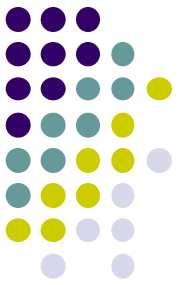
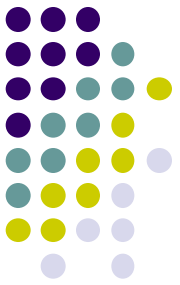


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## The Representational Demands of Elementary Mindreading

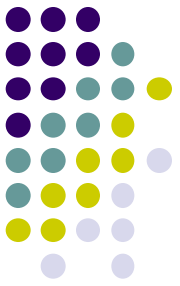
KNEW  
Kasimierz  
September 2011



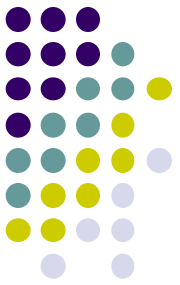
# Introduction

- Embodied cognition approaches tend to marginalize representation
- An explanatory approach: begin with embodied interaction and look at where representation is needed
- Application to social cognition:
  - presents a classic problem
    - representations proposed to explain ToM abilities
    - now argued that interaction could produce behavior appropriate to mental states without representing mental states

# Overview



1. Elementary mindreading
2. Two systems accounts
3. Mindminding: the radical enactivist interpretation
4. The limits of two systems accounts

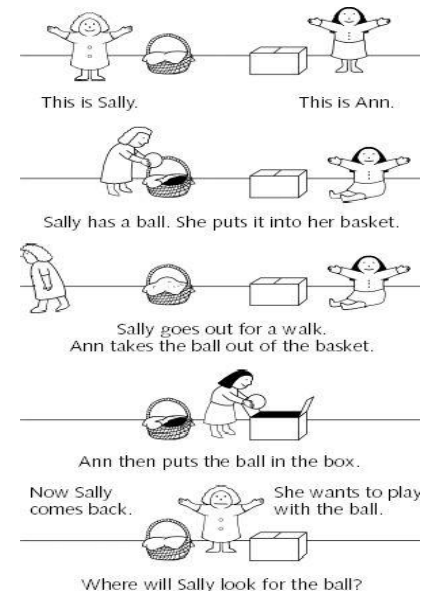


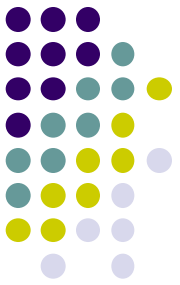
## 1. Elementary Mindreading

- Theory of Mind (ToM)/Mindreading: A mentalistic understanding of agents, which crucially involves the ability to interpret and predict their actions as a function of the content of their desires and beliefs.
- Litmus test for ToM/Mindreading: false belief (FB) test

Because correctly interpreting and/or predicting an agent's action on the basis of true beliefs is indistinguishable from expecting an agent to act according to the facts as they are (as you believe them to be), which would not require ascription of a mental state (belief) with content.

- Received view: children do not succeed at explicit (verbal) FB tests until at least 4 years.





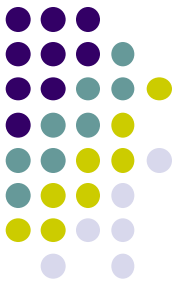
## 1. Elementary Mindreading

- Recent findings strongly suggest implicit FB understanding as early as 13 months. Three methods:

Looking time/violation of expectation (13 months)

Active Helping (18 months)

Anticipatory looking (25 months)

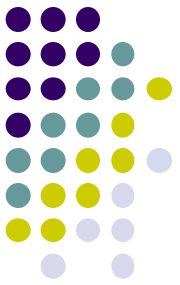


## 1. Elementary Mindreading

Looking time/violation of expectation (13 months)

(Baillergeon et al. 2005: 15 month-olds; Surian et al. 2007: 13 month-olds;  
Träuble et al 2010: 15 months-olds)

When an agent who should have a false belief about the location of an object searches in the correct location, infants look longer, suggesting that they expect that the agent will look in the wrong location on the basis of the false belief.



## 1. Elementary Mindreading

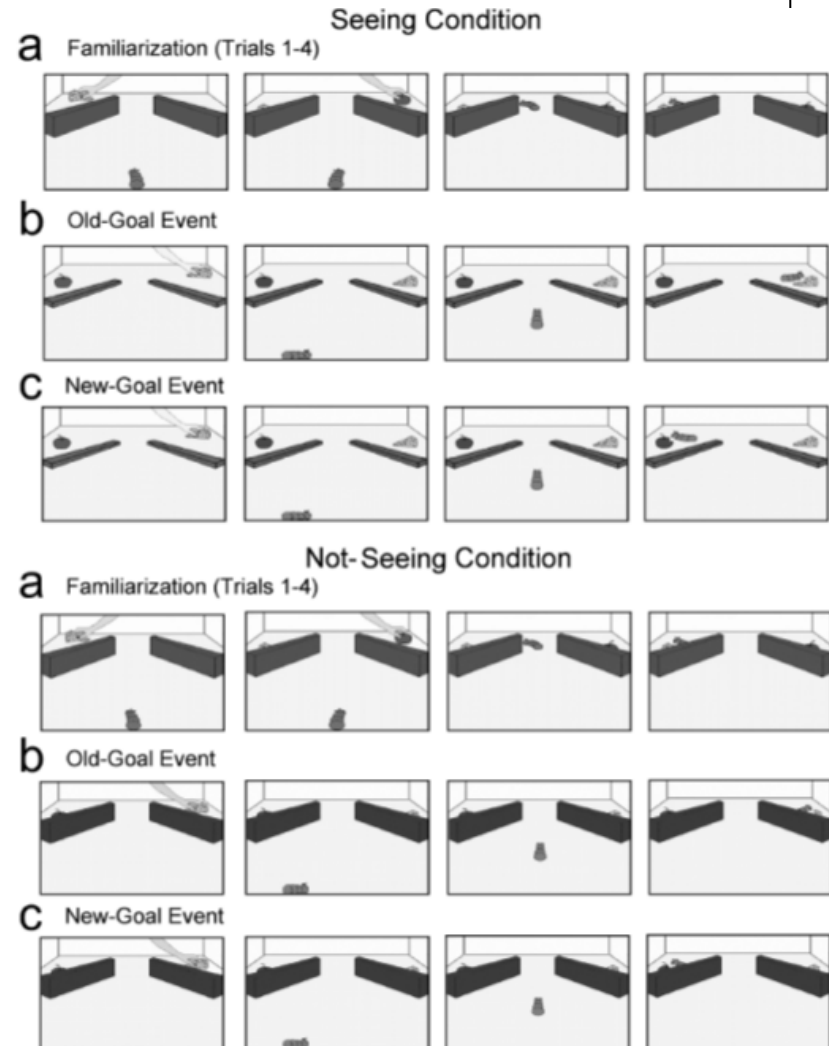
Objection (1):

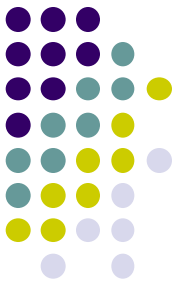
Perhaps they merely expect the agent to be ignorant but not necessarily ascribe a FB (Perner and Ruffman 2005) .



## 1. Elementary Mindreading

BUT: the pattern of responses suggests that the 13-month olds have specific and correct expectations about how the agent will act on the basis of false beliefs (Surian et al 2007)





## 1. Elementary Mindreading

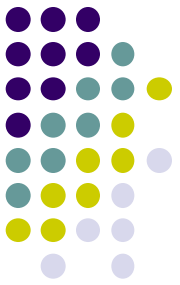
Active Helping (18 months)

(Buttelmann et al. 2009)

18 month-olds help observed agents to get objects out of boxes. In order to help the agents, the infants must interpret their action, and in order to do this they must ascribe a false belief.



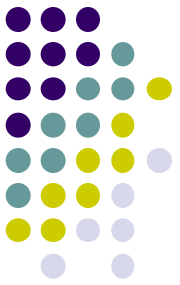
Fig. 1. E2 pulling on the lid of the box he had put the toy in, right before the response period.



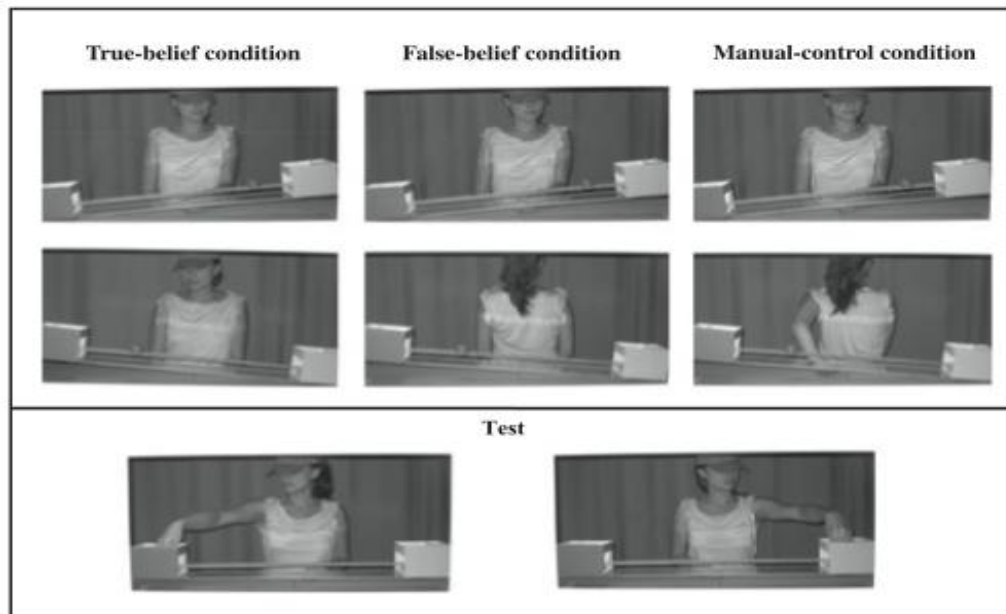
## 1. Elementary Mindreading

Objection (2):

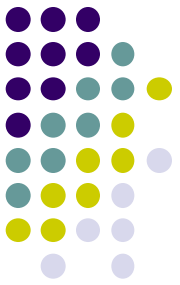
Maybe they employ a behavioral rule: Search where you last saw/encountered the object (but see Träuble et al 2010)



## 1. Elementary Mindreading



**Figure 1** Illustration of selected frames from the three conditions. In each condition infants were tested twice. After the belief induction infants saw the actor reaching for the ball either in the empty box or in the ball box at test (order of test-outcome was counter-balanced). In the false-belief condition the actor's turn is preceded by a short ringing in the background to signal a sudden distraction.



## 1. Elementary Mindreading

Anticipatory looking (25 months)

(Southgate et al. 2007)

25 month-olds look to the location where an agent with a false belief will search on the basis of that false belief. This suggests that they expect the agent to search at that location and thus that they have an implicit understanding of false beliefs.

This method is more demanding insofar as it measures not just behavior that is evidence that an expectation has been violated, but behavior expressing what that expectation is.



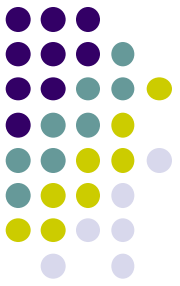
## 2. Two Systems Accounts

If children really do represent mental states (including FBs) at 13 months, why can't they pass explicit FB tests until 4?

Apperly and Butterfill 2010

System 1: an early developing inflexible system that uses limited, non-propositional forms of representation and supports rapid social cognitive abilities in both children and adults

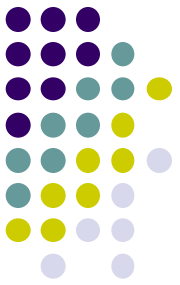
System 2: a flexible, late developing system that supports sophisticated adult-like theory of mind abilities



## 2. Two Systems Accounts

Signature limitations on system 1:

- no evidence as yet demonstrating that pre-verbal infants represent others' mental states as having contents that include multiple features (such as location and type of an object),
- nor as having content that is picked out only by a quantifier (there is no object in location L),
- nor under specific descriptions/ modes of presentation (cf. level 2 perspective-taking).

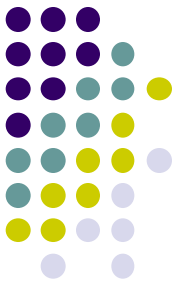


## 2. Two Systems Accounts

Five principles leading to full functioning of system 1:

1. One cannot act upon an object unless one is encountering it.
2. object-directed actions form units in larger goal-directed actions
3. one cannot goal-directedly act on an object unless encountering it
4. registration (as success condition): one cannot goal-directedly act upon an object unless correctly registering it
5. registration as causal factor, which yields implicit FB understanding

### 3. Mindminding



Radical enactivism (Hutto 2010, 2011): Infants do not represent agents' mental states; rather, they are sensitive to agents' intentional activity.

Neither the agents' behavior nor infants' sensitivity is best explained by appealing to representational states.

# Hutto's arguments for RE

Negative argument:

Cognitivism postulates representations freely but has trouble specifying their content when pressed (can't pay it's debts).

Positive argument:

RE provides a coherent, plausible alternative without the debts.

Hence, RE is the best option on the table.

## RE is coherent

Propositional attitudes (PAs): truth-conditional, sententially-mediated.

Intentional attitudes (IAs): non-contentful but world-directed activities.

Registration could be an IA.

Infants could be non-representationally “sensitive” to registrations and other IAs.

But RE is not plausible

It is unlikely that the relevant IAs could be discriminated non-representationally.

## Responding to vs representing

A mosquito responds to CO<sub>2</sub> gradients;

intuitively, it doesn't explicitly anticipate the outcome (a blood host),

signal source, response, and outcome are confounded.

# Three cases where there is evidence for explicit outcome expectancy

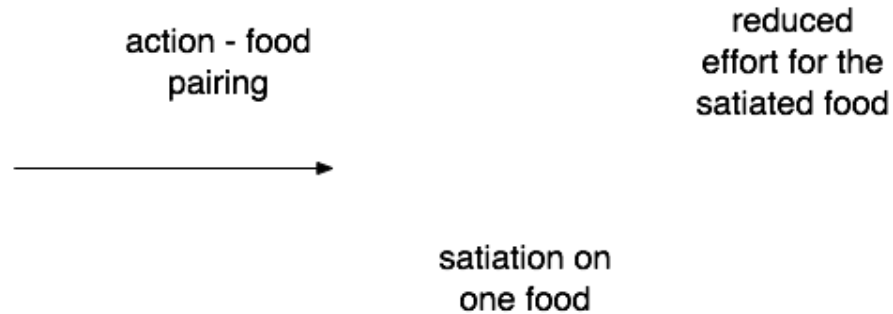
Reward devaluation paradigm.

Place/ response task.

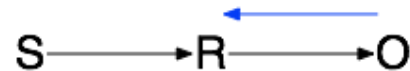
Transitive inference task.

# Reward devaluation

Dickinson (1985): distinguishing AO from SR behavior.

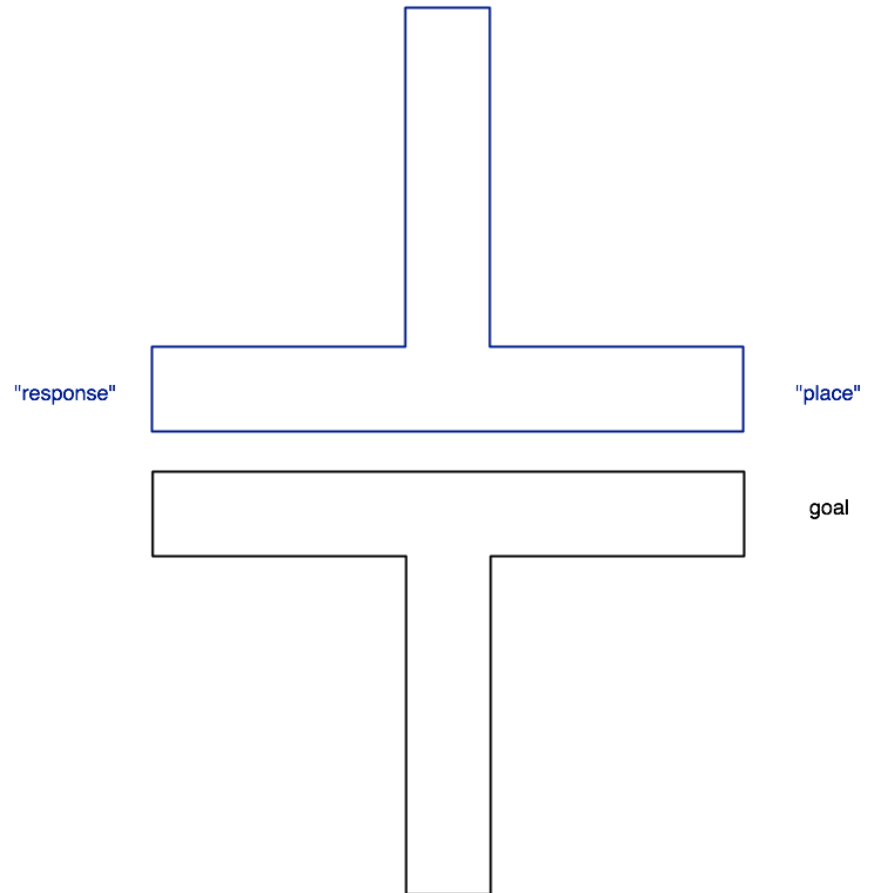


Outcome is disentangled from opportunity for response:



# The place/ response task

Packard & McGaugh (1996):



Model-based representation:  
representation that captures  
relations between features.

# The transitive inference task

Eichenbaum (2000):

$A > B, B > C, C > D, D > E$

BD?

Extraction of a schema.

Assimilation of a novel problem to the schema.

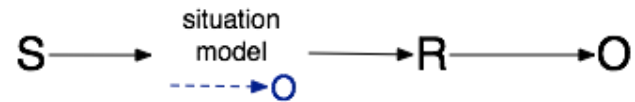
Eichenbaum's relational information processing theory of declarative memory.

# Model-based representation and flexible action

Cued response:



Model-based control:

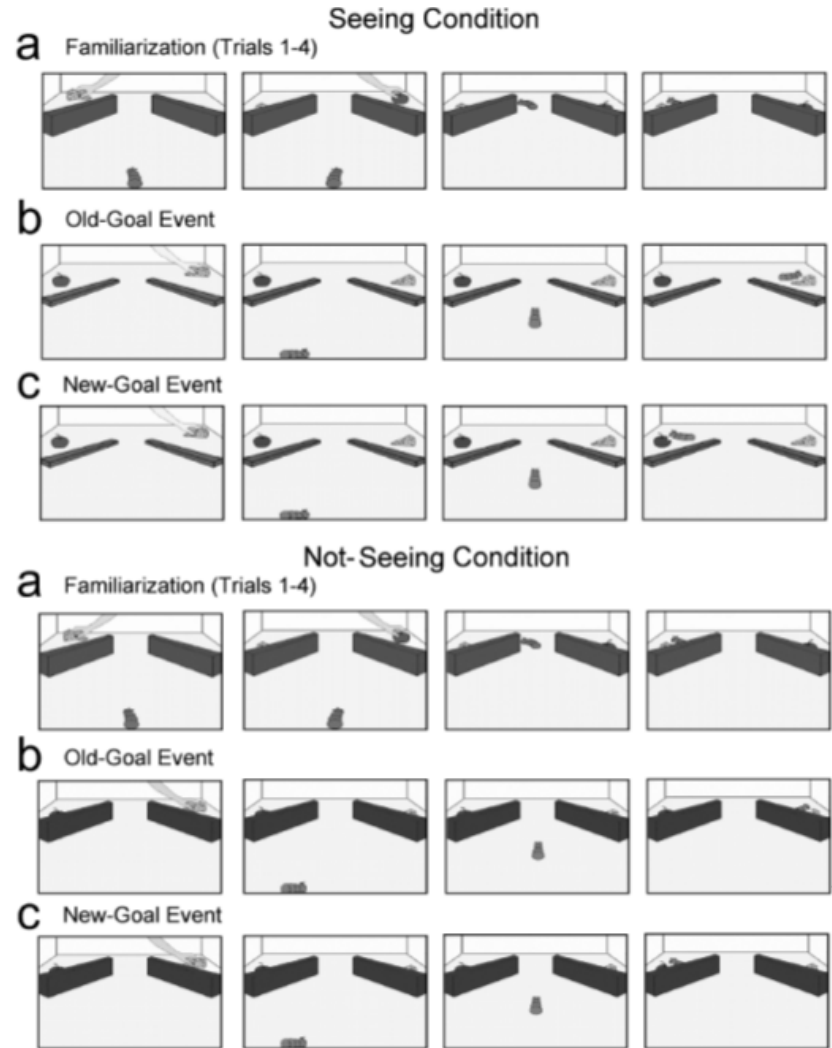


Cued responses tend to fail when there are complex relations between environmental features, stimuli, responses, and outcomes.

MBR helps unconfound these relations.

# Infants are very likely to be representing

Surprise indicates representation.



MBR is a plausible basis for capturing the structure of IAs

Registration is structured:

E.g. 'The cat registers the mouse under the fridge'.

A registers O at L.

IAs in general are structured, capturing this structure will often be very useful; contrast:

'Mummy is afraid.'

'Mummy is afraid that...'

# What of Apperly & Butterfill?

The two systems view again:

System 1: Uses simplified representations, & is inflexible but fast.

System 2: Uses complex representations, & is flexible but slow.

Problems:

MBR learning could explain both early and late representational abilities.

Evidence supports this:

early abilities show some flexibility,

the developmental progression is more complex than A&B suppose.

# MBR learning could explain both early and late representational abilities

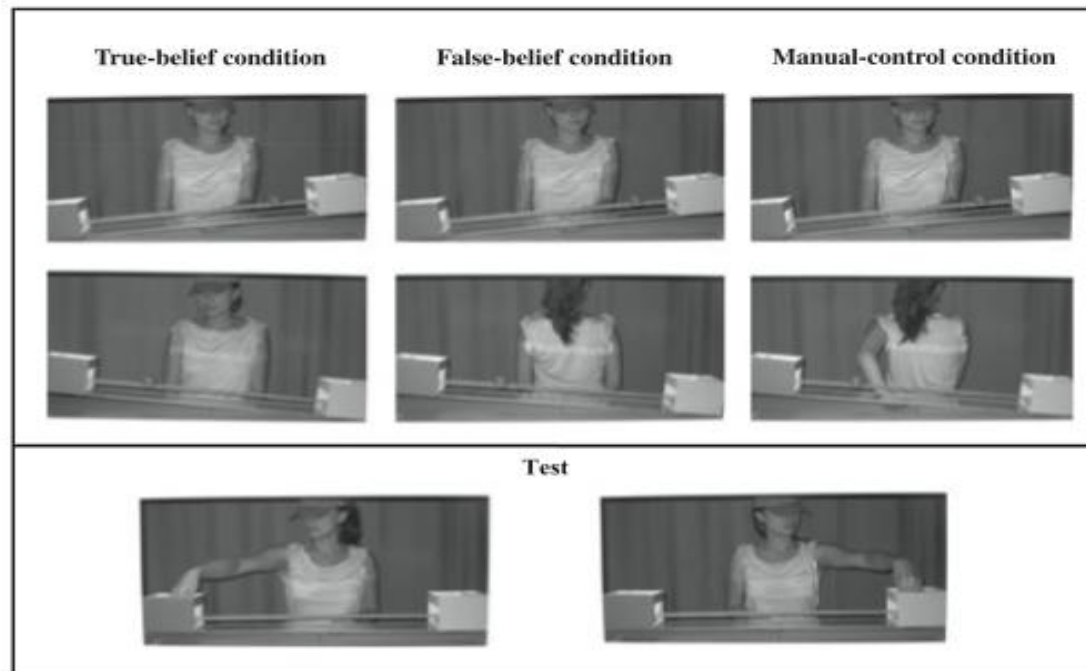
The five principles could be learned in infancy.

1. One cannot act upon an object unless one is encountering it.
2. Object-directed actions form units in larger goal-directed actions.
3. One cannot goal-directedly act on an object unless encountering it.
4. Registration (as success condition): one cannot goal-directedly act upon an object unless correctly registering it.
5. Registration as causal factor, which yields implicit FB understanding.

With full FB abilities resulting from progressive elaboration of the early representations.

# Evidence that infants are reasoning flexibly

Treating evidence acquired in different ways (with different modalities) as equivalent.



**Figure 1** Illustration of selected frames from the three conditions. In each condition infants were tested twice. After the belief induction infants saw the actor reaching for the ball either in the empty box or in the ball box at test (order of test-outcome was counter-balanced). In the false-belief condition the actor's turn is preceded by a short ringing in the background to signal a sudden distraction.

## A relatively fined-grained developmental progression

13 month-olds have mastered B&A's principle 5 (registration as a causal determinant of behavior)

So: B&A's schema does not map onto the development that occurs after 13 months

How to account for infants' increasing sophistication in ability to make use of that information to guide various kinds of behavior, e.g. active helping (18 months), anticipatory looking (25 months)?

Suggests continuous elaboration of representations.

# Conclusions

Precocious mind reading abilities raise fundamental questions about representation attribution.

Hutto asks some of the right questions, but RE isn't plausible. Infants are likely to be representing IA structure.

A&Bs representationalist picture of minimal mind reading is more plausible, but their argument for two systems is flawed and the account fails to capture the developmental progression.