Bootstrapping into Attitudes

Valentine Hacquard
University of Maryland

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...dax...
Bootstrapping into Attitudes

• Not all meaning can be gleaned from situational context alone.

• Attitudes not directly observable. Meaning of attitude verbs (think, want, know...) hard to access without linguistic context.

Gleitman 1990; Gillette et al 1999; Papafragou et al 2004; Gleitman et al 2005
The torp daxes that the vam is in the siltap.
Syntactic bootstrapping

- Children learning meaning of new words work from **constrained space of hypotheses**.
- Principled links between certain semantic and syntactic properties.
  - **Syntactic properties** easier to observe.
  - Syntactic properties provide evidence to the learner about **semantic properties**.

  (Gleitman 1990, Pinker 1989, Lidz 2006... )
Pragmatic challenge 1:
Sentence vs. speaker meaning

Often what people *mean* goes further than what they *say*.

S: “Some students turned in their homework”.

*Implicature*: Not all students turned in their homework
Sentence vs. speaker meaning

• What if the child only heard *some* in enriched contexts, might she lexicalize *enriched meaning*?
  
  – Probably not for *some*.

Noveck, 2001; Chierchia et al. 2001, Papafragou & Musolino 2003, a.o.

– Enough exposure to non-enriched contexts?
– Expectations about meaning complexity?
Sentence vs. speaker meaning challenge:
Can children always extract literal content of an expression from the meaning conveyed?
Pragmatic challenge 2: not at issue content

• Certain words impose requirements on state of discourse as conditions for use.

• Utterances made against a variety of background assumptions. How does the child detect which are required by the conventional meaning of an expression?
Not at issue content

Sentences do not come with ‘#’ any more than they come with ‘*’.
The pragmatic challenge

Syntax

Semantics

Speaker message
The pragmatic challenge

Semantics

Syntax

Speaker message
The pragmatic challenge

Given that children lack direct access to semantics, and only ever hear speaker meanings, how do they untangle semantic and pragmatic contributions?

• Might the child lexicalize an implicature?
• Might she miss a presupposition?
The pragmatic challenge & Attitudes

– **Attitudes** not directly *observable*.

– Some attitudes associated with *presuppositions*.

– Prone to **pragmatic enrichments**:

  • Attitude verbs report speech acts and mental states, and thus are often used for indirect speech acts.
Bootstrapping into Attitudes

• *When* and *how* do children learn attitude meanings?
• What role do *syntax* and *pragmatics* play?

Goals:

• Better understanding of young children’s *semantic* and *pragmatic* competence, and acquisition process.
• Inform theories of interfaces between *syntax-semantics* and *semantics-pragmatics*.
Bootstrapping into Attitudes: Road Map

• ‘Speaker vs. sentence meaning’ challenge: the case of *want* and *think*

• ‘Not at issue content’ challenge: the case of *think* vs. *know*
think vs. want

‘sentence vs. speaker meaning’ challenge
Early understanding of attitude verbs

Cross-linguistically, *think* is acquired late, but *want* isn’t.

Previous research suggests that children:

- Don’t fully master *think* until almost age 5.
- They seem to master *want* at least by age 3.

Tardiff & Wellman 2000; Perner et al 2003...
Early understanding of attitude verbs

Young children consistently misinterpret *think* sentences.
Typical *think* Fail!

(1) Dora *thinks* that Swiper is behind the chest.

*Context:*
*Swiper is behind the curtain*
*Dora thinks he’s behind the chest*

Adults: *True!*
3-4 year olds: *False!*
Early understanding of attitude verbs

However, young children do not seem to have the same difficulties with want sentences.
Typical want Success!

(2) Dora *wants* Swiper to be behind the chest.

**Context:**
Swiper is behind the curtain  
Dora thinks he’s behind the chest

Adults: *-True!*  
3-4 year olds: *-True!*
Whether *want* is used to report a desire that *conflicts with reality*, or *with the child’s own desire*, 3 year olds know that (2) can be true, even if the complement is false.

_Harrigan et al, in prep._
Conceptual Development Hypothesis

• *think* is acquired late because the concept it expresses, i.e., BELIEF, is itself acquired late.

• *want* is acquired earlier because the DESIRE concept is acquired earlier.

Conceptual Development Hypothesis

Children don’t understand that others can have beliefs different from their own until they’re 4.

They don’t have a “Theory of Mind”, as evidenced by their consistent failure at False Belief Tasks.
Doubting the conceptual hypothesis

However:

• **Infants** show understanding of false beliefs in implicit measures.

  Onishi & Baillargeon 2005, Song, et al. 2008, Southgate et al. 2007...

• Perhaps **belief concept** in place early on. Failures at *explicit False Belief tasks* due to extra task demands.
Children’s understanding of *think*

**Pragmatic Hypothesis:**

Children learn the right semantics for *think* and know that people can be mistaken in their beliefs, but this knowledge is obscured.

Their difficulty with *think* is in figuring out what people *mean* when they *say* ‘*think*’...
Untangling *sentence* & *speaker* meaning

*FB scenario*: Swiper is behind the curtain, but Dora thinks he’s behind the chest.

(1) Dora thinks that *Swiper is behind the chest*.
   -FALSE!

(2) Swiper is behind the chest.
   -FALSE!

Children seem to respond to the truth of the *complement* rather than truth of *entire clause*. 
Understanding *think*

Even *adults* sometimes respond to the truth of the complement.

A: Why is John not in his office?
B: Mary thinks he’s out of town.
C: Nuh-uh! He’s here!

C doesn’t deny that Mary holds a particular belief, but denies the content of the *complement* directly.
Understanding *think* in context...
Basic use of *think*...

Sometimes we use *think* to *report a belief* which we may not endorse *(basic use)*:

> Dora *thinks* that Swiper is behind the chest.  
>(that’s why she’s looking for him there)
Pragmatic enrichment with *think*

Sometimes we use *think* to *endorse* someone’s claim (*pragmatically-derived “endorsement” use*):

A: Why is John not in his office?
B: Mary thinks he’s out of town.

*What B said:* Mary thinks John is out of town.
*What B meant:* John is probably out of town. *(I heard it from Mary).*
Pragmatic enrichment with *think*

A: Why is John not in his office?  
B: Mary thinks he’s out of town.

- **Literal** content of B’s utterance doesn’t answer A’s question.

- **Relevance Implicature:** B’s answer addresses A’s question if B *endorses* John’s thought.

- **Quantity implicature:** not *full* endorsement (cf. ‘Mary is out of town’)

[Simons 2007]
Pragmatic enrichment with *think*

- Speakers sometimes use *think* sentences to ‘*proffer*’ the content of complement clause.

- The complement clause carries the ‘*main point*’; main clause plays *evidential* function.

[Simons 2007]
Pragmatic enrichment with *think*

Perhaps children systematically assume *endorsement* uses, even when adults do not?
Pragmatic enrichment with *think*

So that whenever children hear someone *say*:

“Mary thinks John is out of town”

They assume he *means*:

“John is (probably) out of town”

And they say:

“*false!*” if John is not out of town.
Pragmatic enrichment with *think*

Why would children systematically assume enriched uses?

- Uses of *think* with endorsement enrichments frequent in *adult* speech.

- Reinforced by the fact that many instances of *think* are with 1\textsuperscript{st} person subjects.

cf. Diessel & Tommasello (2001)
Pragmatic hypothesis

If children’s difficulty with *think* is primarily *pragmatic*, and not *conceptual*, they should be able to respond to *literal* content in the right contexts.


Shevaun Lewis
3 year olds’ understanding of *think*

*Dora is looking for Swiper...*

*A game of hide and seek*
Typical False Belief Fail

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

**FB context:**

\[ D. \text{ thinks Swiper is behind the chest}\]  \hspace{1cm} \text{sentence true}
\[ \text{Swiper is behind the curtain}\]  \hspace{1cm} \text{complement false}

3 year olds: *False!*
(1) Dora thinks that Swiper is behind the chest.

**Pragmatic Hypo:** kids say *False!* because they assume *endorsement*

**Conceptual Hypo:** kids say *False!* because they can’t conceive a false belief.
• Can children respond to *literal* meaning as well (i.e., belief attribution?)

• Can they *reject* a *think* sentence that is *false*, based on a wrong attribution of belief?
(2) Dora thinks that Swiper is *behind the curtain*.

*FB context:*

*D. thinks Swiper is behind the chest*

Swiper is behind the curtain

*sentence FALSE  complement TRUE*
(2) Dora thinks that Swiper is *behind the curtain*.

If children understand the belief attribution that *think* expresses, they should *reject* (2), *regardless of the truth of the complement*. 
(2) Dora thinks that Swiper is *behind the curtain*.

**Pragmatic Hypo**: kids say *False!* (respond to *belief ascription*)

**Conceptual Hypo**: kids say *True!* (complement true; no False Belief)
Pragmatic Hypothesis Predictions

– When the sentence is true, children assume endorsement and respond to truth of the complement.

– When the sentence is false, children reject it, regardless of the truth of the complement.
Results

3 year olds’ responses highly influenced by complement truth when the sentence is *true*.

3 year olds reject *false* sentences, regardless of complement truth.
Results

• *Like adults*, children reject sentences when the *literal* meaning is false.

• They further reject sentences when they take the *speaker meaning* to be false, even in cases where adults do not.
think

Hypothesis:

- Children have roughly right semantics for *think*.
- Difficulty is *pragmatic*: children assume enriched meaning for *think* $p$, in which speaker endorses truth of $p$, even when adults do not

(either default pragmatic enrichment or lexicalized enrichment)
think vs. want

What about want?

• Why are children so good with want?

• Why don’t they ever respond to the truth of the complement, as with think?
Hypothesis:

- Children have the right semantics for *want*.
- Children don’t respond to the complement with *want*, because *want* doesn’t trigger the kinds of endorsement enrichments *think* does.

A: Where is John?
B: #(I want) him to be in Miami.
B: (I think) he’s Miami.
think vs. want

Why does think lend itself to endorsement enrichments and want doesn’t?

thinko = think but no endorsement interpretation
wanto = want but endorsement interpretation

• Why no thinko and wanto in natural language?
• Why no thinko and wanto in child language?
Semantics of attitude verbs: 

*think* vs. *want*
think vs. want: semantic sketch

Two semantic classes of attitude verbs:

– **Representational attitudes** express *judgments of truth*:
  
  *think, believe, claim, argue...*

– **Preference attitudes** express *preferences*:
  
  *want, wish, order, demand...*

**think vs. want: semantic sketch**

- *think* (but not *want*) expresses a judgment of truth, which a speaker can endorse *directly*:

  (1) Mary thinks that John is in Miami, **which is true**.
  (2) Mary wants John to be in Miami, **#which is true**.

  (3) Mary **correctly** thinks that John is here.
  (4) **#Mary correctly** wants John to be here.

- Or *indirectly* (via relevance implicature):

  A: Where is John?
  B: Mary thinks (correctly) he’s in Miami.
think vs. want: semantic sketch

Because of their *semantics*:

- *think* gets *endorsement of truth* enrichments.
- *want* doesn’t.
thinko & wanto in child language?

- Kids don’t know *a priori* ‘*want*’ means **WANT** (preference) and ‘*think*’ means **THINK** (judgment of truth).

  - Why don’t they ever assume endorsement enrichments for *want*? **WANTO**?

  - Given how good they are accepting *want* sentences with a false complement, why *do* they respond to complement truth with *think*? **THINKO**?

- What gives away *want* and *think*’s semantic classes?
Syntactic Bootstrapping

Syntax cues semantic class.

• **Finiteness of complement?**

  ...Elmo DAXES *that* Ernie *is* behind the bench...
  ...Elmo DAXES Ernie *to be* behind the bench...

**?Constraint:** finite complements = judgments of truth
infinitival complements = preferences
Syntactic Bootstrapping

?Constraint: finite complements = judgments of truth
infinitival complements = preferences

• What about German or Mandarin, which lack same finiteness distinction for *think* and *want*?

(1) Maria *denkt*, dass Peter heute noch *kommt*.
(2) Maria *will*, dass Peter heute noch *kommt*.

*Maria thinks/wants that Peter today still comes*
Syntactic cues

Finiteness just one of several syntactic cues that split the attitude pie in the same two halves (within and across languages)...
Syntactic cues

Mood selection in Romance languages:

(1) Marie *veut* que Jean *soit* à Boston.
Marie *wants* that Jean be-*SUBJ* in Boston

(2) Marie *pense* que Jean *est* à Boston.
Marie *thinks* that Jean be-*IND* in Boston

Bolinger 1968, Farkas 1992, Giannakidou 1998...
Syntactic cues

German:  \textit{V2 complementation}

(1) Maria \textit{denkt}, dass Peter heute noch \textit{kommt}.
(2) Maria \textit{will}, dass Peter heute noch \textit{kommt}.

Maria \textit{thinks/wants} that Peter today still comes

(3) Maria \textit{denkt}, Peter \textit{kommt} heute noch.
(4) *Maria \textit{will}, Peter \textit{kommt} heute noch.

Maria \textit{thinks/**wants} that Peter \textit{comes} today still

Meinunger 2006, Truckenbrodt 2006, Scheffler 2008...
Syntactic cues
differ cross-linguistically, even if the semantic classes are the same:

- Finiteness (English...)
- Mood (Romance...)
- V2 complements (German)

Issue: Children do not know they’re speaking French vs. English vs. German...
The universality challenge

A syntactic bootstrapping account has to be abstract enough to be ‘universal’, but language-specific enough to be useful to the learner.
Syntactic cues

Cues varies across languages, but converge in making a distinction in whether a verb allows syntax of (declarative) ‘main clauses’ in its complement (Dayal & Grimshaw 2009).

English

John is in Boston.
Mary *thinks* John is in Boston.
Mary *wants* John to be in Boston.

French

John est à Boston.
Mary *pense* que John est à Boston.
Mary *veut* que John soit à Boston.

German

John ist in Boston.
Marie *denkt*, dass John ist in Boston.
Mary *will*, dass John in Boston ist.
## Syntactic cues

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</table>
main clause syntax & representationality

Semantics
Represent. attitude

Syntax
main clause features

Speaker message
proffering (indirect assertion)
Addressing the Universality Challenge

• No need to specify *particular* syntactic properties.

• The learner only needs to note whatever *syntactic features* appear in *(declarative) main clauses*, and look for same features in *embedded clauses*. 
What Would a Learner Do?

A learner looking for syntactic features in complement clauses that match **main clauses** quickly discovers the **representational/preferential** split.

Aaron White
**think vs. want: summary**

- Children differentiate *think* and *want* early on.
- Even when they are not fully adult-like, they know to treat *think* and *want* differently.

**Proposal:**

*Syntax* gives away *semantic class*, via the types of *pragmatics* enrichments these verbs trigger.
think vs. know

‘Not at issue’ challenge
think vs. know

- *Think* and *know* both express belief:

  1. John thinks that Mary is out of town.
  2. John knows that Mary is out of town.

- *Know* further presupposes truth of its complement.
think vs. know

Can children differentiate *think* and *know*?

- Do they understand that *think* is non factive?
- Do they understand that *know* is factive?
think: sentence v. speaker meaning

Three year olds tend to assume endorsement uses of *think*.

– **Default** pragmatic enrichment?

– **Lexicalization** of enriched meaning?

  *child think = adult know??*
think

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

3 year olds: *False!*

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

3 year olds: *False!*

*Context:*
*Dora thinks Swiper behind the chest*  
*Swiper is behind the curtain*
child think = know?

(1) Dora *knows* that Swiper is behind the chest.

3 year olds: *False!*

(2) Dora *knows* that Swiper is behind the curtain.

3 year olds: *False!*

**Context:**
Dora thinks Swiper behind the chest
Swiper is behind the curtain
Know: not at issue content

Can the child detect know’s presupposition?
think vs. know

• Children said to not distinguish think and know until age 4, and to not use meaning difference for quantity implicatures.

(1) I think that the toy is in the blue box.
(2) I know that the toy is in the red box.

Cf. Harris 1975; Abbeduto & Rosenberg 1985; Moore et al. 1989…

• Not surprising given endorsement uses with think.

• Can kids distinguish think and know under negation?
3 year olds understanding of *think* vs. *know*

Task: Find the toy!

(1) Lambchop *thinks* that it’s in the blue box.
(2) Lambchop *knows* that it’s in the blue box.
(3) Lambchop doesn’t *think* that it’s the blue box.
(4) Lambchop doesn’t *know* that it’s in the blue box.

*Dudley et al, to appear*
Results

• As a group, 3 year olds differentiate *think* and *know*.

• All 3 year olds have *non factive think*.

• Some 3 year olds have *factive know*.

• Some 3 year olds have *non factive know*. 
• Three year olds seem to have adult-like non factive semantics of *think*.

• Tendency to assume endorsement with *think* not due to factive representation of *think*.

**Hypothesis:** Difficult with *think* sentences is in determining when *beliefs* are relevant in context (cf. Lewis 2012).
factivity

– What gives away *know’s factivity* (and *think’s non factivity*)?
  
  • *Speakers’ commitment to complement p?*
  • State of the discourse? *(was ‘p’ mentioned before?)*
  • Syntax?

– And why don’t *all* children figure out *know’s factivity* at the same time?
Syntactic clue?

Principled link between *factivity* and ability to take declarative and interrogative complements*?*

(1) John knows that Mary left.
(2) John thinks that Mary left.

(3) John knows whether Mary left.
(4) *John thinks whether Mary left.

Cf. Hintikka 1975; Karttunen 1977; Ginzburg 1995; Egre 2007...

*at least for doxastics*
What’s in the input?

Could *factivity* variation be due to *input* variation?

- What kinds of discourses do *think* and *know* appear in child-directed speech?

- Have adult-like children heard more uses of *know* with both interrogative and declarative complements than non adult-like children?

Correlations between types of *think* and *know* sentences in input and performance on factivity task?
In conclusion...
Child attitudes

- **think/know vs. want**: Robust **meaning** difference.
  - Robustly tracked by **syntax**.
  - May help child early on.

- **think vs. know**: much more subtle **meaning** difference, which some 3 year olds can detect.
  - **Syntax** may help adult-like 3 year olds.
  - Syntactic cues not as reliable or salient?
The pragmatic challenge

**Semantics**

**Syntax**

**Speaker message**
Indirect speech acts and syntax

Representational (think):
  – Report: judgment of truth
  – Enrichment: indirect assertion \((D \text{ thinks}) \text{ S is behind the chest}\)
  – Syntax: declarative main clauses (assertions)

Preferentials (want):
  – Report: preference
  – Enrichment: indirect request \((D \text{ wants you to}) \text{ go to your room}\)
  – Syntax: imperatives

Rogatives (ask):
  – Report: question
  – Enrichment: indirect question \((D \text{ is asking}) \text{ where is S}\)
  – Syntax: interrogative main clauses
Indirect speech acts and syntax

• How frequent are request and question enrichments in child-directed speech? Do they ever trip up the learner?

• Can and does the learner exploit syntactic parallels between direct/indirect requests and direct/indirect questions to learn semantics of preferentials and rogatives?
Child pragmatics

Are children “bad” at pragmatics?

- This question presupposes children have prior access to *literal* content that inferences are based off.

- However, what children ever get to hear are *speaker* meanings, not *literal* meanings.

- Children are in fact *good* at understanding speakers’ meanings. Sometimes *too* good.
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False Belief Understanding

Change of Location Task (Wimmer & Perner 1983)

Where will Sally look for her ball?

- Adults and 5-year-olds: *in the basket*
- 3-4 year-olds: *in the box*

Baron-Cohen, Leslie & Frith (1986)

Cf. Wellman, Cross and Watson 2001 for meta-analysis
• 3-year-olds have difficulty maintaining multiple perspectives:
  – conflict with reality?
  – conflict with own attitude state?

• These conflicts are always present with think but not with want in experimental contexts.
Typical experimental context for *think*:

*Scenario:* *Ernie is NOT behind the bench.*

(1) Elmo *thinks* that Ernie is behind the bench.

- Conflict with *reality*
- Conflict with *child’s own belief state*
Typical experimental context for *want*:

*Scenario:* Ernie is NOT behind the bench.

(1) Elmo *wants* Ernie to hide behind the bench.

- **No** direct conflict with *reality* due to future orientation with *want*
- **No** conflict with *child’s own desire state*
Children’s understanding of want

Exp 1: Test want with forced present-orientation in situations that conflicts with reality.

Exp 2: Test want in situations where reported desire conflicts with child’s own desire.

Results: 3 year olds succeed at both

Cf. also De Villiers 2005; Rackoczy et al. 2007
Children’s understanding of *want*

• 3 year olds are adult-like in understanding of *want*, even when the desire reported conflicts with reality, or with the child’s own desire.

• Difficulty with *think* can’t just be difficulty processing an attitude state representation that conflicts with reality, or with their own attitude state.
• Hope shares semantic and syntactic properties with each *think* and *want*.

• How does *hope* fare compared to *think* and *want* in child language?
Endorsement *want*?

*want* doesn’t get the kinds of endorsement interpretations *think* gets. But *hope* does.

**Bill:** Where is Jane?

**Sue:** #I want her to be in Miami.

**Sue:** I hope she’s in Miami.

\[x \text{ hopes } p : x \text{ believes that } p \text{ is possible}\]

hope

*hope* shares *meaning components* with both *want* and *think*:

- It expresses a *desire*.
- It expresses a *doxastic possibility*, which allows endorsement uses.
hope

_hope_ shares **syntactic properties** with both _want_ and _think_:

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Hope

Froggy hopes to get...
Froggy hopes that...

I like hearts and not stars!
When it’s yellow, I guess star,
when it’s red, I guess heart!
# Hope: Design

Breakdown of conditions: Adult-like responses

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<td><img src="image9.png" alt="Star" /></td>
<td>✗️</td>
<td>✔️</td>
<td>✗️</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>
Results: *hope vs. think vs. want*
Results: hope vs. think vs. want
Results: *think* vs. *know*
Individual measure: accuracy on know-matrix

Lambchop doesn’t know that it’s in the blue box

N=28
**think vs. know**

- Children from low SES backgrounds show delays on FB and vocabulary tasks, compared to children from high SES backgrounds.

- Quantitative and qualitative corpus analysis of child-directed speech from low vs. high SES backgrounds.

- ‘Where is the toy’ task in children from low vs. high SES backgrounds.

Dudley et al, *in progress*
know vs. think: corpus study
**know vs. think: corpus study**

- **know**:
  - Adult high: 60% question, 20% noun phrase, 20% finite, 0% discourse
  - Adult low: 60% question, 20% noun phrase, 20% finite, 0% discourse

- **think**:
  - Adult high: 40% question, 40% noun phrase, 10% finite, 10% discourse
  - Adult low: 40% question, 40% noun phrase, 10% finite, 10% discourse