Language and Mind
HONR 218L

Class #12
Theory of Mind

Schedule
• Today: Theory of Mind
• Wed March 14th: Manner of Motion, Prepositions
• SPRING BREAK
• Mon, March 28th: Presentations
• Wed, March 30th: Presentations

Monday March 28
Navigation

• Leanna

• Kellian

• Rob

Mon or Wed (Mar 28 or 30)
Number and Language

• Olivia

• Jason

• Alison

• Chaz

• Christina
Wed March 30

Theory of Mind

• Alisa

• Lisa

• Matt

Presentations

• Time: 15 minutes
• Aim: Explain key ideas and/or evidence to class

• Visual aids
  – Serve as back-up to presenter
  – Serve as class notes
  – No bells and whistles

• Feedback
  – Talk to us!
  – Send a draft!

Whorf (1939)
The Relation of Habitual Thought & Behavior to Language

Whorf’s questions in his own words:

1) Are our own concepts of time, space, and matter given in substantially the same form by experience to all men, or are they in part conditioned by the structure of particular languages?

2) Are there traceable affinities between a) cultural and behavioral norms and b) large-scale linguistic patterns?
Critics

Stephen Pinker
Geoffrey Pullum

Theory of Mind

If you can correctly evaluate the truth of sentences like these, what do you know?

• Syntactic Knowledge: you know that some verbs can take sentential complements
• Social Cognitive Knowledge: you know that other people can have a false belief
• Bridge: you know that there is a connection between this syntactic form and the expression of potentially false beliefs

• Sarah thought *that the earth was flat*

  • The embedded proposition encodes the contents of Sarah’s mind.
  • The ‘truth value’ of the embedded proposition cannot be evaluated with respect to this world. It must be evaluated with respect to Sarah’s mental world.
  • What if a child didn’t know this?
How is this knowledge acquired?

- Usual direction of effect between the development of concepts and the language that encodes them is that the concept develops before the corresponding terms.

  - Syntactic Knowledge: you know that some verbs can take sentential complements.
  - Social Cognitive Knowledge: you know that other people can have a false belief.
  - Bridge: you know that there is a connection between this syntactic form and the expression of potentially false beliefs.

Concepts before knowledge

- “The way we see colors determines how we learn words for them, not vice versa.” —Pinker

An alternative view

- The ability to represent and explain the beliefs, desires, intentions, etc. of others may rely on the ability to represent the syntax of complement clauses.

Syntactic Knowledge: you know that some verbs can take sentential complements.

  - Social Cognitive Knowledge: you know that other people can have a false belief.
  - Bridge: you know that there is a connection between this syntactic form and the expression of potentially false beliefs.
Language as a Toolkit
Neo-Whorfian Idea

- Language does not simply allow us to communicate complex and novel ideas
- Language allows us to represent complex and novel ideas, i.e., language as an enabler for thought

Problem:

- How do you measure children’s understanding that other people can have false beliefs

(abstracted away from their linguistic ability to represent false beliefs)

False-belief Task

- The child is introduced to two puppets, Sally and Anne. While playing, Sally puts a marble into a basket and then goes outside (the puppet disappears under the table, for example). When Sally is not around, naughty Anne changes the location of the marble. She takes it out of the basket and puts it in a box. Some time later Sally comes back and wants to play with her marble.

Children are then asked the critical question: Where will Sally look for her marble?

- 3-year olds typically fail
- 4-5 year olds typically succeed
- Key problem in Autism

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Dora the Explorer

Swiper the Fox
Language Development

- At what age do children start talking about thoughts/beliefs?
- At what age do children first begin to use sentential complements?

Early Language Lacks Mental Verbs

- Two-year Olds
  - Talk a lot!
  - … about what they did, what they want
  - … about what other do
  - … possibly about what others say
  - … not about what others think

Early Language Development: Understanding sentential complements of communication verbs

- “The Mom said she bought apples. But look! She really bought oranges.”
- “What did the Mom say she bought?”
- 3-year olds: oranges
  4-year olds: apples

Appearance of Mental verbs

The appearance of mental verbs like think, know is early (3 years) but often stereotyped e.g. “I don’t know” or “I think I can”.

There are sporadic real uses.
The breakthrough

At around four years of age, children understand that mental verbs can take a whole sentence in their scope (a complement) e.g.

Mom thought that the shampoo was the toothpaste

And the embedded sentence can be FALSE from the child’s Point of View, but TRUE for Mom.

Once the child has this capacity, he can represent two worlds: his own, and someone else’s mental world.

A longitudinal study with typically developing children

- deVilliers & Pyers, 2002

- **Main research question:** Does the emergence of false-belief understanding depend on the child’s mastery of the grammar (syntax and semantics) of sentential complements?

- 28 children, age 3–5 tested 4 times each over the course of 1 year
- Test battery included a variety of language tests and a variety of false belief tasks

Problem

Use of mental verbs with sentential complements occurs at roughly the same time that children are able to pass false belief tasks.

Chicken or egg?

False-belief tasks: Unexpected Contents Task

- Child is given a familiar container (band-aid box, playdoh box)
- Child opens container and finds something unexpected

- **False belief question:** Child is told that a classmate (Sarah) will be brought in, and is asked “What will Sarah think is in the box?”
- **Control question:** Child is asked “Before, when you were sitting over there, what did you think was in the box?”

- 3-year-olds typically answer incorrectly to BOTH questions
False-belief tasks: Unseen Displacement (Sally-Anne)

- **Story:** This boy Bobby and his daddy bought a nice cake for after dinner. But Bobby wanted to go out to play so he put the cake away until after dinner. He put it in this cupboard for later. Then he went out to play. Then the daddy thought, “Oh no, the frosting on the cake might melt!” So he took the cake out of the cupboard and put it in the refrigerator so the frosting wouldn’t melt. Then he went out to get some tomatoes for dinner.

- **Memory check questions:** Where did Bobby put the cake? Where is it now?
- **False-belief question (prediction):** Now Bobby is tired of playing and he’s coming home. He remembers where he put the cake. When he comes in the kitchen, where will Bobby first look for the cake?
- **Explanation question (justified prediction):** Why will he look there?

False-belief tasks: Explanation of Action

- **Setup:** Child is shown a puppet which is then put to sleep out of sight. While puppet is sleeping, the child is shown a familiar box (e.g. egg carton), and the contents are removed and hidden in a neutral box. Puppet is then brought back. Child is then told that the puppet likes to eat eggs when he wakes up. The puppet then picks up the egg carton and tries to get it open.

- **False-belief Question1:** Why is he looking in there?
- **False-belief Question2:** Why isn’t he looking in the other box?

Language tasks: Memory for complements in described mistakes

- **Method:** Child views pictures of stories in which a character is described as making a mistake, telling a lie, or having a false belief. Child has to report the content of the mistake. Both mental state and communication verbs used.

- **Example1:** He thought he found his ring (second picture), but it was really a bottle cap. **What did he think?** (pointing back to the first picture)

- **Example2:** She said she found a monster under her chair, but (second picture) it was really the neighbor’s dog. **What did she say?** (pointing back to first picture)

- **Important:** This task does not require the child to “read” the character’s state of mind, but merely to represent it by holding the sentence in mind and then repeating the relevant part back.

Language tasks: Spontaneous Speech

- **Collected while children talked during the test sessions, played computer games with the experimenters, and after watching silent videos**

- **Analyze for BROAD measures of language development**
  - Mean length of utterance (MLU)
  - IPSYN: total score (test indicating the range and complexity of grammatical forms used)
  - Just the score for sentence types (of any kind)
  - Just the score for complex sentences (of any kind)
  - Complex sentence score MINUS sentence complement score

- **Analyze for TARGETED measures of language development**
  - The total score for just sentence complements
**Language tasks:**

Medial Answers to wh-questions

- **Story:** This little girl went shopping one afternoon but she was very late going home. She went a short way home over a fence but she ripped her dress on the wire. That night when she was in bed she told her mom, "Look, I ripped my dress this afternoon!"

- **Question:** When did the girl say what she ripped?

- **Right answer:** The answer to the short distance question (When did she say it?)

- **Wrong answer:**
  - The answer to the long distance question (When did she rip it?)
  - Medial answer: (What did she rip?)

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**Correlations of language measures with false-belief measures at Round 2**

<table>
<thead>
<tr>
<th></th>
<th>Prediction</th>
<th>Justified Prediction</th>
<th>Unexpected Contents</th>
<th>Explanation of Action</th>
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<tbody>
<tr>
<td>Memory for</td>
<td>.419 (P &lt; .03)</td>
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<td>mental</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory for</td>
<td>.366 (P &lt; .06)</td>
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<td>.232 (ns)</td>
<td>.417 (P &lt; .03)</td>
<td>.294 (P &lt; .04)</td>
<td>.512 (P &lt; .005)</td>
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<tr>
<td>Correct wh-ques.</td>
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<td>.293 (ns)</td>
<td>.224 (ns)</td>
<td>.596 (ns)</td>
</tr>
<tr>
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<td>.101 (ns)</td>
<td>.356 (ns)</td>
<td>.343 (ns)</td>
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<td>IPSYN SS</td>
<td>.226 (ns)</td>
<td>.457 (P &lt; .02)</td>
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**General language measures: 3/24 correlate**

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**General language measures: 3/24 correlate**
Recall

- **Main research question**: Does the emergence of false-belief understanding depend on the child’s mastery of the grammar (syntax and semantics) of sentential complements?
- Still unanswered: What direction does the correlation go?

Contingency Tables of passing Memory for Sentential Complements (syntax) and False Belief (FB)

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<th>Pass Syntax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail FB</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Pass FB</td>
<td>5</td>
<td>10</td>
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</table>

Criteria for passing FB: 5/6 correct
Criteria for passing syntax: 10/12 correct

Explaining exceptions: “In every case, children who passed false beliefs gave us evidence that they had productive command of complementation.”
Another test of direction of correlation

Using statistics (multiple regression), you can ask: what predicts what?

Statistical Question: Do language measures (general or specific) at Round 2 predict false belief results at Round 3?

Answer:
General language measures do not
IPSYN sentential complements do not
Wh-questions do not
Memory for sentential complements does

Important Comparison

The converse does not hold:

Statistical Question: Do false belief results at Round 2 predict Memory for Sentential Complements at Round 3?

Answer: NO

An intriguing twist

• The crucial component of memory for complements that makes it a significant predictor of false belief performance is
  –the communication verbs
  –not the mental verbs
How do children learn the connection between sentential complements of verbs and the expression of potentially false beliefs?

- Difficult to observe: someone else’s thoughts
- Easier to observe: what people say
- “She said that she washed her hands”
- Children will sometimes hear sentences like this in a context where there is overt evidence to suggest that the embedded proposition is false.
- Children can use evidence from verbs like say to generalize to verbs like think and believe

Sarah thought *that the earth was flat*

**Syntactic Knowledge:** you know that some verbs can take sentential complements

**Bridge:** you know from hearing communication verbs and from observing the world while hearing them that there is a connection between this syntactic form and the expression of potentially false propositions

- Having learned this connection from communication verbs, you then generalize that since mental verbs also take sentential complements, their sentential complements must also potentially be false.
- Social Cognitive Result: Therefore you can contemplate other (mental) worlds.

Summary of Main Empirical Finding

- Mastery of sentential complement structures is the best predictor of false-belief performance, and this is NOT just a function of higher overall language ability

Conclusions

- Results do not prove, but are compatible with these claims:
  - “The child needs the full syntax of mental verbs plus sentential complements in order to represent in his own mind the belief states of other people, not simply to encode them for reporting them in speech”
  - The language paves the way for reasoning about others’ mental states: False Belief understanding.
  - Language in this domain seems to drive Theory of Mind rather than vice versa.
  - Question: What predictions do these claims make?
Theory of Mind Presentations

• Testing the Connection in other ways or with other populations
  – What if you train children on communication verbs that take sentential complements? Do they improve on false belief task?
  – Test development in deaf children who are language delayed vs. not
  – Test false belief understanding in non-humans

Another avenue for investigation

• Verbs of communication like *say*, *tell*, may provide the bootstrap for figuring out complements with mental verbs

• What predictions would this make?

Back to Pinker: What do we think now?

• “There is no scientific evidence that languages dramatically shape their speakers’ ways of thinking.”