 2000; Woolfe et al., 2002; P.A. de Villiers, 2005). Some deaf children do not pass false belief tasks until they are 8 years old or older, a very significant delay. Most importantly, their success is predicted almost completely by their language skills: the more impoverished their language, the later is their false belief understanding (de Villiers and de Villiers, 2000; J.G. de Villiers, 2005; P.A. de Villiers, 2005).

Most significant in this regard is the work by Pyers (2004) on the Nicaraguan signers who grew up without benefit of an adult model, who developed a new sign language over the last 25 years when they joined a community of similar deaf children at a school for the deaf (Kegl et al., 1999; Senghas, 2003). Those children who formed the first cohort in the school and therefore had no advanced models for their signing, were found to be considerably delayed in their understanding of false beliefs even as adults. Younger people who had more complex input and thus developed the language further, were able to do false belief reasoning. In all cases, the tasks used were nonverbal. More recent results with the first cohort suggest they are learning to use mental state verbs, presumed to be through interaction with the now-adult second cohort, and they are starting to pass false belief tasks (Pyers, 2004).

Researchers vary in their interpretation of this concomitant delay in deaf children. Siegal and colleagues interpret it as a failure of access to discourse about the mind, in other words, a failure of language as information about the cultural Theory of Mind. It has also been interpreted as a failure of language or conversation as a source of evidence for how minds work (Harris, 2005; Woolfe et al., 2002). Deaf children are deprived in both these ways if they have limited access to a full adult model. In keeping with this perspective, there is extensive work on typically developing children confirming the significance for their development of the richness of maternal input about the mind, use of mental verbs and discourse about the mind (Meins et al., 2002; Dunn, 2005; Harris, 2005; Nelson, 2005).

The input is undoubtedly an important source of information, but is it necessarily just as an information source for the concepts of mind? Other researchers (de Villiers, 2004a;

J.G. de Villiers, 2005) have an account in terms of the child's own language sufficiency as a representational medium. The deaf child with language delay does not yet have the complement structures that permit the representation of embedded sentences about belief. Without them, the child cannot hold in mind the structures necessary for judging the truth and falsity of the content of beliefs. The explanation starts with the observation that verbs of mental state and communication are unique in the complements they take:

3. John thought that he was stung by a wasp.
4. John said that he was stung by a wasp.

Even if the proposition in the lower clause is false – there was no wasp – the whole sentence remains true. Critically then, this is an ideal representation of the ''truth'' subordinated in another mind, from another's perspective. This is unlike other clauses such as adjuncts, wherein if the clause is false so is the whole:

5. John shouted because he was stung by a wasp.

The complement, not the adjunct, is embedded under the verb and takes the particular perspective or point of view (J.G. de Villiers, 2005) of the subject, not of the speaker, licensing also the subject's terms of reference even when these are not the speaker's:

6. John thought that he was stung by a wasp, but in fact it was a hornet.

Critically, wh-questions can extract from complements but not adjuncts:

7. What did John think he was stung by?
8. *What did John shout because he was stung by?

The answer to (7) must be the object of both verbs, not just the last, e.g. *wasp* not *hornet*. This particular development in language acquisition has been studied in some detail, and the evidence from normally hearing children reveals that they achieve an understanding of complementation, indexed by this wh-test, towards the end of the fourth year of life. If one tests children with communication verbs such as *say* or *tell*, thus removing the confound of mental verbs such as think, this mastery is a very strong predictor of the children's performance on standard and nonstandard false belief tasks. This direction of influence was found in normally developing preschoolers, in a longitudinal study in which these specific language skills were a significant predictor of concurrent and later false belief, but the reverse prediction, from false belief to language, was not found (de Villiers and Pyers, 2002). The same result has also been found in a longitudinal study of children with childhood autism, whose false belief scores were again best predicted by complement understanding (Tager-Flusberg and Joseph, 2005). A study of language delay in SLI found the same strong relationship in a very large cross-sectional sample (de Villiers et al., 2003). Finally, data on deaf children and older individuals in several different studies bear this out very strongly (P.A. de Villiers, 2005; de Villiers and Pyers, 2001; Schick et al., in press). Finally, two training studies found improvement on false belief reasoning after training complements with communication verbs (Hale and Tager-Flusberg, 2003; Lohmann and Tomasello, 2003).

There are counter arguments from work in which correlations have not been found between ''syntax'' broadly defined, and false belief reasoning (Ruffman et al., 2002; Perner et al., 2005). However, de Villiers argues that only complementation, of the realis tensed variety, is argued to

be relevant to the issue of representational adequacy (J.G. de Villiers, 2005; Perner et al., 2005, but see Smith et al., 2003 on relative clauses). As the examples show, those structures provide the appropriate way to distinguish the truth in others' minds from that in our own, about reality in the present or past. J.G. de Villiers (2005) and P.A. de Villiers (2005) showed that children have a much easier time judging the truth of complements of the *irrealis* variety such as:

9. Jim thought that Jane should play on the computer.

compared to *realis*:

10. Jim thought that Jane was playing on the computer

even though in both cases, Jane was not currently playing on the computer. A fuller discussion of the acquisition of these forms is provided in de Villiers (2004b), J.G. de Villiers (2005) and P.A. de Villiers (2005).

In this area of false beliefs, the relation of language and Theory of Mind at the interface seems to have reversed. No longer does it seem to be the case that the Theory of Mind information is used to help the language develop. In fact, the opposite seems to be the case; it is developing language, namely the syntax of tensed complements under certain verbs, that opens up a new way of reasoning about others' states of knowledge.

4. How language helps in false belief reasoning

4.1. What are the alternatives?

Several contemporary researchers have been tempted by the Whorfian view that language shapes our way of thinking (Boroditsky, 2001; Levinson, 1996; Lucy, 1992). That is not the issue in this paper, where the search is for a potentially universal property of the interface for language and Theory of Mind.

The first alternative is that the complement forms provide a satisfactory way to represent other's knowledge, or the ''possible world'' in someone else's head, that is just not possible with other forms of representation, whether simple sentences, or pictures, or complex words (Fodor, 1975; Segal, 1998; Olson, 1993). In fact, this may be the real utility, the functionality, of linguistic recursion (de Villiers, 2004a; Hauser et al., 2002). Note that if it proves to be true that the indigenous group, the Pirahã, in Brazil, lack any form of embedding in their language (Everett, 2005), and if this group proves competent at false belief reasoning, then this will significantly alter these ideas about what the possible representational format for false beliefs can be. The empirical possibilities remain for finding other paths to an adult system of understanding. At present, the contention is that complex language affects false belief reasoning precisely because it allows the representation of the *false* contents of other minds.

A second alternative is that the influence of language on thought is ''weak'', only true because discourse provides the child with abstract concepts (i.e. the 'weak'' view of determinism in Bloom and Keil, 2001; see Harris, 2005; Nelson, 2005). Are there stronger alternatives for how language might assist in cognition? At a level outside of knowledge itself, having language might assist in the control of impulsive behavior, so that a child can resist choosing an alternative or delay gratification, or use reminders like ''the blue one''. In this way, the child's behavior would be more adult-like not by virtue of change in conceptual understanding, but by virtue of

controlling interfering impulses that make behavior look immature (Fodor, 1992). Notice that there is no particular aspect of language entailed in such a controlling mechanism: words or short imperatives might suffice. Language is thus involved in a host of control mechanisms known as executive function, and many researchers have tied executive function development to Theory of Mind developments (Hughes, 1998; Jacques and Zelazo, 2005; Moses, 2001). However, in deaf children who fail false belief tasks, executive functions skills can be intact (P.A. de Villiers, 2005).

A third possibility mentioned earlier was that language assists in *representational re-description* of knowledge, as in Karmiloff-Smith's (1992) model of development. On that view, implicit knowing is re-described, perhaps using linguistic symbols, so that it is then available for participation in reasoning or more explicit decision-making. This theoretically attractive possibility is not easily investigated empirically. Dienes and Perner (2002) propose such a move for reconciling the discrepancy between the tasks that involve looking versus decision-making in false belief understanding, but there is not yet empirical evidence to link the change to language.

As a fourth alternative, Spelke (2003) proposed that language serves as a universal medium for combining and integrating the outputs of distinct modules in the mind. For instance, language may serve to connect the outputs of a module concerned with geometric information in space, with the information from a perceptual module concerned with color information. Only when a child can combine these to form a sentence such as ''to the left of the blue wall'', can he successfully find an object that requires that integration (Spelke, 2003). This is a story that Carruthers (2002) finds particularly appealing, and he argues that Logical Form may serve this purpose. In certain reasoning tasks – but certainly NOT all – we may call upon the resources of LF to integrate information. When this process generates a phonological form in addition, we experience it as inner speech, or *conscious* thinking. There is a certain appeal to this, recognized by other writers (Segal, 1998; Collins, 2000), who argue that since language does such a good job representing complex phenomena, why duplicate the machinery of language for thought?

One of the strongest pieces of evidence that language is entailed in cross-modular thinking comes from a dual task study by Hermer-Vasquez et al. (1999), in which they demonstrated that adult subjects whose language module was tied up in a verbal shadowing task, could no longer reason about ''to the left of the blue wall'' scenarios. To test whether this effect would be seen with adult in false belief reasoning scenarios, Newton (2006) and Newton and de Villiers (in press) showed adult subjects nonverbal video of a false belief task whose ending they had to select. At the same time, the subjects shadowed a verbal message or tapped a complex rhythm, tasks whose general cognitive demand equivalence was previously established. Adult subjects in three different experiments proved unable to reason correctly about the ending of the false belief video while simultaneously verbally shadowing, but their reasoning was not disrupted by simultaneous rhythmic tapping. These data suggest that the role of language in false belief reasoning is still an on-line requirement in adults, not merely the source of information about minds to the developing child. However, future work must reconcile these results with the two cases of apparently global aphasics who were able, after some training, to pass false belief tasks (Varley and Siegal, 2000; Varley et al., 2001). The data from aphasics had suggested that the role of language might only be in the *development* of false belief reasoning.

Sperber and Wilson (2002) present a fifth view of the possible relationship between language and Theory of Mind. Sperber and Wilson propose a kind of modularity thesis, in which developments that are requisite for effective conversation would be encapsulated within the

language module, presumably over the course of evolution. The theory predicts that a child might use apparently sophisticated Theory of Mind knowledge in language tasks but might not be able to pass tasks that call upon equivalent understanding but are outside of language. One study bears this out: children studied by Happé and Loth (2002) in a naming study could use information about others' false beliefs in learning a new word before they could pass traditional false belief tasks (unfortunately, these were also verbal). The authors interpret this as in keeping with the proposal that when the task is *prima facie* a language task, children may access information that is not available to general cognition. The proposal is a tantalizing one but there are other facts that seem at variance with the claim, as in the work on referential opacity (see section 5.1).

All of these interesting alternatives are being actively pursued in current research, and it may be some years before they can be teased apart precisely.

5. What does having a mature Theory of Mind allow?

5.1. Referential opacity

It is apparent that there is another 'stage', at least, of interrelationships between language and Theory of Mind. For example, there are studies of the development of understanding of referential opacity, namely judgments about the appropriate use of terms under intentional verbs such as *know* and *think*. Since Frege (1892/1960) and Quine (1960), there is a rich literature in semantics on how reference is affected by intentional contexts, and this is an important domain for exploring whether children's understanding of others' minds gives them immediate access to these constraints on reference. As an illustration, consider the sentence:

11. The girl knew *the silver box* was on the shelf.

Suppose we know that the silver box contains a birthday present, but the girl does not. It would be incorrect to say:

12. The girl knew *the birthday present* was on the shelf

However, in ordinary verb contexts we can call it what we like:

13. The girl lifted down *the birthday present*.

Do children recognize the difference in behavior of words in ordinary versus intentional (mental state) contexts? The answer has been explored in several laboratories and the preliminary answer seems to be ''no'': children who pass false belief tasks may still fail to judge violations of the conditions on referential substitutability (Russell, 1987). Some theories invoke a conceptual difficulty with multiple representations of one object (Apperly and Robinson, 2001), others point to a linguistic difficulty with integrating point of view on both clause and noun phrase (de Villiers, 2001; J.G. de Villiers, 2005; P.A. de Villiers, 2005). There are no convincing nonverbal analogues of the task: it is fundamentally about the names we give things. Neither has any work been done with language-delayed children, although it might be premature until a consensus arises about typical development.

A promising avenue may be to explore children's own production, and one small study has suggested that children aged 4–6 years maintain the right names for things under intentional

contexts when they themselves are producing the sentences (de Villiers, 2004c). In linguistic judgment then, there is still something else to 'fix' even when children are apparently cognizant of other minds and their perspectives in false belief tasks. The finding of difficulty in judgment of linguistic forms seems to be at variance with the proposal by Sperber and Wilson that children might find Theory of Mind access in *within*-language tasks more readily than tasks *outside* of language. In the research on referential opacity, the opposite is true for 4–6 year olds.

5.2. Determiners

Another later language domain in which Theory of Mind is often invoked as explaining delays is that of determiners: *a* versus *the*. Maratsos (1976) discussed this first, in his monograph about children's acquisition of English determiners, but he referred to the older concept of egocentrism. Schafer and de Villiers (2000) invoked it explicitly to account for a late occurring development in the production of certain uses of the definite article. However, in a fairly large empirical study that attempted to correlate false belief reasoning with elicited article production, no significant effects emerged (de Villiers and Kamawar, 2000). The suspicion is that false belief reasoning is not the right index of other minds to connect to the appropriate use of determiners, but since some correct determiner uses are quite late developing, what is the right index?

There is a potential connection to the previous discussion about referential opacity: something is not quite right in 4 and 5 year olds in the domain of *how things should be called* by different individuals with different knowledge. This is especially true in judgment or comprehension tasks. The possibility has been raised (de Villiers, 2004c) that children prioritize dimensions in their judgment differently than adults, though this may be just another way of saying the same thing. So when a child hears a question such as:

14. Did the girl know she picked up the birthday present?

The child first checks: was it the birthday present that she picked up? If yes, the child agrees to the question. But the adult asked such a question then asks: is it apt to attribute that description of the object to the girl? And then the answer is "no". Children even once they "understand" the perspective of other minds, fail to bring it to bear to ask that second question, or do not realize that it "trumps" the first answer.

5.3. Second-order recursion

Finally, there is the issue of recursion of false beliefs. In principle, intentional states can embed infinitely, just like the sentences that describe them:

15. John knew that Mary thought that Bill knew that Fred wanted her to think ....

Of course, there are limitations on our ability to keep the information in mind. The work that has been done on second-order false beliefs relies on a verbal question. Can a nonverbal second-order false belief task be designed? If so, is it dependent in a parallel fashion on second-order complementation? We have recently run a second-order complementation study and it is very clear that 5 year olds who succeed on first order complements and have passed false belief tasks still cannot manage second-order complements even with verbs of communication.

We arranged the scenarios so no false beliefs were involved, just differences of opinion that were transparent:

16. Mom told Dad that Billy said that rolling in mud was fun. What did Mom tell Dad?

Correct: ''Billy said rolling in mud is fun''.

Failure: *''Rolling in mud is fun''.

Children tested up to age 5 years still fail these questions. It remains to be established when this capacity does emerge, and whether it in turn opens the door to the second-order false belief reasoning. In this arena, as with referential opacity, the task may involve a kind of algebra of points of view that is a challenge to any mind (de Villiers, 2001; J.G. de Villiers, 2005). The alternatives are that having opened the door to false belief reasoning, the further developments in reasoning go on without further demands on language itself, or even revert to feeding the language developments. All of this remains a fertile arena for new research.

6. Conclusion

The research so far suggests a stage at the beginning of the process at which information from Theory of Mind, in the most basic sense of sensitivity to people's intentions, opens up ways to fix the reference of early words. It seems probable that the attention to people and their agency is very early developing, if not innate, in typically developing children, preceding language and making it possible.

Between ages 2–4, there are multiple potential connections between the conceptual and linguistic development, but the direction of influence is much less clear. This is primarily because nonverbal indices either do not exist or have not been used to explore directionality or even correlation with language tasks. Secondly, studies of language-delayed children have not focused on this period with ideas of the interface with language in mind. No particular theories of how language might assist cognition have emerged for the domains of, e.g. complex intention, desire or true belief, but it is likely that dialogue plays a role in fixing the meanings of the terms and perhaps then, a fuller grasp of the concepts themselves. Study of evidentiality and epistemic markers and how they relate to access to sources of belief provides an exciting new arena in which to explore direction of influence.

At 4, there is a suggestion that the directionality at the interface may reverse, in that at some critical point, fixing the language structures involved in complementation seem to permit new ways of reasoning about other minds. False belief understanding seems to be inextricably tied to certain language prerequisites. The new data suggesting adults need on-line access to the language faculty to reason about false beliefs calls into question the weaker idea that language merely provides the content of the cultural Theory of Minds to children.

The stage between 4 and 7 years may be among the most interesting of all stages for research, but it is at present unclear whether the further developments such as second-order belief states and referential opacity are entirely *within* language itself, or have nonverbal analogues still to be explored.

References

Aikhenvald, A., 2004. Evidentiality (Oxford Linguistics). Oxford University press.
Aksu-Koç, A., 1988. The Acquisition of Aspect and Modality. Cambridge University Press.

Aksu-Koç, A., Avci, G., Aydin, C., Sefer, N., Yasa, Y., July 2005. The relation between mental verbs and ToM performance: evidence from Turkish children. Paper presented at IASCL, Berlin.

Anderson, E.S., Dunlea, A., Kekelis, L., 1993. The impact of input: language acquisition in the visually impaired. First Language 13, 23–49.

Apperly, I.A., Robinson, E.J., 2001. Children's difficulties handling dual identity. Journal of Experimental Child Psychology 78, 374–397.

Astington, J.W., 1993. The Child's Discovery of the Mind. Harvard University Press, Cambridge, MA.

Astington, J.W., Baird, J., 2005. Why Language Matters for Theory of Mind. Oxford University Press, Oxford.

Baldwin, D.A., 1993. Infants' ability to consult the speaker for clues to word reference. Journal of Child Language 20, 395–418.

Baldwin, D.A., 1994. Understanding the link between joint attention and language acquisition. In: Moore, C., Dunham, P. (Eds.), Joint Attention: Its Origins and Role in Development. Lawrence Erlbaum Associates, Inc., Hillsdale, NJ, pp. 131–158.

Baron-Cohen, S., 1995. Mindblindness: An Essay on Autism and Theory of Mind. The MIT Press, Cambridge, MA.

Bartsch, K., Wellman, H.M., 1995. Children Talk about the Mind. Oxford University Press, New York.

Behne, T., Carpenter, M., Call, J., Tomasello, M., 2005. Unwilling versus unable: infants' understanding of intentional action. Developmental Psychology 41, 328–337.

Bloom, P., 1999. Theories of word learning: rationalist alternatives to associationism. In: Ritchie, W., Bhatia, T. (Eds.), Handbook of Child Language Acquisition. Academic Press, San Diego, CA, pp. 249–278.

Bloom, P., Keil, F., 2001. Thinking through language. Mind and Language 16, 351–367.

Boroditsky, L., 2001. Does language shape thought? Mandarin and English speakers' conceptions of time. Cognitive Psychology 43 (1), 1–22.

Butler, S.C., Caron, A.J., Brooks, R., 2000. Infant understanding of the referential nature of looking. Journal of Cognition and Development 1, 359–377.

Call, J., Tomasello, M., 1999. A nonverbal Theory of Mind test. The performance of children and apes. Child Development 70, 381–395.

Carpenter, M., Nagell, K., Tomasello, M., 1998. Social cognition, joint attention, and communicative competence from 9 to 15 months of age. Monographs of the Society for Research in Child Development 63 (4), 1–143.

Carruthers, P., 2002. The cognitive functions of language. Behavioral and Brain Sciences 25, 657–726.

Choi, S., 1995. The development of epistemic sentence-ending modal forms and functions in Korean children. In: Bybee, J., Fleischman, S. (Eds.), Modality in Grammar and Discourse. Benjamins, Amsterdam, pp. 165–204.

Clark, E.V., Sengul, C.J., 1978. Strategies in the acquisition of deixis. Journal of Child Language 5, 457–475.

Clements, W.A., Perner, J., 1994. Implicit understanding of belief. Cognitive Development 9, 377–395.

Collins, J., 2000. Theory of mind, logical form and eliminativism. Philosophical Psychology 13 (4), 465–490.

Dennett, D., 1991. Consciousness Explained. Little, Brown & Co., Boston.

de Villiers, J.G., 2001. Extension, intension and other minds. In: Almgren, M., ABarrena, M., Ezeizabarrena, A.-J., Idiazabal, I., MacWhinney, B. (Eds.), Research in Child Language Acquisition: Proceedings of the 8th Conference of the International Association for the study of child language. Cascadilla Press, Somerville, MA, pp. 1015–1025.

de Villiers, J.G., 2004a. Meme or module? Invited paper, Web conference on co-evolution of language and Theory of Mind. http://www.interdisciplines.org/coevolution.

de Villiers, J.G., 2004b. Getting complements on your mental state (verbs). In: Van Kampen, J., Baauw, S. (Eds.), Proceedings of 2003 GALA Conference, LOT, Utrecht, pp. 13–26.

de Villiers, J.G., July 2004c. Can referential opacity be considered a form of agreement? Paper in Symposium on Referential Opacity in Child Development. Joint Meeting of the European Society for Philosophy of Psychology and the American Society for Philosophy of Psychology, Barcelona, Spain.

de Villiers, J.G., 2005. Can language acquisition give children a point of view? In: Astington, J., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 186–219.

de Villiers, J.G., de Villiers, P.A., 2000. Linguistic determinism and the understanding of false beliefs. In: Mitchell, P., Riggs, K. (Eds.), Children's Reasoning and the Mind. Psychology Press, Hove, UK, pp. 189–226.

de Villiers, J.G., Kamawar, D., December 2000. Acquisition of articles in SAE and AAE. Paper presented at the U.Mass/U.Conn workshop, Storrs, CT.

de Villiers, J.G., Pyers, J.E., 2002. Complements to cognition: a longitudinal study of the relationship between complex syntax and false-belief-understanding. Cognitive Development 17, 1037–1060.

de Villiers, P.A., 2005. The role of language in Theory of Mind development: what deaf children tell us. In: Astington, J., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 266–297.

de Villiers, P.A., de Villiers, J.G., 1974. On this, that and the other: non-egocentrism in very young children. Journal of Experimental Child Psychology 18, 438–447.

de Villiers, P., Pyers, J., 2001. Complementation and false belief representation. In: Almgren, M., Barrena, A., Ezeizabarrena, M.-J., Idiazabal, I., MacWhinney, B. (Eds.), Research in Child Language Acquisition: Proceedings of the 8th Conference of the International Association for the study of Child Language. Cascadilla Press, Somerville, MA, pp. 984–1005.

de Villiers, P.A., Burns, F., Pearson, B., 2003. The role of language in the Theory of Mind development of language-impaired children: complementing theories. In: Beachley, B., Brown, A., Conlin, F. (Eds.), Proceedings of the 27th Annual Boston University Conference on Language Development. Cascadilla Press, Somerville, MA, pp. 232–242.

Dienes, Z., Perner, J., 2002. What sort of representation is conscious? Behavioral and Brain Sciences 25, 336–338.

Doherty, M.J., 2006. The development of mentalistic gaze understanding. Infant and Child Development 15, 179–186.

Dunn, J., 2005. Individual differences in understanding of mind. In: Astington, J., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 50–69.

Everett, D.L., 2005. Cultural constraints on grammar and cognition in Pirahã: another look at the design features of human language. Current Anthropology 46 (4), 621–646.

Figueras-Costas, B., Harris, P., 2001. Theory of Mind development in deaf children: a non-verbal test of false-belief understanding. Journal of Deaf Studies and Deaf Education 6, 92–102.

Fillmore, C., 1957/1997. Lectures on Deixis. CSLI Publications, Stanford (originally distributed as Fillmore (1975/1971) *Santa Cruz Lectures on Deixis* by the University of Indiana Linguistics Club).

Flavell, J.H., Shipstead, S.G., Croft, K., 1978. Young children's knowledge about visual perception: hiding objects from others. Child Development 49, 1208–1211.

Fodor, J., 1975. The Language of Thought. Crowell, New York.

Fodor, J., 1992. Discussion: a theory of the child's Theory of Mind. Cognition 44, 283–296.

Fond, M., 2003. Deontic and epistemic modal expression theory and acquisition in English and Spanish. Linguistics Honors thesis. Smith College.

Frege, G., 1892/1960. On sense and reference. In: Geach, P., Black, M. (Eds.), Philosophical Writings of Gottlob Frege. Basil Blackwell, Oxford, pp. 56–78.

Gale, E., de Villiers, P., de Villiers, J., Pyers, J., 1996. Language and Theory of Mind in oral deaf children. In: Stringfellow, M., Cahana-Amitay, A.D., Hughes, E., Zukowski, A. (Eds.), Proceedings of the 20th annual Boston University Conference on Language Development, vol. 1. Cascadilla Press, Somerville, MA, pp. 213–224.

Garfield, J., Peterson, C.C., Garson, B., Nevin, A., Perry, T., 2001. Let's Pretend! The Role of Pretence in the Acquisition of Theory of Mind. Smith College, unpublished manuscript.

Gergely, G., Csibra, G., 2003. Teleological reasoning in infancy: the naïve theory of rational action. Trends in Cognitive Science 7 (3), 287–292.

Gergely, G., Bekkering, H., Kiraly, I., 2002. Rational imitation in preverbal infants. Nature 415, 755.

Gergely, G., Nadasdy, Z., Csibra, G., Biro, S., 1995. Taking the intentional stance at 12 months of age. Cognition 56, 165–193.

Goldin-Meadow, S., Mylander, C., 1990. Beyond the input given: the child's role in the acquisition of language. Language 66 (2), 323–355.

Golinkoff, R.M., Mervis, C., Hirsh-Pasek, K., 1994. Early object labels: the case for lexical principles. Journal of Child Language 21, 125–155.

Gopnik, A., 1993. How we know our minds: the illusion of first-person knowledge of intentionality. Behavioral and Brain Sciences 16, 1–15.

Hale, C.M., Tager-Flusberg, H., 2003. The influence of language on Theory of Mind: a training study. Developmental Science 6, 346–359.

Happé, F., Loth, E., 2002. 'Theory of Mind' and tracking speakers' intentions. Mind and Language 17, 24–36.

Harris, P.L., 2005. Conversation, pretense, and Theory of Mind. In: Astington, J., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 70–83.

Hauser, M., Chomsky, N., Fitch, W.T., 2002. The faculty of language: what is it, who has it and how did it evolve? Science 298, 1569–1579.

Heizmann, T., 2006. The acquisition of deontic and epistemic readings of *must* and *Müssen*. In: Heizmann, T. (Ed.), Occasional Papers in Linguistics, vol. 34: Papers in Acquisition. University of Massachusetts.

Hermer-Vasquez, L., Spelke, E.S., Katsnelson, A.S., 1999. Sources of flexibility in human cognition: dual-task studies of space and language. Cognitive Psychology 39, 3–36.

Hughes, C., 1998. Executive function in preschoolers: links with Theory of Mind and verbal ability. British Journal of Developmental Psychology 16, 233–253.

Jacques, S., Zelazo, P., 2005. Language and the development of cognitive flexibility: implications for Theory of Mind. In: Astington, J., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 144–162.

Karmiloff-Smith, A., 1992. Beyond Modularity: A Developmental Perspective on Cognitive Science. MIT Press, Cambridge, MA.

Kegl, J., Senghas, A., Coppola, M., 1999. Creation through contact: Sign language emergence and Sign language change in Nicaragua. In: DeGraff, M. (Ed.), Language Creation and Language Change: Creolization, Diachrony, and Development. MIT Press, Cambridge, MA, pp. 179–237.

Landau, B., Gleitman, L., 1986. Language and Experience. Harvard University Press, Cambridge, MA.

Levinson, S., 1996. Frames of reference and Molyneux's question: crosslinguistic evidence. In: Bloom, P., Peterson, M. (Eds.), Language and Space. MIT Press, Cambridge, MA, pp. 109–169.

Lohmann, H., Tomasello, M., 2003. The role of language in the development of false belief understanding: a training study. Child Development 74, 1130–1144.

Lucy, J., 1992. Grammatical Categories and Cognition: A Case Study of the Linguistic Relativity Hypothesis. Cambridge University Press, Cambridge, England.

Maratsos, M., 1976. The Uses of Definite and Indefinite Reference in Young Children: An Experimental Study of Semantic Acquisition. Cambridge University Press, Cambridge.

Markman, E.M., 1994. Constraints on word meaning in early language acquisition. Lingua 92, 199–227.

McGuigan, N., Doherty, M.J., 2002. The relation between hiding skill and judgment of eye direction in preschool children. Developmental Psychology 38, 418–427.

Meins, E., Fernyhough, C., Wainwright, R., Das Gupta, M., Fradley, E., Tuckey, M., 2002. Maternal mind-mindedness and attachment security as predictors of Theory of Mind understanding. Child Development 73, 1715–1726.

Meltzoff, A.N., 1995. Understanding the intentions of others: re-enactment of intended acts by 18-month-old children. Developmental Psychology 31, 838–850.

Moll, H., Tomasello, M., 2004. 12- and 18-month-old infants follow gaze to spaces behind barriers. Developmental Science 7, 1–9.

Moses, L., 2001. Executive accounts of Theory-of-Mind development. Child Development 72 (3), 688–690.

Mulford, R., 1983. Referential development in blind children. In: Mills, A.E. (Ed.), Language Acquisition in the Blind Child: Normal and Deficient. Croom Helm, London.

Naigles, L., 1990. Children use syntax to learn verb meanings. Journal of Child Language 17, 357–374.

Nelson, K., 2005. Language pathways into the community of minds. In: Astington, J.W., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 26–49.

Newton, A., 2006. Verbal interference with adult false belief reasoning. Honors thesis. Cognitive Science. Smith College.

Newton, A., de Villiers, J.G. Thinking while talking: adults fail non-verbal false belief reasoning. Psychological Science, in press.

Nimtz, C., 2005. Reassessing referential indeterminacy. Erkenntnis 62, 1–28.

Olson, D.R., 1993. The development of representations: the origins of mental life. Canadian Psychology 34, 1–14.

O'Neill, D., 1996. Two-year-old children's sensitivity to a parent's knowledge state when making requests. Child Development 67, 659–677.

O'Neill, D., Chong, S., 2001. Preschool children's difficulty understanding the types of information obtained through the five senses. Child Development 72 (3), 808–815.

O'Neill, D., Gopnik, A., 1991. Young children's ability to identify the sources of their beliefs. Developmental Psychology 27, 390–397.

O'Neill, D., Astington, J., Flavell, J., 1992. Young children's understanding of the role that sensory experiences play in knowledge acquisition. Child Development 63, 474–490.

Onishi, K.H., Baillargeon, R., 2005. Do 15-month-old infants understand false beliefs? Science 308, 255–258.

Papafragou, A., 1998. The acquisition of modality: implications for theories of semantic representation. Mind and Language 13, 370–399.

Papafragou, A., Li, P., 2001. Evidential morphology and Theory of Mind. In: Skarabela, B., Fish, S., Do, A.H.-J. (Eds.), Proceedings from the 26th Annual Boston University Conference on Language Development. Cascadilla Press, Somerville, MA, pp. 510–520.

Perner, J., 1991. Understanding the Representational Mind. MIT Press, Cambridge, MA.

Perner, J., Ruffman, T., 2005. Infants' insight into the mind: how deep? Science 308, 214–216.

Perner, J., Leekam, S., Wimmer, H., 1987. Three-year-olds' difficulty in understanding false beliefs: cognitive limitation, lack of knowledge or pragmatic misunderstanding. British Journal of Developmental Psychology 5, 125–137.

Perner, J., Sprung, M., Zauner, P., Haider, H., 2003. Want that is understood well before say that, think that, and false belief: a test of de Villiers's linguistic determinism on German-speaking children. Child Development 74, 179–188.

Perner, J., Zauner, P., Sprung, M., 2005. What does 'that' have to do with point of view? The case of conflicting desires and 'want' in German. In: Astington, J.W., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 220–244.

Peterson, C., Siegal, M., 1999. Representing inner worlds: Theory of Mind in autistic, deaf, and normal hearing children. Psychological Science 10 (2), 126–129.

Peterson, C., Siegal, M., 2000. Insights into a Theory of Mind from deafness and autism. Mind and Language 15, 123–145.

Pettito, L., 1987. On the autonomy of language and gesture: evidence from the acquisition of personal pronouns in American Sign Language. Cognition 17, 1–52.

Povinelli, D.J., DeBlois, S., 1992. Young children's (Homo Sapiens) understanding of knowledge formation in themselves and others. Journal of Comparative Psychology 106 (3), 228–238.

Povinelli, D., Vonk, J., 2004. We don't need a microscope to explore the chimpanzee's mind. Mind and Language 19, 1–28.

Pratt, C., Bryant, P., 1990. Young children understand that looking leads to knowing (so long as they are looking into a single barrel). Child Development 61, 973–982.

Pyers, J., 2004. The relationship between language and false-belief understanding: evidence from learners of an emerging sign language in Nicaragua. Ph.D. dissertation. University of California, Berkeley, CA.

Quine, W.V.O., 1960. Word and Object. MIT Press, Cambridge, MA.

Reddy, V., 1991. Playing with others' expectations. In: Whiten, A. (Ed.), Natural Theories of Mind. Blackwell, pp. 145–158.

Repacholi, B.M., Gopnik, A., 1997. Early reasoning about desires: evidence from 14- and 18-month-olds. Developmental Psychology 33, 12–21.

Ruffman, T., Slade, L., Crowe, E., 2002. The relation between children's and mothers' mental state language and Theory-of-Mind understanding. Child Development 73, 734–751.

Russell, J., 1987. "Can we say ...?" Children's understanding of intensionality. Cognition 25, 289–308.

Schafer, R., de Villiers, J., 2000. Imagining articles: what *a* and *the* can tell us about the emergence of DP. In: Catherine Howell, S., Fish, S.A., Keith-Lucas, T. (Eds.), Proceedings of the 24th Boston University Conference on Language Development, Somerville. Cascadilla Press, pp. 609–620.

Segal, G., 1998. Representing representations. In: Carruthers, P., Boucher, J. (Eds.), Language and Thought. Cambridge University Press, Cambridge, pp. 146–161.

Senghas, A., 2003. Intergenerational influence and ontogenetic development in the emergence of spatial grammar in Nicaraguan Sign Language. Cognitive Development 18, 511–531.

Schick, B., de Villiers, P., de Villiers, J.G., Hoffmeister, R. Language and false belief reasoning; a study of deaf children. Child Development, in press.

Shatz, M., Wellman, H., Silber, S., 1983. The acquisition of mental verbs: a systematic investigation of first references to mental state. Cognition 14, 301–321.

Smith, M., Apperly, I., White, V., 2003. False belief reasoning and the acquisition of relative clause sentences. Child Development 74, 1709–1719.

Sodian, B., 1991. The development of deception in young children. British Journal of Developmental Psychology 9, 173–188.

Spelke, E.S., 2003. What makes humans smart? In: Gentner, D., Goldin-Meadow, S. (Eds.), Advances in the Investigation of Language and Thought. MIT Press, Cambridge, MA.

Sperber, D., Wilson, D., 2002. Pragmatics, modularity and mindreading. Mind and Language 17, 3–23.

Sullivan, K., Zaitchik, D., Tager-Flusberg, H., 1994. Preschoolers can attribute second-order beliefs. Developmental Psychology 30, 395–402.

Tager-Flusberg, H., 2000. Language and understanding minds: connections in autism. In: Baron-Cohen, S., Tager-Flusberg, H., Cohen, D.J. (Eds.), Understanding Other Minds: Perspectives from Developmental Neuroscience. second ed. Oxford University Press, Oxford, UK, pp. 124–149.

Tager-Flusberg, H., 2005. Language and communication disorders in autism spectrum disorders. In: Bauman, M.L., Kemper, T.L. (Eds.), The Neurobiology of Autism. second ed. Johns Hopkins University Press, Baltimore, MD, pp. 45–58.

Tager-Flusberg, H., Joseph, R., 2005. How language facilitates the acquisition of false belief in children with autism. In: Astington, J., Baird, J. (Eds.), Why Language Matters for Theory of Mind. Oxford University Press, New York, pp. 298–318.

Tomasello, M., 1995. Joint attention as social cognition. In: Moore, C., Dunham, P.J. (Eds.), Joint Attention: Its Origin and Role in Development. Lawrence Erlbaum Associates, Mahwah, NJ, pp. 103–130.

Tomasello, M., Farrar, J., 1986. Joint attention and early language. Child Development 57, 1454–1463.

Tomasello, M., Haberl, K., 2003. Understanding attention: 12- and 18-month olds know what is new for other persons. Developmental Psychology 39, 906–912.

Tomasello, M., Carpenter, M., Call, J., Behne, T., Moll, H., 2005. Understanding and sharing intentions: the origins of human social cognition. Behavioral and Brain Sciences 28, 675–735.

Varley, R., Siegal, M., 2000. Evidence for cognition without grammar from causal reasoning and ''Theory of Mind'' in an agrammatic aphasic patient. Current Biology 10, 723–726.

Varley, R., Siegal, M., Want, S.C., 2001. Severe impairment in grammar does not preclude Theory of Mind. Neurocase 7, 489–493.

Want, S.C., Harris, P.L., 2001. Learning from other people's mistakes: causal understanding in learning to use a tool. Child Development 72, 431–443.

Wellman, H.M., 1990. The Child's Theory of Mind. MIT Press, Cambridge, MA.

Wellman, H.M., Liu, D., 2004. Scaling of theory-of-mind tasks. Child Development 75, 523–541.

Wellman, H., Woolley, J., 1990. From simple desires to ordinary beliefs: the early development of everyday psychology. Cognition 35, 245–275.

Wellman, H., Cross, D., Watson, J., 2001. Meta-analysis of theory-of-mind development: the truth about false belief. Child Development 72, 655–684.

Wimmer, H., Perner, J., 1983. Beliefs about beliefs: representation and constraining function of wrong beliefs in young children's understanding of deception. Cognition 13, 103–128.

Witt, J., de Villiers, J.G., April 2001. Reading desires: preschoolers' limitations. Poster presented at SRCD, Minneapolis.

Woodward, A.L., 1998. Infants selectively encode the goal object of an actor's reach. Cognition 69, 1–34.

Woodward, A.L., 1999. Infants' ability to distinguish between purposeful and non-purposeful behaviors. Infant Behavior and Development 22, 145–160.

Woodward, A.L., 2005. Infants' understanding of the actions involved in joint attention. In: Eilan, N., Hoerl, C., McCormack, T., Roessler, J. (Eds.), Joint Attention: Communication and Other Minds. Oxford University Press, pp. 110–128.

Woolfe, T., Want, S., Siegal, M., 2002. Signposts to development: Theory of Mind in deaf children. Child Development 73, 768–778.