

The semantics and pragmatics of belief reports in preschoolers

Children under 4 years old seem to interpret sentences with belief verbs by evaluating the truth of the complement clause with respect to the actual world [1-4]. For example, suppose Mary left her keys on the kitchen table, but John moved them to the drawer while she wasn't looking. Adults would say that (1) is true in this situation, but 3-4 year-olds would say it is false.

(1) Mary thinks that the keys are on the kitchen table.

This result is often taken to reflect a lack of conceptual understanding of false belief [e.g. 1,2]. We propose an alternative explanation: the developmental change we observe in the comprehension of attitude verbs is due to changes in *pragmatic competence* rather than in *conceptual* [1,2], *syntactic* [3] or *semantic* [1] representations. Specifically, we argue that children's non-adult-like judgments reflect an over-reliance on parenthetical interpretations of 'think', which arise due to a failure to grasp the relevance of belief in context.

In adult speech, attitude verbs can be demoted to *parenthetical* status, serving an evidential-like function, while their clausal complement carries the "main point" of the utterance [5-8]. For example, in a dialogue like (2), B's utterance is a felicitous answer to A's question only with a parenthetical interpretation of 'think'.

(2) A: Where are the keys?

B: Mary thinks they're on the kitchen table.

Such uses are frequent in adult speech [9], and children's early productions of 'think' are almost exclusively parenthetical in function [9,10]. Under our **Parenthetical Hypothesis**, children often choose the parenthetical reading in comprehension as well: they judge sentences like (1) based on the truth of the complement clause, even in the absence of an appropriate context like (2A).

In **Experiment 1**, we sought to rule out an alternative explanation based on extra-linguistic processing limitations. Although a growing body of evidence suggests that infants as young as 7 months can *represent* false beliefs [e.g. 11,12], children may nevertheless have difficulty *processing* them. According to the **Conflict Hypothesis**, false beliefs are difficult because they introduce a conflict with the child's own beliefs or with a bias to assume beliefs are true.

In a truth-value judgment task, children watched videos of hide-and-seek stories and judged sentences about them uttered by a puppet. In a representative story, Donald Duck hides under the bed and another duck hides behind the curtain. The feet of both remain visible, but are indistinguishable. In half the stories the participants watch the hider hide (*Knowledge* condition); in the other half the screen is obscured during this stage, so the participants are ignorant of the hider's location (*Ignorance* condition). Mickey comes in to look for Donald and notices the feet in one of the locations. He guesses that they are Donald's, and decides to look there. We counterbalanced the truth of the complement clause, which determined whether the seeker's guess was correct (*True Belief (TB)* vs. *False Belief (FB)* scenarios). The truth of the target sentence was manipulated as a factor. Table 1 shows scenarios and sample target sentences for each condition. Each child saw 12 stories (3 per condition). The *Ignorance* condition is critical: the **Conflict Hypothesis** predicts that children's judgments should be adult-like, since there is no conflict between the character's belief and the child's belief. By contrast, the **Parenthetical Hypothesis** predicts that children should respond at random, since they will have no way to evaluate the truth of the complement clause.

We tested 14 children aged 3;10-4;2. Children's accuracy was significantly above chance in *TB* scenarios and significantly below chance in *FB* scenarios (see Table 1), replicating the usual

findings with 4-year-olds. Crucially, children’s accuracy was no different from chance in the *Ignorance* condition. This clearly contradicts the prediction of the **Conflict Hypothesis**, but is consistent with the **Parenthetical Hypothesis**.

In **Experiment 2**, we investigated the source of children’s “parenthetical” interpretations. Children could be limited to an evidential-like semantic representation of belief verbs at this stage (the **Deviant Grammar Hypothesis** [9,13]). Alternatively, children might have an adult-like semantic representation for ‘think’, but tend to interpret it parenthetically for pragmatic reasons, e.g. by misconstruing the relevant Question Under Discussion (QUD) in situations involving belief (the **Pragmatic Hypothesis**). For example, in the story described above, children may take the QUD to be “Where is Donald hiding?”, and thus respond to the truth of the complement clause of the target sentence, “Mickey thinks that Donald is hiding under the bed.”

The design and setup of Experiment 2 were identical to Experiment 1, except that in each story *two* seekers look for the hider in different locations, emphasizing the relevance of the seekers’ beliefs. The **Deviant Grammar Hypothesis** predicts that this manipulation should have no effect on children’s responses, while the **Pragmatic Hypothesis** predicts that the increased salience of the seekers’ beliefs will cause children to generate adult-like responses more often.

We tested 15 children aged 3;10-4;4. Since the target sentences and intended responses were identical in Experiments 1 and 2, the results can be compared directly. Analysis with a logistic linear mixed effect model revealed a main effect of the number of seekers: children’s performance in Experiment 2 improved across all conditions compared to Experiment 1 (see Table 1). This improved performance is not consistent with the prediction of the **Deviant Grammar Hypothesis**, but is consistent with the **Pragmatic Hypothesis**.

We conclude that 4-year-olds have adult-like semantic representations of ‘think’ available to them, but frequently prefer a parenthetical interpretation when the relevance of belief is not particularly salient. If these findings can be extended to younger children, they will substantially change our understanding of the timeline of acquisition of attitude verbs: syntactic and semantic representations of attitude verbs would have to be in place earlier.

Table 1: Experiment design and results (+ = significantly above chance, - = sig. below chance)

Scenario Type	Sent.		Results	
	Truth	Example sentence	Exp 1	Exp 2
<i>Knowledge:</i> <i>TB</i>	T	<i>Mickey thinks that Donald is under the bed.</i>	100% ⁺	96% ⁺
	F	<i>Mickey thinks that Donald is behind the curtain.</i>	71% ⁺	86% ⁺
<i>Knowledge:</i> <i>FB</i>	T	<i>Mickey thinks that Donald is behind the curtain.</i>	29% ⁻	50%
	F	<i>Mickey thinks that Donald is under the bed.</i>	21% ⁻	64%
<i>Ignorance</i>	T	<i>M. thinks that D. is under the bed/behind the curtain.</i>	55%	76% ⁺
	F	<i>M. thinks that D. is behind the curtain/under the bed.</i>	55%	83% ⁺

[1] Johnson & Maratsos (1977). *Child Development*. [2] Perner et al. (2003). *Child Development*. [3] de Villiers & Pyers (2002). *Cognitive Development*. [4] Sowalsky et al. (2009). *GALANA 2008*. [5] Urmson (1952). *Mind*. [6] Hooper (1975). In *Syntax and Semantics, Vol. 4*. [7] Rooryck (2001). *Glott International*. [8] Simons (2007). *Lingua*. [9] Diessel & Tomasello (2001). *Cognitive Linguistics*. [10] Shatz et al. (1983). *Cognition*. [11] Kovács et al. (2010). *Science*. [12] Baillargeon et al. (2010). *TICS*. [13] Johnson & Wellman (1980). *Child Development*.