Foundations of Mind

Other Minds 2

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Slide #1

1) Infants & chicks can pick out relevant social agents (innate input analyzers for faces/conspecifics)
2) Infants recognize mental agents as having perceptual states that may differ from their own

Today: Mental agents have goals, intentions, beliefs regarding the world…

Is this a part of core knowledge???

Review…

Slide #2

Understanding Intention

She comes in contact with it.
She repeatedly goes near it, then farther, then near again.

She WANTS to get it.

Do infants encode human events as merely a mechanical Sequence of actions, or do they see them as driven by internal (hidden) goals???

Slide #3

Understanding Intention

Avian Intentionality?

Slide #4
Understanding Intention

Do infants view human actions as unpredictable, or do they view them as goal-directed?

By 5 months, infants represent a human actor’s reach as directed to a particular goal object (Woodward, 1998)

Control Condition:

Maybe infants just think the hand “goes with” one of the toys

Infants distinguish human actions from inanimate object motions; only the human action is seen as directed to a particular goal object.

Understanding Intention

Do infants view ALL human actions as goal-directed?

Infants distinguish intentional from accidental human actions; only the intentional actions are seen as goal-directed.

Core Knowledge of Social Agents?

• Infants pay attention to social agents & reason about their intentions

• We already know that infants DO reason about inanimate objects like the stick from Woodward’s study

(from way back when…):

1) Solidity

2) Continuity

3) No action at a distance

• A suggestion: Infants represent social agents (animates) and objects (inanimates), and have different sets of expectations about each
Core Knowledge of Social Agents?
Habituation Events:
Reasoning about inanimate objects: action on contact

Core Knowledge of Social Agents?
Contact

Core Knowledge of Social Agents?
No contact

Infants look longer at the no-contact event. Infants infer that the first object hit the second behind the screen.

(Woodward, Phillips & Spelke, 1995)
Core Knowledge of Social Agents?

Young infants distinguish in their reasoning between human action and inanimate object motion.

A double dissociation:

<table>
<thead>
<tr>
<th></th>
<th>Contact</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inanimate objects</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>People</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Furthermore, young infants further distinguish intentional from accidental actions:
only intentional actions are seen as goal-directed.

Understanding Intention

Predicting goal-directed action from “rational” analysis

Do infants expect agents to take the shortest path to their goal? (Geregly & Csibra, 1995)

By 12 months (and perhaps earlier), infants attribute goals to agents and assume that agents will pursue the most direct path to their goal.

Understanding Intention

Inferring a goal from a series of actions

Meltzoff studies of observational learning:
At 18 months, infants attempt to perform the same actions on objects that they see other people perform

What happens if other people try and fail?

Result: Infants imitate the GOAL of the actions, not the actions themselves!
Understanding Intention
Inferring a goal from a series of actions

Alternative explanation: Maybe infants are not imitating the agent’s goal, but simply utilizing the objects’ natural properties

Result: Infants imitate the goal of the actions ONLY when they’re performed by an animate agent
Implication: Infants imitate to replicate GOALS, not just simple action-sequences

Slide #17

Understanding Intention
Combining rational analysis & imitation of agents

Gergely, Bekkering, Kiraly (2002)

Adult pushes switch w/ forehead; Hands are wrapped
Adult pushes switch w/ forehead; Hands are free

Results: Infant pushes switch w/ HANDS
Infant pushes switch w/ forehead

Slide #18

Slide #19

Infants’ reasoning about human action: Summary

Infants show at least 3 abilities to represent and reason about the goal-directed actions of other people:

1) Determine goal from completed action (Woodward)
2) Determine goal by rational analysis (Gergely, Bekkering, Kiraly)
3) Determine goal by analysis of intentions (Meltzoff)

Infants use representations of goal-directed action to:

1) Direct their attention to the things adults are looking at or acting on (gaze following, last lecture)
2) Learn words (Baldwin studies)
3) Learn functional properties of objects (Meltzoff)
4) Learn conventional actions (Gergely, Bekkering, Kiraly)
Infants’ reasoning about human action: Summary

Young children recognize mental agents, know they can have different perceptual info, expect them to behave intentionally when do children understand that people can have belief states that are different from their own?

He doesn’t know I’m here…

He thinks I’m in my room!

Theory of Mind

The False Belief task
(Perner & Wimmer, 1984)

Results:

Age 2-3: Sally will look in the box (where the ball actually is).

Age 4 and above: Sally will look in the basket (where Sally thinks the ball is).

Another task (the “Smarties task”):

“Look at this box. What do you think is in the box?”

“Nope! It’s a pencil! Let’s close it up again.”

“Here comes Johnny. What will Johnny think is in the box?”

Theory of Mind

Findings:
Age 2-3: Johnny will think there’s a pencil in the box
Age 4 and above: Johnny will think there are Smarties in the box

Findings of both paradigms robust over changes in wording, not due to superficial problems with attention, memory, etc.

• Young children develop a “theory of mind” at about age 4
• Younger children understand the task and answer consistently, but they predict the person’s actions will accord with reality, not with her false-beliefs
• Young children make the same mistake for their own beliefs
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Theory of Mind
Why are False Belief tasks so hard?
(1) “Egocentrism”? (inability to represent another person’s mental state when it differs from one’s own?)
The Not-own Desire task (Gopnik)
“I love broccoli!”

Yum! Can you give me some?”
Age 3: children prefer goldfish but give Exp. broccoli. Egocentrism isn’t the problem!

Theory of Mind
Why are False Belief tasks so hard?
(2) Lack of knowledge of words “think” & “want”?
• Used early
• Understood at 3 years when they apply to a relation between a person and a goal object:

Johnny is thinking about his dog

Mary wants an apple

Young children do not have a problem understanding the meanings of these words.

Theory of Mind
Why are False Belief tasks so hard?
(3) Lack an understanding of propositional attitudes

Johnny thinks that his dog is hungry.”

Mary wants that she should eat an apple.”

A difficulty with propositional attitudes: opacity

Johnny thinks that it’s raining.”
“it’s raining”: false
“Johnny thinks that it’s raining.”: true
Theory of Mind

• Between 3 and 4 years, children come to understand propositional attitudes
• This understanding underlies success on the false belief task
• This understanding is central to viewing persons as having mental lives: representations of the world that are distinct from reality

Theory of Mind

By 18 months, children seem to understand propositional attitudes in a different context: pretense (Leslie, 1987)

Child: “Mom is pretending the banana is a telephone”
• Opacity

How good are children at tracking these embeddings in complex pretense sequences?
• Giving teddy a bath

But: Children don’t understand the role of beliefs in pretense “Johnny lives in Australia. There are no rabbits there. Johnny has never seen a rabbit. He has never heard of a rabbit. Look, Johnny is hopping across the field. Is he pretending to be a rabbit?” < 4 years: “YES”

Theory of Mind

How does an understanding of propositional attitudes develop?

One possibility: Language plays a role

Previously:
• Language in creating exact integer concepts from core representations of large approximate & small exact quantities
• Language in allowing kids to represent “Left of the blue wall,” Combining landmarks (blue wall) and geometric info (left)

? Core knowledge of mental agents, goals, intentions… Transcended by language, allowing a Theory of Mind?

Theory of Mind

Development of Theory of Mind:
A hypothesis (Jill & Peter DeVilliers)

Successful false-belief reasoning emerges at about the same time as comprehension of sentences with embedded clauses

“This leaf is red.”
• Is it true that the leaf is red?
• Is it true that Peter said that the leaf is red?”

This leaf is red.
Theory of Mind

Does learning the syntax and semantics of embedded sentences help children to understand false beliefs?

2 Sources of evidence:

- Studies of deaf children: children with delayed understanding of sentences with embedded clauses show delayed false belief reasoning
- (DeVilliers & DeVilliers, 2000; Tager-Flusberg; Lohman)

(b) Training studies with young children: 3 year olds trained to understand sentences with embedded clauses show enhanced false belief reasoning

This thesis is controversial… But here’s one way it might work:

UG:  
```
S  
NP VP
V S
```
(subject) (verb) (sentence)

Learning English: John said that the leaf is green.

Core knowledge of persons: John thinks about his dog.

Learning more English:  
```
S  
NP VP
V NP
```
John thinks about his dog

Now the child hears: “John thinks that the leaf is green.”

Core knowledge of persons: John thinks about his dog.

Learning more English:  
```
S  
NP VP
V NP
```
John thinks about his dog

Constructed knowledge of propositional attitudes: thinks
Two candidate sources for uniquely human cognitive abilities:

(1) Language (and language-dependent concepts and cognitive abilities like number/mathematics, space/maps & models, mentalistic reasoning)

(2) Mentalistic reasoning abilities (which result both in rapid acquisition of language and in acquisition of other culturally conveyed information and culture-specific skills)

Either of these abilities could be the source of the other. Or, both abilities could contribute to uniquely human knowledge and cognitive abilities.