

Theory of Mind in Chimpanzees (according to Povinelli et al)



Chimpanzee Minds:

Suspiciously Human? - Povinelli and Vonk 2003

- *Background: Theory of Mind*
 - We humans are often able to reason about what other people are thinking
 - For example, we modify some of our behavior in order to avoid evoking anger in others
 - Point: we are able to reason about the mental state of another person = “theory of mind”
 - Question: do chimpanzees also possess this “theory of mind”? That is, are chimps able to reason about the mental states of other chimps?

Humans are “innate psychologists”

That is, we tend to interpret behavior of animals as well as humans in terms of mental states
AND we assume that animals must do the same!

Povinelli & Vonk: but we should not allow this innate tendency to generalize or extrapolate (or anthropomorphize) to blind us to different kinds of mental strategies that might be used by chimps (and other animals) in social interactions

Chimps vs. Humans

- The ability to form these **abstract representations** of behavior is present in the ancestor common to humans and chimpanzees
- However, the further ability to **reason about mental states** may have evolved as a **uniquely human capability**
- *Question to test:* do chimpanzees have this additional ability to construe behavior in terms of mental states? Do they have a “theory of mind”?
- How does chimp respond to angry chimp?



Alternative Explanation for Behavior

- Chimps are probably able to form **abstract representations of behavior** independent of any particular chimpanzee that performs the behavior
- For example, chimp can probably categorize **"threat display"** as a general type of behavior that any chimpanzee can, in principle, exhibit.
- Further, chimp can probably predict consequences (threatening chimp will charge, hit, etc.)
- Further, chimp probably able to modify its behavior according to the probability that a charge will follow a threat
- However**, does this mean that chimp associates the occurrence of a "threat display" with a mental state of "anger"? That is, does chimp reason, "the other chimpanzee is charging at me and will hit me **because he is angry**", or is the **last clause** absent from chimp's thought process?

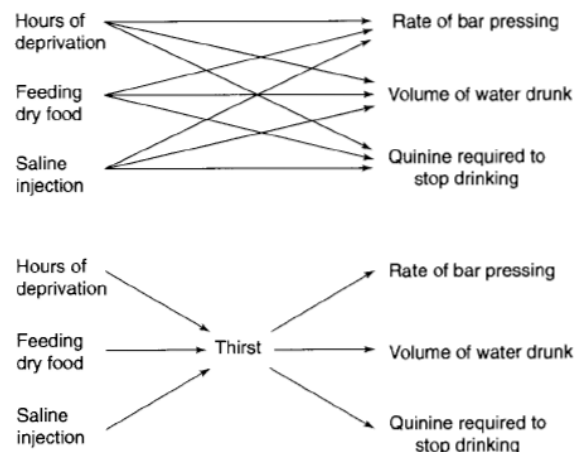
Intervening Variables

Povinelli & Vonk are not opposed to intervening variables such as the hypothesized Theory of Mind. They agree that humans use such a mechanism. They just question whether chimps do the same, vs. working from simple behavioral abstractions.

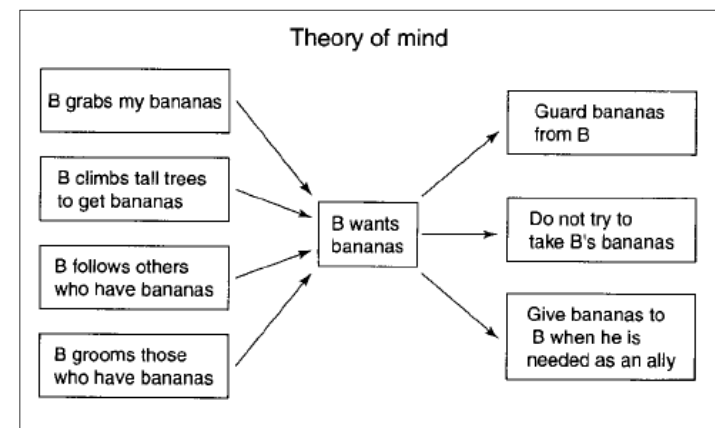
"The skeptic is wrong to suggest that the only alternative to attributing a theory of mind is to accept the tenets of behaviorism (i.e., positing that the chimpanzee has no mental representations), but the believer's invocation of parsimony (economy of expression) constitutes an error in logic: for each anecdotal instance of deception in which a chimpanzee might have been reasoning about the mental states of others, the agent must *also* have possessed a corresponding behavioral abstraction that could have done the same work".

Povinelli & Vonk 2003

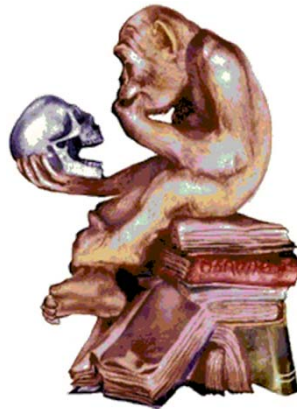
Intervening Variables



Intervening Variables



Theory of Mind in Chimpanzees (according to Tomasello, Call et al)



Call & Tomasello (2008):

Does the chimpanzee have a theory of mind? 30 years later

Premack & Woodruff (1978) first asked this question.

In earlier review (1997), Tomasello & Call came to the pessimistic conclusion that chimps do not understand the psychological states of others. They can predict the actions of others but “do not go beneath the surface to an understanding of the goals, perceptions, knowledge and beliefs that guide action”.

However, in the present review C & T say: “The story since the late 1990s has been one of experimenters finding better ways to tap into what chimpanzees know about the psychological states of others – and so getting many more positive results. In most cases this has been guided by attempts to model the experiments more closely on situations that chimpanzees routinely encounter in their natural environments, for example, presenting them with problems not in situation in which must cooperate with others but, rather, in situations in which they must compete with others.

Call & Tomasello (2008):

Does the chimpanzee have a theory of mind? 30 years later

Research examples illustrating what the chimp understands and what he doesn't:

☛ Povinelli & colleagues 1995; 1996

☛ Hare, Call & Tomasello 2006

☛ Bräuer, Call & Tomasello 2007

☛ ☛ Kaminski, Call & Tomasello 2008



Michael Tomasello



Daniel Povinelli
& friends



Background

Tactical Deception by Chimps: Behavioral vs. TOM interpretations of Deception

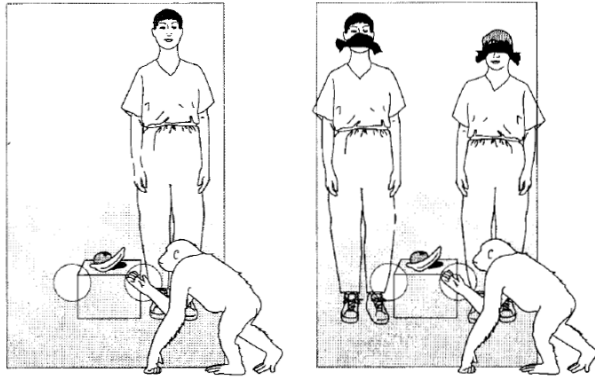
e.g., Woodruff & Premack 1979

1. Chimps trained to indicate location of hidden food to E (who shares food with chimp).
2. Two new Es introduced:
E1 has mask, does not share
E2 has no mask, does share

Only 2 of 4 chimps learned to refrain from showing E1 the food and it took them a very long time to learn this.

Even here, do we need to invoke theory of mind? Perhaps the chimps that learned merely learned that the mask was a cue to withhold signaling.

Povinelli & Preuss 1995; Povinelli & Eddy 1996
Chimps beg for food from blindfolded human



Problems: Is it really fair to say chimp doesn't "know" the human can't see them given that a chimp doesn't normally expect to communicate with a human? Also task is cooperative, not competitive – not 'natural'.

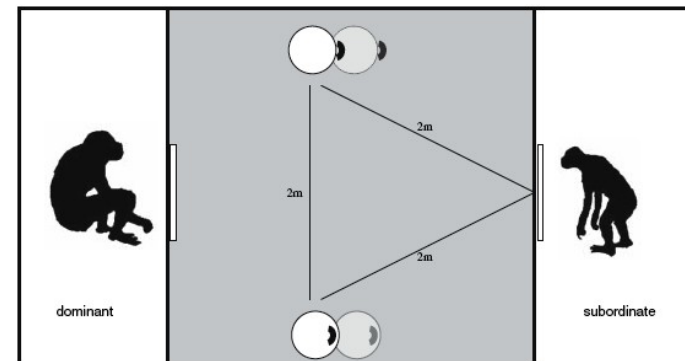
Background

- Povinelli experiments: also – chimps were unable to use gaze cues from humans to locate food.
- Hare et al (2000): "Chimpanzees know what conspecifics do and do not see"
 - Argued that the chimps failed the Povinelli experiments because they involved cooperation (i.e. informing one another of the location of food) which is rare in chimp real-life situations
 - Also, chimps rarely face situations where they must choose between two individuals to communicate with, especially when neither one is looking directly at them
 - Researchers designed an experiment where two chimps spontaneously competed for food
 - Results consistent with title of the paper

Bräuer, Call & Tomasello (2007)
"Chimpanzees really know what others can see in a competitive situation"

- Argh.... Povinelli could not replicate findings of Hare et al (2000)
- Bräuer et al attempted to replicate the main findings of Hare et al (2000) with improved methods
- The main goal was to determine whether chimps really know what others can see in this kind of competition
- What factors would influence their choices?

Bräuer, Call & Tomasello (2007)
"Chimpanzees really know what others can see in a competitive situation"



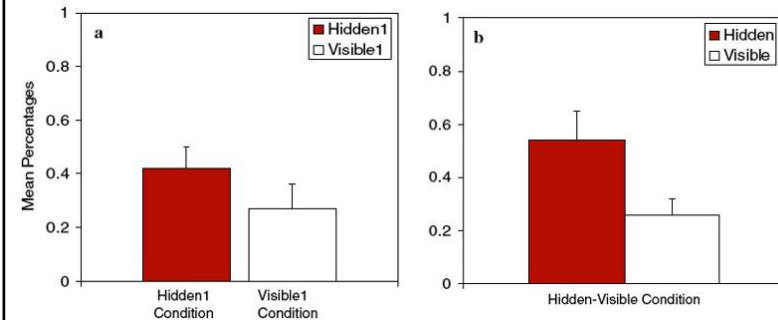
Bananas were placed either on a bucket (in which case both could see it) or behind the bucket (in which case, was hidden from the dominant).

Bräuer, Call & Tomasello (2007)
 “Chimpanzees really know what others can see in a competitive situation”

Conditions

- **Hidden 1:** only one piece of food behind one bucket, only subordinate can see it
- **Visible 1:** only one piece of food on top of bucket, both chimps can see it
- **Hidden-Visible:** one piece on top of one bucket, 2nd behind 2nd bucket – only subordinate can see it

Results – Expt 2

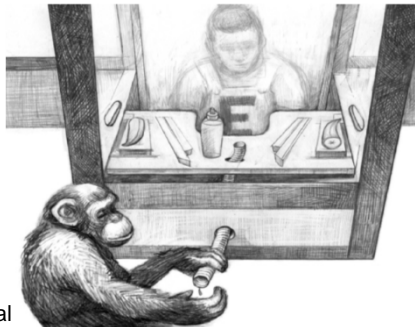


- Mean percentage food reached for by subordinate
- **Results:** Subordinate no more likely to reach for hidden over visible food when only one bucket is baited (left) but more likely to reach for hidden food when both buckets are baited (right).

Hare, Call & Tomasello (2006):
 Chimps deceive a human competitor by hiding

Competitive task:

E pulled the food out of the chimp's reach if chimp attempted to approach the food. In this way the chimp came to “understand that E, like her own group mates, was no longer willing to share prized food with her”.



Predictions:

Chimps will spontaneously conceal their approach from their competitor by:

- (1) avoiding food E's face is oriented towards
- (2) preferring to approach behind visual occluders over transparent barriers
- (3) avoiding a direct approach to the food if a more indirect route might better conceal their intent to approach

Test 1: Body Orientation Face & Chest Condition



Subjects could retrieve banana behind E, rather than the banana E faced toward.

Test 1: Body Orientation Face versus Chest Condition



Regardless of which banana subject approached, E removed it

Test 1: Body Orientation Non-social Control



E left room, allowing subject to obtain both bananas

Test 1: Body Orientation

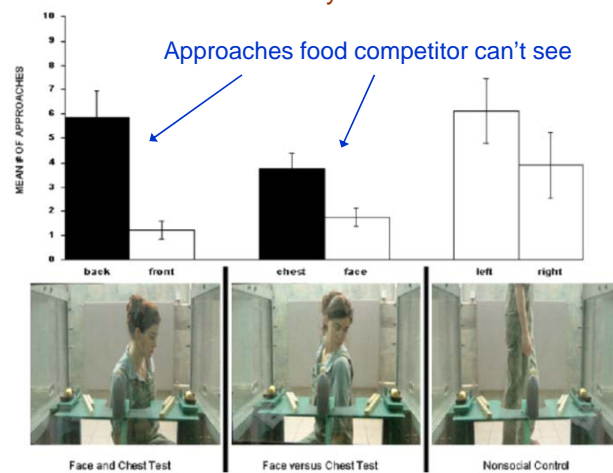


Fig. 2. A picture of experimental manipulations used in the Test 1 and the mean number of approaches within each of the three test conditions (note: the two social cues in the two social tests were presented on the right side (as in pictures) in half of trials and on the left side in the other half of trials).

Test 3: Occluder

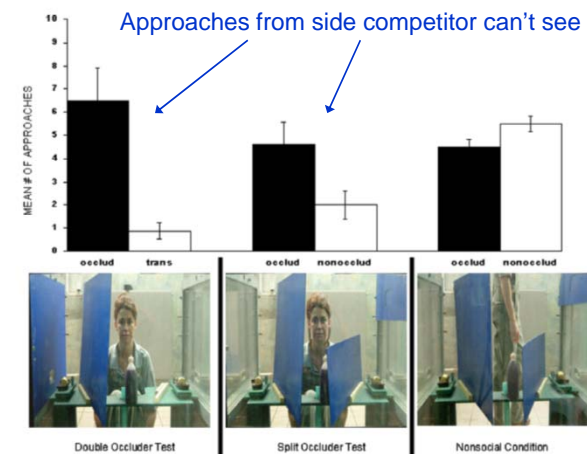
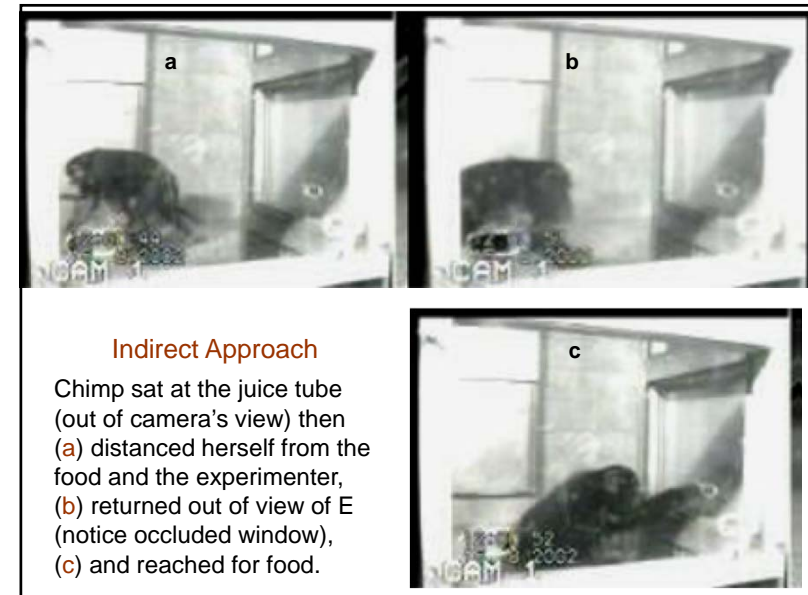
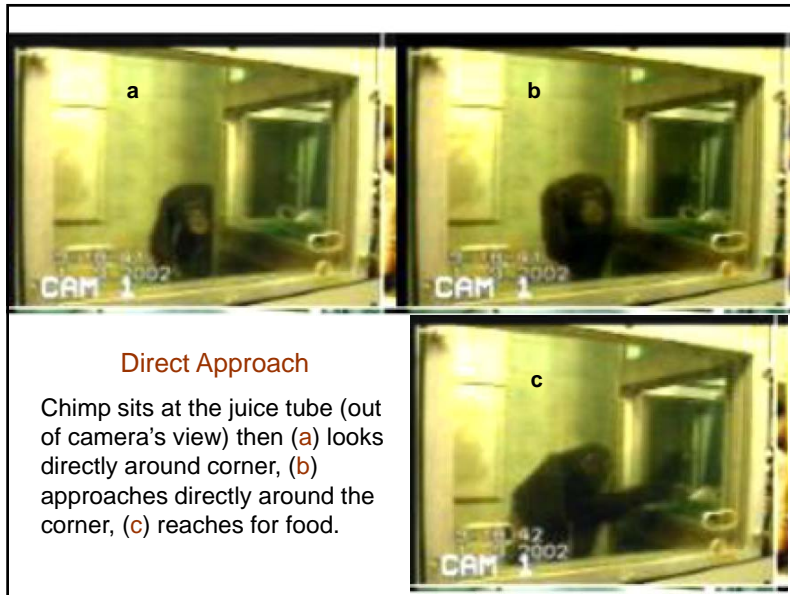


Fig. 4. A picture of experimental manipulations used in Test 3 and the mean number of approaches within each of the three test conditions.



Summary of Results

% of trials in which subject hid in the six different conditions

	Test 1		Test 2		Test 3	
	face & chest	face vs. chest	face & chest	occluder	double occluder	split occluder
total	81%	67%	79%	70%	80%	77%
1st trial	6/8	6/8	5/8	7/8	6/8	7/8

Conclusions

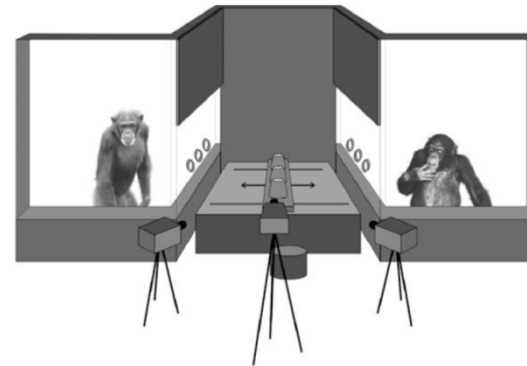
Results demonstrate that chimps “can flexibly use knowledge of what a competitor can and cannot see to develop active, deceptive strategies for concealing their approach to contested food – and they do this from the very first trials in several novel situations. **Contrary to the conclusions of Povinelli and colleagues...chimpanzees in the current experiment spontaneously avoided food that the experimenter was watching, as indicated by gaze direction, and instead approached food that he was not watching...[they] preferred to approach food behind various visual occluders while refraining from approaching food behind non-occluding barriers”.**

Conclusions

Most striking aspect: subject's exclusive use of indirect approaches when initially distancing themselves from the food could potentially aid in concealing their later approach towards the food. Subjects **only used** indirect approaches **if** the experimenter **was able to see** them distance themselves from the food, but subsequently **could not see them** approach the food after positioning themselves behind the experimenter or occluder. Subjects did not use indirect approaches if the positioning of the occluders prevented the experimenter from seeing them distance themselves from the food (Test 3).

Kaminski, Call & Tomasello (2008): **Chimpanzees know what others know, but not what they believe** *Cognition*, 109, 224-234

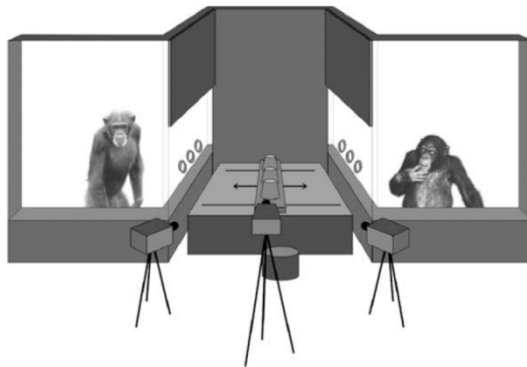
Tested both chimps and human children. Chimp situation: 2 chimps in separate rooms with windows so they can see each other and a table between their rooms. The subject and a competitor **take turns** choosing from 3 opaque buckets, one of which contains a reward.



Subject always chooses 2nd.

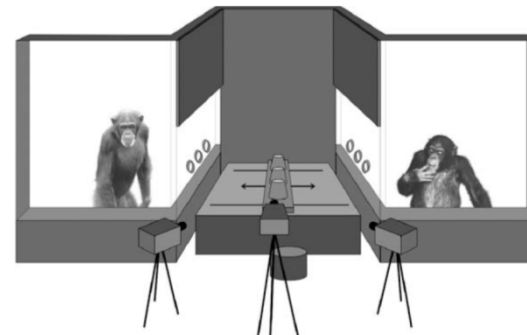
Table pushed toward chimp when it's her turn. Subject sticks her finger through the appropriate hole to request the particular bucket (food).

Each chimp's view of the table could be blocked separately. For each task, the experimenter hid a piece of banana under **one** of the three buckets. In addition, each chimp had a 4th bucket she could choose, on a table close to her (not shown in picture) which she knew contained a less appealing snack: a piece of apple.



So subject could try for the banana on the central table or take the sure thing, the apple near her.

False Belief Test. (1) While **both** chimps watch, E places the banana under one of the buckets. (2) E either moves banana to a new bucket, **or returns it to same bucket**, while (a) **both** chimps watch **OR** (b) while competitor has her view of the buckets blocked. (3) The chimps get to pick which bucket has the treat but the competitor picks 1st, and subject does **not get to see her competitor making her choice**. (4) When it's her turn, subject has option of picking the guaranteed treat on the table next to her, **OR** taking a chance and going for the banana.



Known stay: after initial baiting, E lifts the bucket but returns reward to same place

Known shift: E moves reward to new bucket

Unknown stay: E returns reward to same bucket **and competitor doesn't see this**

Unknown shift: E moves reward to new bucket, **and competitor doesn't see this**

24 trials total, 6 per condition – so competitor is learning something here...

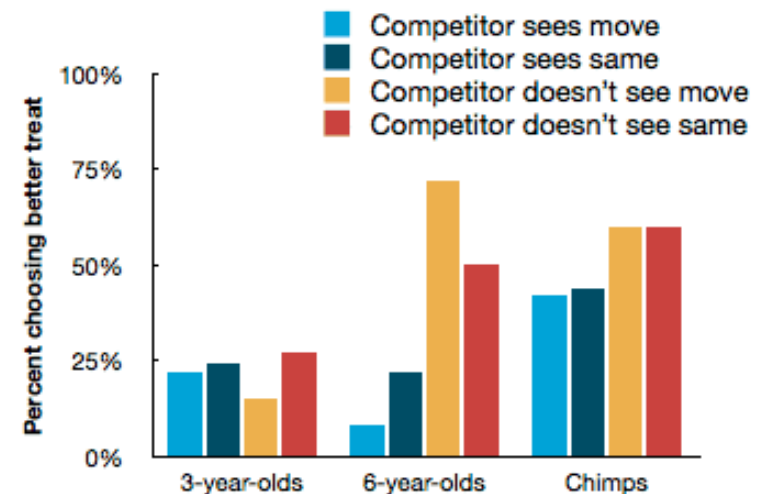
Results

Scenario: Either both chimps saw the banana being moved or kept in the original bucket, **or** only the subject saw the banana moved or kept in the original bucket while hidden from view of the competing chimp.

Question: How often will the chimps try for the better treat? And in their comparable test, how often will the kids?

Optimal Strategy: Go for banana *when competitor doesn't see the shift*, otherwise go for the sure-thing apple. (This assumes competitor will expect the banana to still be where she last saw it.)

Results (Fig. 3)



Results

Six-year-olds came closest to optimal strategy: generally didn't choose better treat when the competitor saw the treat being moved (or not moved). Even though they didn't see the competitor choose a bucket, they guessed that the competitor would have already taken the treat, and therefore the best they could do would be to pick the guaranteed, lesser treat.

Three-year-olds, by contrast, pretty much always chose the guaranteed lesser treat, presumably because they had no idea what their competitor had done, even in the condition where the treat was moved and the competitor didn't see this!

Chimps intermediate: they chose to go after the preferred treat more often when they saw that competitor hadn't seen it moved. However, the chimp's decision was the same whether or not the treat was actually moved, suggesting that it's understanding of what its competitor knows is not as sophisticated as a six-year-old child's: they did not behave differently when there was reason to believe that their competitor had a mistaken impression of where the treat was located.

Call & Tomasello (2008):

Does the chimpanzee have a theory of mind?
30 years later

Conclusions about Kaminski et al

- Kaminski et al: "Chimpanzees know what others know, but not what they believe"
- Call & Tomasello: "Chimpanzees understand ignorance, but not false belief"
- C & T's overall conclusion 30 years later: "chimpanzees understand others in terms of perception-goal psychology, as opposed to a full-fledged, human-like belief-desire psychology".