DOI: 10.1111/mila.12192

WILEY

ORIGINAL ARTICLE

Children's attitude problems: Bootstrapping verb meaning from syntax and pragmatics

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Funding information
NSF, Grant/Award Number: #BCS-1124338

How do children learn the meanings of propositional attitude verbs? We argue that children use information contained in both syntactic distribution and pragmatic function to zero in on the appropriate meanings. Specifically, we identify a potentially universal link between semantic subclasses of attitude verbs, their syntactic distribution and the kinds of indirect speech acts they can be used to perform. As a result, children can use the syntax as evidence about the meaning, which in turn constrains the kinds of pragmatic enrichments they do and do not make in understanding these verbs in conversation.

KEYWORDS
attitude verbs, pragmatics, speech act, syntactic bootstrapping, theory of mind, word learning

1 | INTRODUCTION

This paper explores the role of syntax and pragmatics in word learning, by focusing on so-called attitude verbs, verbs that express mental states or "attitudes" of individuals toward particular states of affairs, such as *think, want,* or *hope.* Our proximate goal is to provide an account of *how* children acquire attitude verb meanings. Specifically, we examine the contributions of syntax and pragmatics in both helping and hindering the acquisition process. Ultimately, we hope that the lessons learned in this narrow domain will generalize to word learning more broadly. We focus empirically on the asymmetry in acquisition between *think* and *want.* Whereas preschoolers make systematic errors with *think* when its complement is false, they do not with *want.* We argue that this asymmetry derives from the information that children use to identify attitude verb meanings. Exploiting parallels between the syntactic distribution of a verb and its pragmatic function, children use syntax and pragmatics in a mutually constraining way to drive their hypotheses about verb meaning. We show how this account correctly explains the *think–want* asymmetry, and provide evidence that syntactic distribution is predictive of attitude meanings and that children use such cues when hypothesizing attitude meanings.

The problem of word learning in general has received a mountain of attention, much of it motivated by puzzles of induction. As Quine (1951) famously observed, the extralinguistic environment accompanying the use of a word leaves open the particular concepts in the mind of the speaker that condition that use. A situation in which a speaker uses a word to refer to a rabbit might be identical to one in which he intended to refer to the rabbit's fur, the speed at which it is moving, or the memory of a delicious stew. Moreover, even if a learner can pinpoint precisely the part of the world being picked out by a novel word—recognizing, for example, that the speaker was referring to the rabbit—this reference would be consistent with a broad range of concepts with overlapping extensions (e.g., rabbits or black holes, things physically identical to rabbits, etc.; Goodman, 1955). Linguists and cognitive scientists have responded to these philosophical problems by noting that word learners can draw on perceptual, conceptual, and linguistic abilities that lead them to parse the world into the same pieces and to relate those pieces to the same concepts as the speakers producing those words (Carey, 2010; Gleitman, 1990; Markman, 1990; Spelke, 1990; Waxman & Lidz, 2006). Moreover, these conceptual burdens may be significantly reduced by learners' ability to track the goals and intentions of their interlocutors (Baldwin, 1991; Bloom, 2001; Clark & Amaral, 2010).

Despite these constraining capacities, attitude verbs pose a significant challenge for any theory of word learning. These verbs describe abstract mental states that do not leave reliable correlates in the physical world, providing little evidence for learners to recognize that they are being referred to (Landau & Gleitman, 1985). And, although children may have a rich capacity to see people's actions in terms of their beliefs, desires, goals, and intentions (Gergely, Nadasdy, Csibra & Biro, 1995; Onishi & Baillargeon, 2005; Southgate, Senju & Csibra, 2007; Woodward, 1998, among others), this ability is distinct from the recognition that those mental states make likely word meanings (Papafragou, Cassidy & Gleitman, 2007).

The problem of recognizing that a word picks out a mental state is highlighted by results from the human simulation paradigm (Gillette, Gleitman, Gleitman & Lederer, 1999). Adult subjects were shown silenced videos of mother–child interactions, with a tone occurring when a particular word was used, and asked to guess what word was uttered there. Participants were able to recover nouns more easily than verbs. Among verbs, action verbs such as *push* were identified more frequently than attitude verbs like *think* and *want.* Indeed, participants almost never correctly identified attitude verbs, suggesting that the meaning of these words is not easily gleaned from paying attention solely to what speakers attend to in the ***situational context*** in which they speak (Gillette et al., 1999; Gleitman, Cassidy, Nappa, Papafragou & Trueswell, 2005; Snedeker & Gleitman, 2004). This is not to say that the situational context does not play a role: certain situations make attitudes more salient and encourage speakers to use mental state vocabulary. Papafragou et al. (2007) show that scenes in which a character has a false belief prompt speakers to use words like *think* more often. Yet the bulk of children's exposure to mental state vocabulary does not occur in such informative contexts; most instances of *think* in child-directed speech do not report false beliefs (Shatz, Wellman & Silber, 1983; Bloom, Rispoli, Gartner & Hafitz, 1989; Diessel & Tomasello, 2001; Dudley, Rowe, Hacquard & Lidz, 2018, a.o.). Hence, the child may need more reliable cues to figure out attitude meanings—in particular, from the ***linguistic context*** in which these words occur.

A word's ***lexical context*** (the set of words that occur in the same sentence), for instance, can be quite useful in learning the meaning of verbs like *eat* or *drink*, which co-occur with noun phrases from a very narrow semantic range (edibles and drinkables). It is, however, less clear that lexical context is informative as to attitude meanings, given that attitude verbs (e.g., *want*) impose few restrictions on the semantic range of noun phrase arguments (Resnik, 1996; White, 2015).

Syntactic context may be especially useful if the syntactic distribution of a word correlates with its semantic class. Gleitman and colleagues propose that syntactic cues play a critical role in children's acquisition of abstract words like attitude verbs (which they refer to as "hard words"). Supporting evidence comes from adult experiments, in which subjects systematically hypothesize attitude meanings for nonce verbs that appear with a sentential complement (Gillette et al., 1999). Given how much better adults fare with syntactic cues, compared to situational cues, **syntactic bootstrapping** (i.e., using a word's syntactic distribution to infer its meaning) seems like our best bet for how children acquire attitude meanings. This bet is made good, however, only if children are sensitive to such distributional cues, if these distributional cues are connected to meaning differences in principled ways, and if children are somehow privy to these connections.

While the syntactic bootstrapping hypothesis for word learning was originally proposed specifically for abstract terms like attitude verbs, most of the studies testing this hypothesis have focused on simple transitive and intransitive verbs (e.g., Landau & Gleitman, 1985; Lidz, Gleitman & Gleitman, 2003; Naigles, 1990, 1996; Naigles & Kako, 1993; Pinker, 1989; Yuan & Fisher, 2009), or on whether attitude verbs as a class can be differentiated from other verbs (Fisher, Gertner, Scott & Yuan, 2009; Fisher, Gleitman & Gleitman, 1991; Fisher, Klinger & Song, 2006; Gleitman, 1990; Gleitman et al., 2005). From this body of work, we have good reason to believe that children pay attention to syntactic distribution when learning new words, and specifically, that a verb's selection of a sentential complement provides good evidence that this verb expresses some attitude meaning. It is, however, much less clear whether further syntactic differences help the child differentiate *among* attitude meanings. Are semantic differences between verbs like *think* and *want* reflected in their syntactic distribution? And can children use such distributional information to infer the right meanings?

As we will see, children differentiate *think* and *want* early on, even before they have fully mastered their meaning and use, as evidenced by their systematic comprehension errors with *think*, but not *want* sentences. This differential treatment suggests that something cues children in early that *think* and *want* belong to different semantic classes. As we have just seen, it is unlikely that this something resides in the situational or lexical contexts. Syntactic distribution presents a more promising avenue, given that it clearly differentiates verbs like *think* and *want.* In English, *think* and *want* differ in the finiteness of their complement. *Think* takes a finite, *want* a nonfinite complement:

(1) Mom thinks that Andy is going to bed.

(2) Mom wants Andy to go to bed.

But is the link between finiteness and attitude meaning principled? A challenge to this view is that not all languages show the same finiteness contrast between verbs like *think* and *want.* The German counterparts of (1) and (2), for instance, both involve finite complements. And yet German-speaking children seem to differentiate *think* and *want* in the exact same ways as English-speaking children (Perner, Sprung, Zauner & Haider, 2003). The viability of a syntactic bootstrapping account for attitude verb meanings depends on whether we can find principled mappings between attitude verb meanings and their syntactic distribution in each language, and a way for children to figure out these language-specific mappings.

Another aspect of the linguistic environment particularly relevant to attitude verb learning is their ***pragmatic context***. One challenge to word learning that is perhaps less often discussed comes from the distinction between *sentence meanings* and *speaker meanings* (Austin, 1975; Grice, 1975; Searle, 1969). Sentences are used to achieve conversational goals, so often what gets communicated is not merely the literal meaning of the words, but something richer. Thus, even if children can perceive the

point of a speaker's utterance, they still lack direct access to the literal sentence meaning, and hence to the meanings of specific lexical items.

In the case of attitude verbs, this problem is acute. Because attitude verbs describe speech acts and mental states, they are often used by speakers to perform indirect speech acts in which the literal content of the attitude report only plays a minor role in the speaker meaning. Specifically, a sentence that is literally about the thoughts or desires of the speaker or the hearer can be used to indirectly describe or demand a situation that satisfies these attitudes. When a parent utters (3), she is not merely describing a desire, but ordering her child to go to bed. Such uses are predominant in speech to children, and present yet a further challenge to the acquisition of attitude verbs: how do children manage to extract their literal meaning, given that this literal meaning is clouded by the speaker meaning?

(3) I **want** you to go to bed. *Go to bed!*

(4) I **think** Mary's in bed. *Mary is in bed.*

But perhaps these pragmatic enrichments are not just a curse, but also a blessing. Might they not, in fact, provide useful cues as to literal content? (3) is literally a desire report, but it is often used as an indirect request. (4) is literally a belief report, but it is often used to make an indirect assertion as to Mary's location. For Searle (1975), this is because the literal content of (3) and (4) expresses the sincerity condition of the indirect speech acts being performed: to make a request, one has to want that request to be fulfilled; to make an assertion, one has to believe its content.

Being privy to the illocutionary force of the intended speech act a speaker conveys with an attitude report could give the child clues as to its literal meaning: a request is an expression of a preference, hence a verb used to make a request may express a preference; an assertion is an expression of a judgment of truth, hence a verb used to perform an assertion may express a judgment of truth.

For such **pragmatic bootstrapping** to work, children would have to be sensitive to the intended force of speakers' utterances, even if they do not fully understand their content, and figure out whether the utterance was intended as a request or as an assertion. The existing literature suggests that this is a viable possibility. From infancy, children are remarkably sensitive to the goals (referential and other) of the people around them (Baldwin, 1991; Bloom, 2001; Csibra, Biro, Koos & Gergely, 2003; Halberda, 2006; Woodward, 1998). Children are notably very good at understanding the force of indirect speech acts like requests and questions (Begus & Southgate, 2012; Evans, Stolzenberg, Lee & Lyon, 2014; Grosse, Moll & Tomasello, 2010; Grosse & Tomasello, 2012; Shatz, 1978; Spekman & Roth, 1985), even if they may not be able to reconstruct the literal meaning.

If children can understand the intended speech acts behind speakers' utterances, they may be able to use cues from the type of indirect speech act to recover the meaning of the direct one. But might pragmatic bootstrapping not backfire? Whereas *think* sentences are often used for indirect assertions, they can also be used to perform indirect requests. A sentence like (5) can be used to send a child to bed. If a child were to rely on the force of the indirect speech act (request) to recover the meaning of the direct speech act, might she hypothesize a desire meaning for *think*?

(5) I think it's time for bed.

We will argue that the syntax acts as a crucial filter on this kind of pragmatic bootstrapping. We propose that what allows the child to infer the lexical semantics of attitude verbs—to which she is never directly exposed—is the exploitation of correlations between syntax (what syntactic

complements appear in attitude reports) and pragmatic function (how these attitude reports are used by speakers). The challenges to syntactic and pragmatic bootstrapping resolve each other by being mutually constraining: the syntax helps the learner parse the pragmatic context, while the pragmatics, in turn, helps the learner make use of the syntactic distribution. We will refer to this proposal as the **pragmatic syntactic bootstrapping hypothesis**.

In a nutshell, attitude verbs split into two main semantic classes: attitudes that express judgments of truth (e.g., *think*), what Bolinger (1968) called the "representationals," as they represent a picture of the world; and attitudes that express preferences (e.g., *want*), which we will call the "preferentials." Because of their semantics, representationals and preferentials are conventionally used for different indirect speech acts: *assertions* and *requests*, respectively. Syntax tracks this semantic split (e.g., Bolinger, 1968; Farkas, 1985; Giannakidou, 1997; Hooper, 1975; Villalta, 2008), but via different syntactic means. These different means, however, converge in a way that is robust to cross-linguistic variation: representationals take complements with syntactic hallmarks of declarative clauses, the clause type typically associated with **assertions** (finite clauses in English); preferentials do not—if anything, their complements resemble imperative clauses, the clause type typically associated with **commands** (nonfinite clauses in English).

Given this, the learner might observe that a certain attitude verb embeds complements with syntactic hallmarks of declarative clauses. From this, she might infer that with this attitude report, the speaker intends to indirectly *assert* the complement (indirectly, because the complement clause is embedded). She might further infer that the embedding verb's semantics must lend itself to such indirect assertions, that is, that it is a verb that expresses a truth judgment (e.g., a belief). This proposal resolves the cross-linguistic challenge to syntactic bootstrapping: the learner only needs to track syntactic hallmarks of declarative clauses, whatever these turn out to be in a specific language (such as finiteness in English).

We will develop this hypothesis by focusing on the long noted asymmetry in children's acquisition of the verbs *think* and *want.* Children seem to understand *want* in an adult-like way by age three. However, they struggle with *think* sentences used to report a false belief until well after their fourth birthday (de Villiers, 2005; Johnson & Maratsos, 1977; Perner et al., 2003). We will argue that this asymmetry is due to a difference in how these verbs are used pragmatically, a difference that leads children astray in standard tasks testing their understanding of *think.* This is in contrast to the traditional view, according to which the asymmetry reflects an asymmetry in the development of the concepts expressed (*belief* vs. *desire*) (Bartsch & Wellman, 1995; Perner, 1991a, 1991b; Perner et al., 2003; Perner, Zauner & Sprung, 2005; Repacholi & Gopnik, 1997; Wellman & Bartsch, 1988). According to our proposal, children's errors with *think* need not reflect a nonadult-like conceptual or even semantic representation.

2 | ASYMMETRY IN THE ACQUISITION OF *WANT* AND *THINK*

The developmental literature argues that children master *want* before *think.* Children make consistent mistakes with *think* when it is used to report a false belief well after their fourth birthday. Consider the following scenario (adapted from Perner et al., 2003), in which Andy is watching TV, but his mother falsely believes that he is going to bed. In such a scenario, 3-year-olds typically reject the true sentence in (6):

(6) Mom thinks that Andy is going to bed.

However, given a variant of the scenario where Andy is watching TV but his mother wants him to go to bed, 3-year-olds have no trouble accepting *want* sentences like (7). This asymmetry in acquisition holds for the German counterparts of *want* and *think* (Perner et al., 2003), and other languages, such as Mandarin and Cantonese (Tardif & Wellman, 2000):

(7) Mom wants Andy to go to bed.

While the asymmetry is robust throughout the experiments in which it has been tested, the tasks comparing children's understanding of *want* and *think* do not always involve the same processing demands. *Think* is typically tested in false belief contexts, where the reported belief conflicts both with reality, and with the child's own beliefs. In (6), Mom's belief conflicts with the reality set up by the scenario (Andy is actually watching TV); given that the child knows what Andy is actually doing, her own beliefs naturally line up with reality. Thus, to assess the sentence in (6), the child has to hold in memory and process a belief that conflicts both with reality and with her own beliefs.

The same types of conflict are not always present when testing *want.* In listening to the story about Andy watching TV, the child does not necessarily have any desires about what Andy does. Thus, the reported desire in (7) does not conflict with her desires the way the reported belief in (6) conflicts with her beliefs. Moreover, strictly speaking, the desire reported in (7) does not conflict with reality, either. This is due to the fact that when *want* takes a complement with an eventive predicate like 'go to bed', it is future-oriented. The sentence in (7) describes a desire for an event to occur at a time that *follows* the wanting time.[1]

Thus (6) describes a belief that conflicts with reality, (7) a desire that does not necessarily conflict with reality. Could children's relative ease with *want* in studies like Perner et al.'s, be an artifact, due to differences in processing demands, when compared to *think*? Does children's performance with *want* decline when it is used to report a truly counterfactual desire or a desire that conflicts with the child's own desires? The literature is mixed, but overall, it suggests that children do better than with *think* sentences used to report false beliefs.

Moore et al. (1995) tested 3-year-olds' understanding of *want* sentences used to report a desire that conflicts with their own by setting up a game in which the child competes with a puppet. Less than half of the children passed the task. Rakoczy, Warneken and Tomasello (2007) improved on Moore et al.'s methodology. Children's performance hovered around 50%. However, the game was still fairly complex, and failures may be due to a poor understanding of the game and to the small number of critical trials. In Harrigan, Hacquard and Lidz (2018a), we build on these studies and set up a competitive game with the child and a puppet, Froggy, consisting of flipping colored cards, with various colors leading to a positive outcome for either Froggy, the child, both, or neither. For instance, when the card is green, Froggy wins, but when it is pink, the child wins. A second puppet utters target sentences like those in (8):

(8) a. Froggy wants the card to be green.

b. Froggy wants the card to be pink.

Children received extensive training on the game to ensure that they understood its rules, before they were tested on target sentences. Three-year-olds' performance was adult-like: they readily

[1] This future-orientedness holds even in German, where *want* takes a present tensed finite complement.

accepted sentences like (8a) when the reported desire conflicted with their own, and rejected sentences like (8b), despite their own desire for the card to be pink.

We also tested children's understanding of truly counterfactual desires. In a representative story, Megan and her mother are in a grocery store. Megan's mother wants her to stay in the grocery cart, but Megan gets out to find cereal while her mother is not looking. In such scenarios, 3-year-olds accepted (9a) and rejected (9b):

(9) a. Mom wants Megan to be sitting in the grocery cart right now.

b. Mom wants Megan to be getting cereal right now.

These experiments confirm that 3-year-olds' have an adult-like understanding of *want.* They further suggest that whatever difficulty 3-year-olds have with *think*, it cannot solely be due to the processing demands of assessing a mental state that conflicts with reality, or with the child's own mental state. What is the nature of this asymmetry? The traditional explanation is that it reflects an asymmetry in the acquisition of the concepts these verbs express. We review this conceptual hypothesis next, and then show that it cannot be right. Instead, we argue that children's difficulty with *think* sentences is essentially pragmatic.

3 | EXPLAINING THE *THINK/WANT* ASYMMETRY

3.1 | Conceptual hypothesis

Young children's comprehension difficulty with *think*, and their relative ease with *want*, is often tied to conceptual development in the psychology literature. Children's failures with *think* are taken to reflect their inability to ascribe beliefs—in particular, false beliefs—to others. Their success with *want*, on the other hand, is taken to show that the desire concept develops earlier (for an overview, see Steglich-Petersen & Michael, 2015).

The thesis that children initially lack a *theory of mind* that allows them to attribute false beliefs to others has received considerable experimental support, independent of their performance with *think* sentences (for a meta-analysis of over 150 studies, see Wellman, Cross & Watson, 2001). In a typical "change of location" false belief task (Baron Cohen, Leslie & Frith, 1985; Wimmer & Perner, 1983), a character (Sally) has a false belief about an object's location (her ball). Sally hides her ball in a basket and then leaves. While she is gone, her friend Anne takes the ball and moves it into her box. The child is then asked: "When Sally comes back, where will she look for her ball?" Adults and older children point to the basket, but 3-year-olds consistently point to the box. This type of error is taken to show that young children cannot ascribe to Sally the false belief that her ball is still in the basket. Thus, independently of their understanding of *think*, young children seem unable to reason about false belief, but they do much better on tasks testing their understanding of unfulfilled desires.

If children acquire the belief concept after the desire concept, they will have more difficulty with a verb that expresses belief than one that expresses desire. The asymmetry in acquisition of *think* and *want* could thus reflect an asymmetry in the acquisition of the concepts they express.

There are, however, reasons to doubt the conceptual hypothesis. In the past 10 years, various infant studies have provided considerable evidence that false belief understanding may be in place early on (Onishi & Baillargeon, 2005; Song, Onishi, Baillargeon & Fisher, 2008; Southgate et al., 2007 a.o.). Using implicit measures such as looking time, these studies show that infants are surprised

when actors perform actions that are inconsistent with their beliefs, whether these beliefs are *true* or *false*.

There is still no consensus on how to reconcile the results from these infant studies with older children's consistent failure at explicit false belief tasks (for overviews, see Apperly & Butterfill, 2009; Perner & Roessler, 2012; Carruthers, 2013). Some argue that success on these implicit tasks does not require a full-fledged false belief understanding, but merely low-level expectations about how agents behave (e.g., Perner & Ruffman, 2005). Others take infant studies to show that the concept is in place early on, with failures at explicit false belief tasks due to additional task demands (e.g., Leslie, 1994). One possibility is that children's failures are not due to a lack of competence, but performance—with children reading more into the task and, specifically, the goals and desires of the experimenters in asking where certain characters think an object is located (Hansen, 2010; Rubio-Fernández & Geurts, 2013; Helming, Strickland & Jacob, 2014; Westra & Carruthers, 2017). This last hypothesis is appealing because it can make sense of the apparent discrepancy between the results from infant studies and those from explicit false belief tasks, and does not require a categorical change in conceptual understanding. Regardless of which hypothesis is ultimately correct, there are reasons to doubt that children lack the concept of belief at age three, though they seem to have difficulty in deploying it in explicit tasks.

Before we turn to our own account, we briefly discuss Jill de Villiers' intriguing hypothesis for children's difficulty with *think* and the more general connection between linguistic and conceptual development. de Villiers (2005) and de Villiers and de Villiers (2000) argues that children initially lack the ability to encode false belief. What gives them the "scaffolding for false-belief representation" is the special syntax associated with verbs like *think*—namely, the structural means to embed a finite sentential complement, whose truth can differ from the truth of the sentence in which it is embedded. According to this view, children initially lack both the concept of false belief, and the syntax and semantics of *think* sentences. Their linguistic abilities develop first with the acquisition of the syntax of finite complementation which, in turn, allows them to represent a belief whose content can be false. A verb like *want* is acquired sooner, because the syntax it projects is different (nonfinite complements) and acquired earlier.

Two main issues arise with de Villiers' proposal, however. First, the infant studies here again undermine the thesis that children develop the false belief concept around age four. If false belief understanding is in place early, then practice with attitude verbs may help *deploy* this concept in explicit false belief tasks, but it does not *enable* false belief representation. Second, as Perner et al. (2003) argue, de Villiers' hypothesis makes wrong predictions for German-speaking children. Both *want* and *think* in German take finite complements. If children initially lack finite complementation, we would expect German-speaking children to perform equally bad at *want* as *think*, contrary to fact. In response to this challenge, de Villiers revised her proposal in semantic terms (de Villiers, 2005, 2007): *think* and *want* take semantically (if not syntactically) different types of complement: "realis" complements for *think*, whose "truth can be evaluated," "irrealis" complements for *want*, whose "truth cannot be evaluated." In this updated version, realis complements provide the scaffolding for false belief representation.

We agree with De Villiers that *think* and *want* differ semantically in that the former expresses a judgment of truth but not the latter. However, we will argue that children's difficulty with *think* is not due to its *syntax* or *semantics*, but to the kinds of *pragmatic* enrichments that verbs that express truth judgments trigger. We will present evidence that when we control for pragmatic enrichments, 3 year olds display an adult-like understanding of *think* sentences, even in false belief contexts.

3.2 | Pragmatic root of the *think/want* asymmetry

In Lewis, Hacquard and Lidz (2012, 2017), we investigate the possibility that children's difficulty with *think* is pragmatic, and argue that children acquire the right semantics for *think* early on: they know that people can be mistaken in their beliefs, but this knowledge is obscured by their difficulty understanding what *speakers* mean when using *think.*

The literal meaning of a *think* sentence is a mere belief report. This literal meaning is seen clearly in contexts in which we are reasoning about the motivations behind someone's actions:

(10) a. Why is Max opening the cupboard?

b. He thinks that there's chocolate in there.

In certain contexts, however, speakers use *think* sentences to convey more than a belief ascription: they use them to proffer the complement clause. To see how this kind of pragmatic enrichment works, consider the following dialog from Simons (2007):

(11) A: Why isn't Louise coming to our meetings these days?

B: Henry thinks that she's left town.

The literal content of B's answer is a mere belief report, which does not directly address A's question. Why, then, is it an appropriate thing for B to say? A natural way in which B's utterance addresses A's question is if B endorses this belief, and thus "proffers" or indirectly asserts its content. With such "parenthetical" uses of *think* (Urmson, 1952), the complement clause carries the "main point" of B's utterance (Simons, 2007). The main clause gets demoted to parenthetical status, and plays an evidential function (indicating the source of evidence for the proffering).

For Hooper (1975), in a situation like (11) the complement is "asserted," but as Simons (2007) points out, these parenthetical uses, unlike real assertions, do not require the full commitment of the speaker. For Simons, with parenthetical uses the complement carries the main point of the utterance, but it does not require speaker endorsement. If B fully endorsed Henry's belief, B should have uttered the complement clause *tout court.* By using an attitude report, B implicates some hedging. But even if B has doubts as to Henry's being right, she is still offering the possibility that Louise is out of town (in Henry's name, as it were). We will call this pragmatic enrichment a "proffering" or "indirect assertion" of the complement: it is not a direct assertion, and it may not be fully endorsed by the speaker, but it is nonetheless put forward by the speaker as a possible answer to the question under discussion.

Consider now a third party, C, listening in to the conversation in (11). Upon hearing B's utterance, C can intervene as follows:

(12) C: No she's not, she's home.

With this denial, C is not responding to the *literal* meaning of B's utterance, but to the indirect proffering of the complement (the *speaker* meaning): C is not denying that Henry holds a particular belief (the literal content of B's utterance), but rather that Louise is out of town (the content of the complement). This kind of denial is what we hypothesize underlies children's rejection of *think* sentences in scenarios where they know the complement to be false: their rejection is a rejection of what they take to be the speaker meaning.

To see this, recall that children's errors with *think* typically arise in false belief contexts. In a scenario where Andy is watching TV, but his mother falsely believes that he is going to bed, young children tend to reject (6). Suppose that children take the question under discussion to be what Andy is doing. In this context, an utterance of (6) would amount to an indirect assertion that Andy is going to bed. Because they know that Andy is in fact watching TV, they should reject what they take to be a false speaker meaning, the same way C rejects B's utterance in (12). Under this view, children's rejection of *think* sentences is a response that is itself adult-like. What is not adult-like is the use of this rejection in contexts in which the intended speaker meaning is merely the literal meaning, and not an indirect assertion of the complement. We now turn to experimental evidence in support of this proposal.

We hypothesize that the reason children respond to the truth of the complement is that they tend to assume indirect assertion uses, even in cases where adults do not. When they hear a sentence like (6), they assume that the speaker indirectly asserts the complement, and reject the sentence, if they know the complement to be false. If children's errors with *think* are pragmatic rather than conceptual, their performance should improve via contextual manipulation. This is what we find.

In Lewis et al. (2012), we manipulate the salience of belief to help children overcome their tendency to assume indirect assertion uses. Four-year-old children watch hide and seek stories where one character hides, and either *one* or *two* other characters look for him. In the *one*-seeker false belief condition, Swiper is hiding behind the curtain, but Dora thinks that he is behind the chest. Children then have to judge whether the sentence in (13) is true. In the corresponding *two*-seeker condition, another character, Boots, is also looking for Swiper, but he thinks that Swiper is behind the curtain. Because Dora and Swiper have conflicting beliefs about the same situation, this scenario highlights the salience of the beliefs each have, and helps prevent indirect assertion interpretations of the target sentence.[2]

(13) Dora thinks that Swiper is behind the chest.

Our results show that while 4-year-olds tended to reject (13) in the *one*-seeker condition, their performance significantly improved in the *two*-seeker condition.

In Lewis et al. (2017), we further test whether 3-year-olds can respond to the falsity of a *think* sentence in a false belief context, where the *literal* meaning of the *think* sentence is false, but the complement is true. In a typical false belief scenario, Swiper is hiding behind the curtain, but Dora thinks that he is behind the chest. In such a scenario, 3-year-olds reject (13), while older children and adults accept it. In this context, the entire sentence is true, but the complement is false. According to the conceptual hypothesis, children reject (13) because they are unable to attribute to Dora a false belief. According to the pragmatic hypothesis, they reject (13) because they assume an indirect assertion of the complement, which they know to be false. The crucial manipulation is a change in the target sentence. In the same false belief scenario where Swiper is behind the curtain and Dora thinks that he is behind the chest, children have to assess the target sentence in (14):

(14) Dora thinks that Swiper is behind the curtain.

[2] An anonymous reviewer points out that "the mere presence of conflicting mental states [could] draw attention to the fact that people may have different perspectives", or merely makes these beliefs salient; the increase in children's performance shows they can access the literal, belief ascription meaning of *think* even when the reported belief is false.

In this scenario, (14) is false, but the complement is true. Here, the two hypotheses make different predictions. According to the conceptual hypothesis, children should *accept* (14). Given that they are unable to attribute to Dora a false belief, and that the complement is true, they should attribute to Dora the true belief that Swiper is behind the curtain. The pragmatic hypothesis, however, predicts that children should correctly *reject* (14): if children have access to the literal meaning of *think*, they should reject (14) regardless of the truth of its complement.

The conceptual hypothesis thus predicts that children should reject (13) and accept (14) for the same reason: they cannot ascribe to Dora a false belief, so they reject a *think* sentence when the complement is false, but accept it when it is true. The pragmatic hypothesis predicts that children should reject *both* (13) and (14). They should reject (14) because they have access to its *literal meaning*, and that literal meaning is false; they should reject (13) because of its assumed *speaker meaning*, an indirect assertion of the complement, which is false, the same way C in (12) rejects B's speaker meaning in (11).

Our results support the pragmatic hypothesis over the conceptual hypothesis: children's responses were highly influenced by the truth of the complement when the entire sentence was true (as in [13]): they tended to accept the sentence if the complement was true, reject it if the complement was false, and vary when they did not know whether the complement was true or not. However, when the sentence was false (as in [14]), they correctly rejected it, regardless of the truth of the complement. Thus, like adults, 3-year-olds reject *think* sentences when their literal meaning is false. They further reject *think* sentences when they take the speaker meaning to be false, even in cases where adults do not.

To sum up, 3-year-olds appear to have the right semantics for *think*, or at least understand that it commits its subject to the complement, even if the complement is actually false[3]; they are able to respond to the literal meaning of a *think* sentence, and reject it if it is false. They tend to further reject *think* sentences that are literally true, but where the speaker meaning they assume is false.

The pragmatic hypothesis, according to which children's errors with *think* arise from over-assuming assertive uses, is reminiscent of Diessel and Tomassello's (2001) proposal that children's initial understanding of *think* is as an illocutionary force marker. However, it crucially differs in allowing children's knowledge be continuous with adults' in a way that Diessel and Tomasello's does not. Furthermore, our results show that 3-year-olds have access to the literal meaning of *think* sentences used to report a false belief.

Assuming that children have the right semantics for *think*, but pragmatics interferes, we ask why children do not make these kinds of errors with *want.* Given its meaning in the adult grammar, *want* does not lend itself as easily to indirect assertion uses. But how could children know this a priori, before they have fully mastered either verb? Why do not they hypothesize a meaning for *want* that would lend itself to routine indirect assertions? We hypothesize that syntax constrains children's hypothesis space for these verbs meanings.

4 | PRAGMATIC SYNTACTIC BOOTSTRAPPING FOR ATTITUDE VERBS

Three-year-olds consistently differ in their mastery of *think* and *want.* According to the traditional view, the source of children's difficulty with *think* is conceptual; according to our hypothesis, it is pragmatic. Whatever the source, it is clear that children treat the two verbs differently, even before they have fully mastered at least one of them. What gives rise to this early differential treatment of

[3] These results are compatible with children having a "factive" *think* (like *know*), but see Dudley, Orita, Hacquard and Lidz (2015) for evidence that children differentiate *think* and *know*.

the two verbs? What gets children to attribute to *think* a different semantics than *want*, one that leads them to reject *think* sentences when the complement is false?

In this section, we develop the hypothesis that the way children acquire the semantics of attitude verbs is by exploiting correlations between the syntactic shape and pragmatic function of attitude reports (Hacquard, 2014). We first discuss the semantics of attitude verbs and their subcategorization behavior in different languages, and then turn to their pragmatic uses. We then explain how syntax and pragmatics can work in tandem to help children figure out attitude verb meanings.

4.1 | *Want* and *think*: Syntax and semantics

While attitude verbs come in many flavors, they seem to split into two main semantic classes: those that express a judgment of truth ("representationals") and those that express a preference ("preferentials"). The representationals correspond to Hooper's (1975) "*assertives*", that is, attitudes that can be used to make indirect assertions:

(15) a. **Representational attitudes**: *think, know, say, believe…*

b. **Preferential attitudes**: *want, wish, demand, order…*

That representationals like *think*, but not preferentials like *want*, deal in matters of truth is evidenced by the following contrast (Pesetsky, 1992) (# indicates infelicity):

(16) Mom thinks that Andy is going to bed, *which is true.*

(17) Mom wants Andy to be going to bed, *#which is true.*

Syntactic subcategorization seems to track this split in representationality, as has been most extensively argued in the formal linguistic literature on mood selection in Romance languages. In Romance languages like French, representationals take complements with indicative mood, while preferentials take complements with subjunctive mood (Bolinger, 1968; Farkas, 1985; Hooper, 1975; Villalta, 2008):

(18) Maman pense que Andy est au lit.

Mommy thinks that Andy is-IND in bed.

(19) Maman veut que Andy soit au lit.

Mommy wants that Andy is-SUBJ in bed.

English does not use mood productively. Instead, it tracks representationality in two ways: via (i) finiteness: representationals tend to take finite complements and preferentials take nonfinite complements; (ii) "sentence-lifting" ("slifting"; Ross, 1973), where the main clause appears inside the complement (20), and "complement preposing," where the main clause follows the complement (21), which are only possible with representationals (Bolinger, 1968; Hooper, 1975) (* indicates ungrammaticality)[4]:

(20) John, {I think/*I want}, is home.

(21) John is home, {I think/*I want}.

[4] Slifting/preposing is less prevalent in French, but like in English, only representationals allow it.

In German, the use of mood is more productive than in English, but it does not track representationality as in Romance. Rather, subjunctive mood is used to indicate reported speech. German, moreover, differs from English in that it does not use finiteness to mark representationality. Yet, German still tracks representationality syntactically in at least two ways: via (i) slifting/preposing; (ii) word order. While in main clauses, the verb appears in the clause's second position (so-called "verb second"), in embedded clauses it typically appears at the end:

(22) Maria {denkt/will}, dass Peter heute kommt.
Maria {thinks/wants} that Peter today comes

However, representationals, unlike preferentials, optionally allow the embedded verb to appear in the second position (Scheffler, 2008). This is in fact the prevalent word order for verbs like *think* in child-directed speech (Brandt, Lieven & Tomasello, 2010):

(23) Maria {denkt/*will}, Peter kommt heute.
Maria {thinks/wants} Peter comes today
'Mary thinks that Peter is coming today.'

We thus see that in languages like English, French and German, representationality is marked syntactically, in ways that could potentially help the learner. However, the way it is tracked seems to be language-specific: mood in Romance; finiteness and slifting in English; word order in German. If there are no universal syntactic reflexes of representationality, how useful can syntax be in helping the child pick up meaning differences between verbs like *think* and *want*? At most, it might help children realize that the verbs belong to different semantic classes. But how do they figure out the correct semantic class? Can syntactic distribution do more than cluster attitude verbs in different classes? Can it provide cues as to particular semantic classes? To address this question, we first turn to their pragmatic uses.

4.2 | *Want* and *think*: Pragmatic uses

Representationals and preferentials trigger different routine pragmatic enrichments. Because preferentials express preferences, speakers can easily use them to make indirect requests, by implicitly endorsing the expressed preference:

(24) a. I want you to clean your room.
b. Dad wants you to clean your room.
c. **Speaker meaning**: *Clean your room!* [indirect request]

Because representationals express truth judgments, speakers can easily use them to indirectly assert the complement, by implicitly endorsing the expressed truth judgment:

(25) a. I think Mary is in her room.
b. Dad {said/thinks} that Mary is in her room.
c. **Speaker meaning**: *Mary is (perhaps) in her room.* [indirect assertion]

Indirect assertion uses of *think* are rampant in speech to children: most *think* sentences children hear have first person subjects and present tense (Bloom et al., 1989; Dudley et al., 2018, a.o.). In such cases, the main point of the speaker's utterance (her "primary speech act" in Searle's terms) is the proffering of the complement, rather than a mere belief report. The frequency of such uses may contribute to children assuming indirect assertions by default with *think.*

Want does not express a judgment of truth that can be endorsed, as the infelicity of (17) illustrates. This is why indirect assertion uses are less readily available with *want.* They are not, however, impossible. Consider a variant of the Simons dialog in (26):

(26) A: Why isn't Louise coming to our meetings these days?

B: Henry wants her to be out of town.

We can make sense of B's utterance in response to A's question by making additional assumptions about why Henry's desires might be relevant to Louise's whereabouts. We might assume that Henry is Louise's boss, whose desires amount to commands, which Louise tends to obey. However, if Henry has no authority on Louise and his desires no bearing on her actions, B's utterance seems inappropriate (in contrast, B's utterance in [11] is appropriate even if Henry's beliefs have no bearing on Louise's actions).

Thus, while speakers often use *think* to indirectly assert the complement, they do not typically do so with *want.* Yet, it is possible to use a *want* sentence to convey that the complement is true, as in the boss scenario in (26). Similarly, it is possible to use *think* to make indirect requests, as in (27), where the mother is telling her child to go to bed:

(27) I think it's time for bed.

While such uses may be less routine, they raise an important caveat as to the usefulness of indirect speech act cues to attitude meanings. To the extent that pragmatic bootstrapping can help, it needs to be constrained, to prevent children from hypothesizing desire meanings for verbs like *think* and belief meanings for verbs like *want*, in cases where these verbs are used for indirect requests and assertions, respectively. We will argue next that pragmatic bootstrapping is constrained by syntax, and that pragmatics, in turn, guides syntactic bootstrapping.

4.3 | Pragmatic syntactic bootstrapping for attitude verbs

We have seen that *think* and *want* belong to two different semantic classes that are routinely used to perform different indirect speech acts: assertions and requests. We hypothesized that children's errors with *think* are caused by their assuming indirect assertion uses to a fault, which leads them to respond to the truth (or rather falsity) of the complement. Children, however, do not make the same mistakes with *want*: they never reject a *want* sentence because they know the complement to be false. Why not? Why do they not assume indirect assertions with *want*? Why do they so systematically assume them with *think*? What gives away *want*'s and *think*'s semantic classes?

We saw that syntax may provide robust cues: in English, *think* takes finite complements, *want* nonfinite complements. A principled link between finiteness and representationality could help children categorize these two verbs. However, not all languages show the same finiteness distinction. In German, both *want* and *think* take finite complements. And yet children learning German show the same successes and failures with *want* and *think* as their English-speaking peers (Perner et al., 2003).

TABLE 1 Syntactic reflexes of representationality

	Main clause	Complement of *think*	Complement o*f want*
English	Finite	✓ Finite	✗ Finite
French	Indicative	✓ Indicative	✗ Indicative
German	Verb second	✓ Verb second	✗ Verb second

This, in fact, is what led Perner and colleagues to conclude that the asymmetry in acquisition between the two verbs must reflect a conceptual rather than a linguistic problem, since, they argue, children's comprehension of the two verbs is insensitive to language-specific differences. Given the varying cross-linguistic subcategorization profiles of attitude verbs, how does the learner know what to look for in the syntactic input, to figure out the semantic class that each verb belongs to?

We have seen different reflexes of representationality across languages: mood in Romance, finiteness in English, word order in German. Languages mark the same split syntactically, but with different syntactic reflexes. Children do not know what language they are learning, so how do they arrive at the correct language-specific mappings? A syntactic bootstrapping account needs to be universal so that it can help any child learning any language. And this universality must be abstract in a way that leads to variability in language-specific mappings, so that learning can be robust to this variation.

While the syntactic reflexes of representationality differ across languages, they converge in maintaining a distinction in whether the attitude verb allows declarative main clause syntax in its complement. Representationals all take complements that syntactically resemble declarative clauses, but preferentials do not. In Romance, the complements of representationals are in the indicative, the mood of declarative clauses. In English, they are finite, just like declarative clauses. In German, they allow verb second word order, the word order of declarative clauses (see Table 1). The syntactic features differentiating declarative clauses thus differ across languages—but within a language, the syntax of declarative clauses and that of the complements of representationals overlap.

At this abstract level, the syntax distinguishes the two attitude classes in the same way: representationals take complements with declarative syntax, preferentials do not. Paying attention to main clause syntax can thus help the learner differentiate *think* and *want* (and their French and German counterparts) early. But not only does it allow children to bin the verbs in different classes, main clause syntax is informative as to what the class is, given its connection to speech acts. Indeed, the syntactic reflexes are not random: the syntax associated with *assertions* (*declarative* clauses) is found in complements of attitudes used for *indirect* assertions (i.e., representationals).[5] Thus, hearing attitude reports with declarative syntax in the complement might lead children to hypothesize that the speaker's message is an indirect assertion. This in turn might lead them to infer that the embedding verb is one whose semantics lends itself to indirect assertions—that is, one that expresses a truth judgment that the speaker can endorse; that is, that it is representational.[6]

To sum up, children make categorical distinctions between *think* and *want* early on, rejecting true *think* sentences with false complements, but accepting corresponding *want* sentences. We argued that this is due to a tendency to assume indirect assertions of the complement with *think.* Three-year-olds do not reject *want* sentences with false complements because they do not assume indirect assertions. What leads children to assume different meanings and pragmatic functions for *think* and *want* is their syntactic distribution: like other representationals, *think* takes complements that allow declarative

[5] See, for example, Hooper (1975), Thompson and Mulac (1991), Dayal and Grimshaw (2009).

[6] It cannot be that children only pay attention to the complement and assume that it is indirectly asserted. As we saw in section 3.2, 3-year-olds do not ignore *think*: they *reject* false sentences with *true* complements. Thus, children seem to keep track not only of the shape of the complement, but also of the fact that it is *embedded.*

syntax; *want*, like other preferentials, does not. While children do not have direct access to the underlying semantics, there are helpful correlations between syntax (clause type) and pragmatics (speech acts) that they can exploit, and that give them a way into the broad semantic class each verb belongs to.

5 | EVIDENCE FOR PRAGMATIC SYNTACTIC BOOTSTRAPPING

For syntactic bootstrapping to work, subclasses of attitude verbs must have different syntactic distributions. In addition, it must be that these differences can be linked to cross-linguistically stable properties, so that it is possible for learners to link the distributional differences to those aspects of meaning that explain them. Finally, learners must be sensitive to the relevant distributional features and use them to make inferences about meaning. This is what we show in the next sections.

5.1 | Predicting representationality from syntactic (main clause) features

In White, Dudley, Hacquard and Lidz (2014); White, Hacquard and Lidz (2018a), we test whether subclasses of attitude verbs reliably show different distributional signatures. We collect two kinds of adult judgment data: first, syntactic acceptability judgments for a set of 30 attitude verbs in 19 syntactic environments, which were used to identify subclasses of verbs based on the similarity of judgments across all 19 environments. We find that the acceptability judgments are predictive of semantic subclasses of verbs, as identified by the linguistics literature (e.g., the representationality split). Second, we collect semantic similarity judgments in sets of three for all 30 verbs. Again, we find that verbs can be classified along several meaning dimensions and that these dimensions are like those identified by prior linguistics literature. Finally, we show that the verb similarities identified in the semantic similarity task are highly predictive of the similarities identified in the syntactic acceptability judgment task. Together, these results indicate that attitude verbs with similar meanings show similar syntactic distributions. This result establishes the first condition on the syntactic bootstrapping hypothesis, namely that verb meaning is predictive of syntactic distribution.

In White, Hacquard and Lidz (2018b), we address the subsequent question of whether the semantic classes of attitude verbs are linked to cross-linguistically stable properties of syntactic distribution, focusing on the role of declarative clause features as a cue to representationality. As discussed above, although languages differ in the particular features that distinguish representationals from preferentials, there is a higher order generalization that links these classes to the syntax. Specifically, representationals take complements that have syntactic features of declaratives. Our model proceeds in two steps. First, it identifies the morphosyntactic features of declarative main clauses. In English, these features include lack of a complementizer, presence of subject/verb agreement, obligatory overt subjects, among others. The model then looks for these features inside complement clauses to classify the embedding verbs. This model successfully figures out the representationality split in English. Crucially, it does so not by relying on specific morphosyntactic properties, but rather, via more abstract expectation about verb classes, whose expression can be discovered depending on the surface features of the language being acquired.

5.2 | Sensitivity to syntactic cues in attitude verb learning

We now turn to the question of whether actual learners take declarative syntax as evidence for representational meanings. We present initial evidence that children do use syntactic cues like finiteness when figuring out the meanings of unfamiliar (*hope*) and novel attitude verbs.

So far, we have been assuming that attitudes either belong to the representational or the preferential class. This is, however, not quite accurate. A few verbs (*hope*, *fear*, *worry*…) share semantic and syntactic properties with both representationals and preferentials. Like *want*, *hope* clearly expresses a preference. However, *hope* further expresses doxastic possibility (Anand & Hacquard, 2013; Portner, 1992; Scheffler, 2008), as the following contrast illustrates:

(28) a. Dora knows that it's not raining, #but she hopes that it is.

b. Dora knows that it's not raining, but she wants it to be.

(28a) seems contradictory in a way that (28b) is not. This is because *hope* (but not *want*) conveys that the hoper believes that the complement is possibly true.

Because *hope* expresses a doxastic possibility for its subject, a *hope* report can be used to indirectly proffer this possibility (Scheffler, 2008):

(29) A: Where is John?

B: I hope that he's here/I think that he's here/??I want him to be here.

Hence, *hope* shares semantic features with both *want* (desire) and *think* (belief). Interestingly, it also shares syntactic features with both. In English, *hope* can take both finite and nonfinite complements. In German, it allows verb second word order in its complement. In Romance, it can take either subjunctive or indicative complements (Farkas, 1985). Given that *hope* can appear with both finite and nonfinite complements, we can ask whether complement type influences children's interpretation. We predict that children should initially tend to assume indirect assertion uses for *hope* with a finite complement, but not with a nonfinite complement.

In Harrigan, Hacquard and Lidz (2016, 2018b), we provide support for this hypothesis in experiments probing 4-year-olds' understanding of *hope. Hope* is relatively uncommon in child-directed speech; it should thus be familiar enough to 4-year-olds to know that it is an attitude verb, but perhaps not enough for them to be sure about its meaning. We set up a game where both the beliefs and desires of a puppet, Froggy, are salient, and test whether the syntactic shape of the complement influences children's interpretation of *hope.*

In this game, the child and one experimenter are behind an occluder, while Froggy is on the other side. In front of the child is a box with 40 wooden hearts and stars, which are either red or yellow. Color is predictive of shape: 15 of the hearts are red, 5 are yellow, and 15 of the stars are yellow,

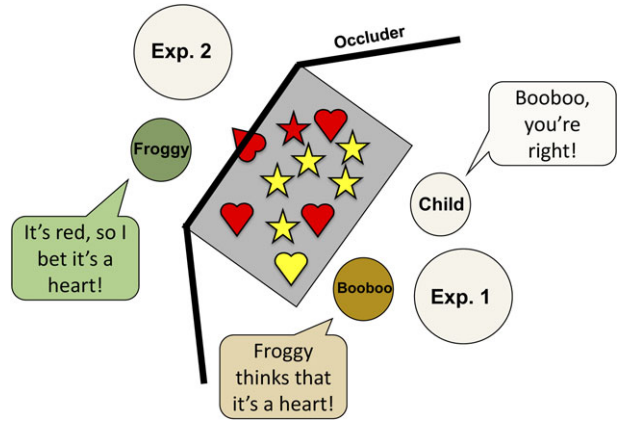

FIGURE 1 Set up for task testing children's comprehension of *think, want* and *hope* (from Harrigan et al., 2018b)

5 are red. The child and the experimenter pull shapes out of the box to show Froggy, and every time the shape is a heart, the child gives Froggy a sticker. Froggy likes getting stickers; therefore, his desire on every trial is that the shape be a heart. On each trial, before Froggy sees what the shape is, the child and the experimenter show him a "clue," which is ambiguous as to shape but not color, by inserting a point (of the heart or the star) through an opening in the occluder (see Figure 1). Thus, on every trial, Froggy has both a desire about shape (he always wants the shape to be a heart), and a belief about shape (when it is red, he always guesses that it's a heart and when it is yellow, that it's a star). Another puppet, Booboo, whom the child is told is "silly and wants to learn how to play the game, but often gets things mixed up," utters test sentences about what Froggy wants (30), thinks (31), or hopes (32) and (33). The child's task is to say whether Booboo is right.

(30) Froggy wants it to be a heart/star!

(31) Froggy thinks that it's a heart/star!

(32) Froggy hopes to get a heart/star!

(33) Froggy hopes that it's a heart/star!

Our results replicate the traditional split in performance with *think* and *want.* Children correctly judge *want* sentences even when the reported desire conflicts with reality, but they tend to reject *think* sentences that report beliefs that conflict with reality. Crucially, children's responses to *hope* sentences differ significantly, based on the syntactic frame in which they are presented. With a finite complement, their responses pattern with responses to *think* sentences. However, with a nonfinite complement, their responses pattern with responses to *want* sentences.

These results reveal that children use complement syntax to identify aspects of an attitude verb's meaning: 4-year-olds treat *hope* as a desire verb when it takes a nonfinite complement, and a belief verb when it takes a finite complement. One potential concern with this finding is that it depends on children's performance with a real verb (though one that they likely have very little experience with) and uses the false belief error as evidence of the verb's representationality.

To get a more direct demonstration of the role of syntax in learning attitude meanings, in Lidz, Dudley & Hacquard, 2017, we test 4-year-olds' understanding of a *novel* attitude verb, in an experiment building on Asplin, 2002. In a representative story, Dad (the discoverer) leaves chicken legs on the kitchen table and goes to work. Fido (the actor) arrives hungry but cannot find any food. Jimmy (the enticer) arrives and **entices** Fido to eat the chicken legs, puts them in Fido's bowl and leaves. Fido decides to eat the chicken. When Dad returns, he finds his chicken legs gone and chicken bones in Fido's bowl, thereby **discovering** that Fido ate his chicken. The enticer has a desire (for Fido to eat the chicken); while the discoverer has a belief (that Fido ate the chicken). After each story, two puppets deliver test sentences as descriptions of the story using the same novel verb and complement syntax (finite vs. nonfinite), but with different subjects:

(34) Finite Condition

Puppet 1: *Dad* gorped that Fido ate the chicken.

Puppet 2: *Jimmy* gorped that Fido ate the chicken.

(35) Nonfinite Condition

Puppet 1: *Dad* gorped Fido to eat the chicken

Puppet 2: *Jimmy* gorped that Fido ate the chicken.

Preferential attitudes (e.g., enticings) take nonfinite complements; representational attitudes (e.g., discoveries) take finite complements. If children are sensitive to this mapping, they should pick the discoverer when they hear a sentence with a finite complement, but the enticer when they hear a sentence with a nonfinite complement. This is what we found. In the finite condition, children were significantly more likely to pick the puppet that mentioned the discoverer, but in the nonfinite condition, they were significantly more likely to pick the one that mentioned the enticer.

6 | CONCLUSIONS AND IMPLICATIONS

When learning word meanings, children do not have direct access to the semantics: all they ever get exposed to are speaker meanings and syntactic forms. Children somehow have to infer the semantics from both. We have focused here on how children learn the meaning of *think* and *want*, two verbs that children seem to differentiate early on, even before they have fully mastered their meaning, and examined the syntactic and pragmatic contributors to this learning process.

We have argued that because children are not exposed to the semantics directly, they have to reconstruct it by exploiting correlations between syntactic distribution and pragmatic function. Specifically, we have hypothesized that the way syntax helps bootstrap attitude class is by offering parallels between the clause type used for different speech acts, and the syntax found in the complements of attitude verbs used to express the corresponding indirect speech acts.

Representationals are often used for indirect assertions because they express judgments of truth that the speaker can endorse. We proposed that the learner could figure out *think*'s semantic class by matching the syntax of its complement with the syntax typically used for assertions, that is, declarative clauses. This is illustrated in Figure 2. The observable features of the language and context appear below the dotted line, the linking between semantics, syntax and pragmatics above it. The learner uses observations about the use of a sentence to infer its semantics.

Preferentials report preferences, and are often used for indirect requests. Young children seem adult-like with *want* in never responding to the falsity of the complement. This, we argued, is because *want* is not typically used for indirect assertions, and children are cued to this from the fact that *want* does not take complements with declarative syntax. But might they not make other speaker meanings errors, by over-assuming, for instance, that a desire report is an indirect request? We leave this possibility for future research.

We have argued that for syntactic bootstrapping to work for attitude meanings, it needs to be abstract enough to be used by learners of various languages, but still lead to language-specific syntax/semantics mappings. The pragmatic syntactic bootstrapping hypothesis we propose does not require hard-coding language-specific information, such as finiteness, but it does require that learners be equipped with certain expectations by the time they are learning attitude meanings. Minimally, they would need an understanding that (i) some verbs embed clauses, and that when they do, they report a relation between the subject and some state of affairs described by the complement; (ii) certain clause types are strongly associated with certain speech acts (e.g., declarative clauses with assertions); (iii) speech acts can be indirect; (iv) the type of complement an attitude verb takes is predictive of its meaning, in matching the clause type of the canonical speech act the verb easily lends itself to.

We have focused on a handful of languages here, because their syntax, semantics and acquisition have been extensively studied. Other languages, however, may not mark representationality in such explicit ways. Do children learning such languages show the same acquisitional profile as their English learning peers? In Huang, Liao, Hacquard & Lidz, 2018, we argue that even in a language

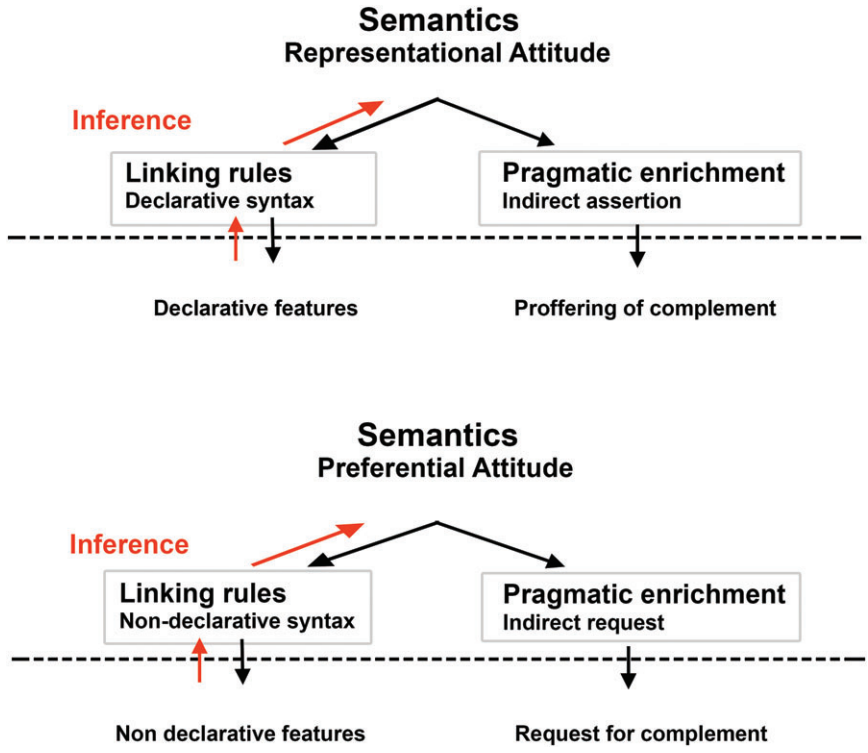

FIGURE 2 Pragmatic syntactic bootstrapping for representationals (e.g., *think*) and preferentials (e.g., *want*)

like Mandarin, with no clear finiteness markers, syntactic hallmarks of declarative clauses still differentiate complements of representationals and preferentials—for instance, in allowing aspect markers and overt subjects. It remains to be determined whether such cues are sufficient in acquisition.

Finally, we have argued that children's pragmatic competence, while not completely adult-like, is quite sophisticated. According to our proposal, children's errors with *think* arise from children reading too much into the intentions of a speaker using a *think* sentence—namely, in assuming that the speaker is proffering the complement. This pragmatic overdrive seems to go counter to the conventional wisdom, according to which children tend to be hyper literal and unable to compute enriched meanings. This conventional wisdom is motivated by the literature on scalar implicatures, starting with Noveck's (2001) pioneering study, which shows that with scalar expressions, children tend to respond to literal meaning and fail to compute an enriched meaning. The question in that literature is how children get from literal to enriched meaning. The question we addressed here is the converse: given that children are only ever exposed to speaker meanings, and given that attitude verbs are routinely used in enriched contexts, how do children extract their literal content? Our results suggest that children have an early appreciation that literal and speaker meanings do not always align. Children can—and, in fact, do—hypothesize speaker meanings, but with belief reports they have trouble figuring out when speaker meanings are merely literal meanings. The source of this difficulty is likely the overwhelming frequency of indirect assertion uses of *think* in speech to children, which may lead them to assume such uses by default. But if children have access to speaker meanings, their difficulty with scalar implicatures cannot be due to an inability to assume speaker meanings that go beyond literal meaning. Instead, it might stem from difficulty figuring out what alternatives are relevant in a given context (for overviews, see Lewis, 2013; Pouscoulous, 2012; Papafragou & Skordos, 2016).

Our results thus add to the growing body of literature that argues that young children's pragmatic abilities have been underestimated: children's pragmatic sophistication is present early on—and is, in fact, necessary to get attitude verb learning off the ground.

ACKNOWLEDGEMENTS

We are grateful to our collaborators: Shevaun Lewis, Aaron White, Kate Harrigan, Rachel Dudley, Naho Orita, Morgan Moyer, and Meredith Rowe; to our research assistants: Fayna Kostyukovsky, Sam Blitzstein, Leah Whitehill, Jessica Lee, Sara McVeigh, Anne Ramirez, Susan Ojo, Anna Ball, Courtney Cooper; and to lab manager Tara Mease. For useful feedback, thanks to Pranav Anand, Erin Eaker, Jane Grimshaw, John Grinstead, Chris Kennedy, Angelika Kratzer, Keir Moulton, Magda Oiry, Paul Pietroski, Tom Roeper, Florian Schwarz, Jill De Villiers, Evan Westra, and Alexander Williams. This research was supported by NSF grant #BCS-1124338.

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How to cite this article: Hacquard V, Lidz J. Children's attitude problems: Bootstrapping verb meaning from syntax and pragmatics. *Mind Lang*. 2018;1–24. https://doi.org/10.1111/mila.12192