"I think that's enough": Mental state verbs rarely report beliefs in child-directed speech

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CUNY 2015

Children evaluate belief reports based on reality

By age 4, children use mental state verbs (e.g. *know*, *remember*), but tend to reject sentences such as *Suzy thinks giraffes have stripes* and do poorly on false belief tasks (i.a., Wimmer & Perner 1983, Johnson & Maratsos 1997, de Villiers & de Villiers 2000).

Why?

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Psychological	Lack of theory of mind (i.a., de Villiers 2005)
Syntactic	Difficulty with multi-clause sentences (i.a., Lohmann & Tomasello 2003)
Pragmatic	**Lack understanding of context** (Lewis et al. 2012)

In some contexts, mental state verbs have a parenthetical interpretation (Rooryck 2001, Simons 2007)

(1) A: Who stole the cupcake?
B: John thinks <u>Bill was the thief</u>.   *hedge assertion of complement*

(2) A: Why is John mad at Bill?
B: <u>John thinks</u> Bill was the thief.   *relevance of belief*
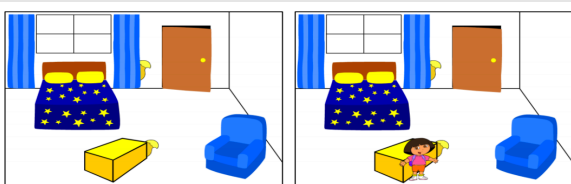
Lewis et al. 2012
QUD   (Where is Swiper?)
Exp: (Dora thinks that) Swiper is behind the toy box.
Child: No—he's behind the curtain!

Does the distribution in the input give evidence for the pragmatic hypothesis?
– Parenthetical uses might be highly frequent in child-directed speech
– When belief is more relevant, the belief reported might be true

Corpus study

1281 utterances (mental state verbs and complements) in context from CHILDES Brown corpus

think (694), *know* (439), *remember* (34), *guess* (27), *mean* (24), *forget* (17), *bet* (12), *wonder* (8), *pretend* (7), *suppose* (7), *wish* (5), *understand* (3), *believe* (2), *hope* (2), *dream* (0), *figure* (0)

Utterance purpose: (Shatz 1983) kappa: .75

Assertion	I think it's a truck.
Belief report	I didn't think you would miss it.
Directing interaction	Do you know where he's hiding?
Clarification	I don't know what you mean.

Veridicality of the complement: (de Marneffe et al. 2012) kappa: .86

CT+/-	I don't think you can put it back.
PR+/-	I think maybe it came from your basket.
Uu	Do you think she needs a helper?
Wh-C	I don't know what bumped it Adam.

In 40% of our data, complement clauses are true and 70% of these are assertions

	Assertion	Belief	Interaction	Clarification
CT+	16.9	5.2	1.0	0.8
PR+	10.5	3.0	1.2	0.5
CT-	8.9	3.4	0.5	0.0
PR-	3.7	2.1	0.2	0.3
Uu	0.6	1.4	0.3	0.2
Wh-C	0.0	23.3	10.9	1.1
	40.6	38.2	14.1	2.9

The majority of assertions are true

The majority of belief reports are highly marked syntactically

Our corpus study provides evidence for the pragmatic hypothesis of Lewis et al. (2012): children are overwhelmed with parenthetical interpretations (true facts asserted but hedged).

Which factors help predict belief report uses?

Howard et al. 2008 suggest that tense, verb, subject and modal auxiliary matter. We train a linear model on our corpus:

Favor	past tense; main subject 2nd/3rd; presence of *wh*-item; complement repeated in context
Disfavor	*think, remember, bet, forget, guess, mean*; complement subject 1st
No effect	modal and negation scope; type (declarative/interrogative)

The classifier highlights lexical/pragmatic factors which (dis)favor belief report uses. The age at which children become sensitive to each cue needs to be investigated.

think – factive in child-directed speech

	Assertion	Belief	Interaction	Clarification
CT+	**20.7**	3.5	1.2	0.6
PR+	**16.1**	5.0	2.0	0.4
CT-	15.6	4.5	0.3	0.0
PR-	6.5	3.6	0.3	0.1
Uu	0.6	1.0	0.6	0.1
Wh-C	0.0	9.5	7.5	0.1
	59.5	27.1	11.9	1.3

know – predominantly true beliefs

	Assertion	Belief	Interaction	Clarification
CT+	12.1	**8.9**	0.9	0.5
PR+	0.2	**0.9**	0.2	0.0
CT-	0.9	1.6	0.2	0.0
PR-	0.7	0.5	0.0	0.0
Uu	0.5	2.3	0.0	0.0
Wh-C	0.0	**49.2**	18.2	1.4
	14.4	**63.4**	19.5	1.9