

# Lecture 02 : Heuristics (in Reasoning) and Automaticity (in Perspective Taking) : Two Systems

Corrado Sinigaglia & Stephen A. Butterfill

< >

Tuesday, 22nd March 2022

## Contents

<b>1</b>	<b>Mindreading: Automaticity</b>	<b>2</b>
1.1	False Belief Tasks . . . . .	2
1.2	Models of Minds and Actions . . . . .	2
1.3	Automatic Mindreading? . . . . .	3
1.4	Objection 1 . . . . .	3
1.5	Objection 2 . . . . .	4
<b>2</b>	<b>Mindreading: Signature Limits, and Development</b>	<b>4</b>
2.1	What Is a Model? . . . . .	4
2.2	Signature Limits . . . . .	5
2.3	Objections . . . . .	6
	<b>Glossary</b>	<b>6</b>

## 1. Mindreading: Automaticity

Mindreading in adults is sometimes entirely a consequence of relatively automatic processes and sometimes not. Further, automatic and nonautomatic mindreading processes are independent in this sense: different conditions influence whether they occur and which ascriptions they generate.

*Mindreading* is the process of identifying a mental state as a mental state that some particular individual, another or yourself, has. To say someone has a *theory of mind* is another way of saying that she is capable of mindreading.<sup>1</sup>

### 1.1. False Belief Tasks

Wimmer & Perner (1983) set out to determine when humans can know facts about others' beliefs. They told children a story like this:

‘Maxi puts his chocolate in the BLUE box and leaves the room to play. While he is away (and cannot see), his mother moves the chocolate from the BLUE box to the GREEN box. Later Maxi returns. He wants his chocolate.’

They then asked the children, ‘Where will Maxi look for his chocolate?’

The core feature of a standard *false belief task* is this:

‘[t]he subject is aware that he/she and another person [Maxi] witness a certain state of affairs x. Then, in the absence of the other person the subject witnesses an unexpected change in the state of affairs from x to y’ (Wimmer & Perner 1983, p. 106).

The task is designed to measure the subject's sensitivity to the probability that Maxi will falsely believe x to obtain.

### 1.2. Models of Minds and Actions

A *model* is a way the world could logically be, or a set of ways the world could logically be.

We can contrast a *fact model* of minds and actions with a *belief model*.

On the fact model, it is facts about where things are which explain an agents' actions.

---

<sup>1</sup> According to an influential definition offered by Premack & Woodruff (1978, p. 515), for an individual to have a theory of mind its for her to ‘impute mental states to himself *and* to others’ (my italics). I have slightly relaxed their definition by changing their ‘and’ to ‘or’ in order to allow for the possibility that there are mindreaders who can identify others’ but not their own mental states.

On the belief model, it is an agents' beliefs about where things are which explain her actions.

False belief tasks can be used to distinguish the hypothesis that a subject is using a fact model from the hypothesis that she is using a belief model of minds and actions.

### 1.3. Automatic Mindreading?

Is mindreading automatic? (More carefully: Does belief tracking in human adults depend only on processes which are automatic?)

A process is *automatic* to the degree that whether it occurs is independent of its relevance to the particulars of the subject's task, motives and aims.

There is evidence that some mindreading in human adults is entirely a consequence of relatively automatic processes (Kovács et al. 2010; Schneider et al. 2012; van der Wel et al. 2014; Edwards & Low 2017, 2019), and that not all mindreading in human adults is (Apperly et al. 2008, 2010; van der Wel et al. 2014).

Qureshi et al. (2010) found that automatic and nonautomatic mindreading processes are differently influenced by cognitive load, and Todd et al. (2016) provided evidence that adding time pressure affects nonautomatic but not automatic mindreading processes.

There is also limited evidence that people are unaware of automatic belief tracking processes:

‘Participants never reported belief tracking when questioned in an open format after the experiment (“What do you think this experiment was about?”). Furthermore, this verbal debriefing about the experiment's purpose never triggered participants to indicate that they followed the actor's belief state’ (Schneider et al. 2012, p. 2)

### 1.4. Objection 1

Level 1 perspective-taking in the Samson ‘dot task’ does not appear to be more automatic than Level 2 perspective-taking (Todd et al. 2020).<sup>2</sup> This

<sup>2</sup> These authors comment:

‘not only did we consistently observe that altercentric interference was weaker when the avatar's perspective was less relevant to participants' task goal; we also consistently failed to observe any evidence of altercentric interference in L1-VPT in these conditions’ (Todd et al. 2020, p. 16).

and

finding is puzzling if we take the evidence for automatic belief-tracking at face value: why would belief-tracking but not level-1 perspective taking be automatic? Todd et al.'s finding is also incompatible with, and therefore evidence against, the conjecture that automatic belief-tracking processes rely on minimal theory of mind because minimal theory of mind involves Level-1 perspective-taking.

### 1.5. Objection 2

Christensen & Michael argue that the dual process theory is less well supported overall than an alternative:

‘A cooperative multi-system architecture is better able to explain infant belief representation than a parallel architecture, and causal representation, schemas and models provide a more promising basis for flexible belief representation than does a rule-based approach of the kind described by Butterfill and Apperly’ (Christensen & Michael 2016; see also Michael & Christensen 2016; Michael et al. 2013).

## 2. Mindreading: Signature Limits, and Development

The method of signature limits enables us both to generate predictions from a dual process theory and to re-identify processes across groups (e.g. human adults and human infants; or humans and nonhumans).

### 2.1. What Is a Model?

*A model* is just a way some aspects of the world could be. *A model of minds and actions* is a way mental aspects of the world could be.

A model is something that can serve different purposes. Having a model does not commit you to using it for any particular purpose. The model's usefulness does not depend only on its accuracy: the ease with which it can be used to imagine, build or navigate matters. The best model for a given set of purposes may not be the most accurate. Further, it can be advantageous

---

‘reducing the goal-relevance of a cartoon avatar’s perspective weakened both Level-1 and Level-2 visual perspective calculation. ... both Level-1 and Level-2 visual perspective calculation may be dependent on having a (remote) goal to process a target agent’s perspective’ (Todd et al. 2020, p. 18).

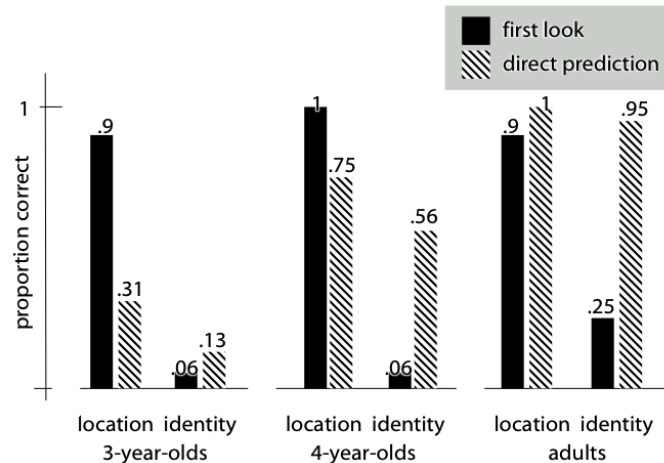


Figure 1: Signature limits illustrated. A response-by-content interaction that is robust across age-groups. *Source*:redrawn from Low & Watts (2013)

to have multiple models of a single thing. For example, building a house can involve creating multiple models.

Theorists specify models in various ways including by giving a theory or by constructing something physical.

A model is distinct from a theory. A model can be used to make claims about the world, but the model itself entails nothing about how the world actually is. By contrast, a theory does (Godfrey-Smith 2005).

In saying that an individual or a process *relies* on a model, we are attempting to capture the way aspects of the world seem from the individual's or processes' point of view. There is no commitment to any claim about how the model relates to the individual or process. There is no suggestion, in saying that an individual relies on a model, that they have a physical model; nor that they know any of a theory which we, as theorists, use to specify the model.

## 2.2. Signature Limits

A signature limit of a model is a set of predictions derivable from the model which are incorrect, and which are not predictions of other models under consideration.

Automatic belief-tracking in adults, and belief-tracking in infants, are both subject to signature limits associated with minimal theory of mind (Wang et al. 2015; Low & Watts 2013; Low et al. 2014; Mozuraitis et al. 2015; Edwards & Low 2017; Fizke et al. 2017; Oktay-Gür et al. 2018; Edwards & Low 2017, 2019; contrast Scott et al. 2015).

### 2.3. Objections

1. Low & Watts (2013) is replicable, but the paradigm involves confounds and so the results do not provide good evidence of belief tracking (Kulke et al. 2018).<sup>3</sup>
2. Infant belief-tracking is not subject to the signature limit about identity (Scott et al. 2015).
3. ‘the theoretical arguments offered [...] are [...] unconvincing, and [...] the data can be explained in other terms’ (Carruthers 2015b; see also Carruthers 2015a).

## Glossary

**automatic** On this course, a process is *automatic* just if whether or not it occurs is to a significant extent independent of your current task, motivations and intentions. To say that *mindreading is automatic* is to say that it involves only automatic processes. The term ‘automatic’ has been used in a variety of ways by other authors: see Moors (2014, p. 22) for a one-page overview, Moors & De Houwer (2006) for a detailed theoretical review, or Bargh (1992) for a classic and very readable introduction 3, 5

**mindreading** The process of identifying a mental state as a mental state that some particular individual, another or yourself, has. To say someone has a *theory of mind* is another way of saying that she is capable of mindreading.

---

<sup>3</sup> Kulke et al. (2018) argue that although the paradigm from Low & Watts (2013) replicates, attempts to modify it to avoid confounding factors do not produce comparable results. In full:

‘There are two broad possibilities why only the Low and Watts (2013) paradigm was robustly replicated. One possibility is that this paradigm is particularly valid (perhaps because of lower processing demands or other relevant task factors) and therefore the most sensitive and suitable one to tap implicit theory of mind. The contrary possibility is that this task may be particularly prone to alternative explanations because of potential confounds’ (p. 8)

This motivated them to consider modified versions of the paradigm avoiding confounds, but:

‘the original pattern of belief-congruent looking could be reproduced only under conditions in which the belief congruency of the locations is confounded with additional factors, and therefore, this pattern might not reflect belief-based anticipation’ (p. 9)

According to an influential definition offered by Premack & Woodruff (1978, p. 515), for an individual to have a theory of mind its for her to 'impute mental states to himself *and* to others' (my italics). (I have slightly relaxed their definition by changing their 'and' to 'or' in order to allow for the possibility that there are mindreaders who can identify others' but not their own mental states.) 3

**minimal theory of mind** A theory of the mental in which: (a) mental states are assigned functional roles that can be readily codified; and, (b), the contents of mental states can be distinguished by things which, like locations, shapes and colours, can be held in mind using some kind of quality space or feature map. 4

**signature limit** A signature limit of a system is a pattern of behaviour the system exhibits which is both defective given what the system is for and peculiar to that system. A signature limit of a model is a set of predictions derivable from the model which are incorrect, and which are not predictions of other models under consideration. 5

## References

- Apperly, I. A., Back, E., Samson, D., & France, L. (2008). The cost of thinking about false beliefs: Evidence from adults' performance on a non-inferential theory of mind task. *Cognition*, *106*(3), 1093–1108.
- Apperly, I. A., Carroll, D. J., Samson, D., Humphreys, G. W., Qureshi, A., & Moffitt, G. (2010). Why are there limits on theory of mind use? evidence from adults' ability to follow instructions from an ignorant speaker. *The Quarterly Journal of Experimental Psychology*, *63*, 1201–1217.
- Bargh, J. A. (1992). The Ecology of Automaticity: Toward Establishing the Conditions Needed to Produce Automatic Processing Effects. *The American Journal of Psychology*, *105*(2), 181–199.
- Carruthers, P. (2015a). Mindreading in adults: evaluating two-systems views. *Synthese*, *forthcoming*, 1–16.
- Carruthers, P. (2015b). Two systems for mindreading? *Review of Philosophy and Psychology*, *7*(1), 141–162.
- Christensen, W. & Michael, J. (2016). From two systems to a multi-systems architecture for mindreading. *New Ideas in Psychology*, *40*, 48–64.
- Edwards, K. & Low, J. (2017). Reaction time profiles of adults' action prediction reveal two mindreading systems. *Cognition*, *160*, 1–16.

- Edwards, K. & Low, J. (2019). Level 2 perspective-taking distinguishes automatic and non-automatic belief-tracking. *Cognition*, 193, 104017.
- Fizke, E., Butterfill, S. A., van de Loo, L., Reindl, E., & Rakoczy, H. (2017). Signature limits in early theory of mind: Toddlers spontaneously take into account false beliefs about an objects' location but not about its identity. *Journal of Experimental Child Psychology*, forthcoming.
- Godfrey-Smith, P. (2005). Folk psychology as a model. *Philosophers' Imprint*, 5(6).
- Kovács, Á. M., Téglás, E., & Endress, A. D. (2010). The social sense: Susceptibility to others' beliefs in human infants and adults. *Science*, 330(6012), 1830 –1834.
- Kulke, L., von Duhn, B., Schneider, D., & Rakoczy, H. (2018). Is Implicit Theory of Mind a Real and Robust Phenomenon? Results From a Systematic Replication Study. *Psychological Science*, 0956797617747090.
- Low, J., Drummond, W., Walmsley, A., & Wang, B. (2014). Representing how rabbits quack and competitors act: Limits on preschoolers' efficient ability to track perspective. *Child Development*, forthcoming.
- Low, J. & Watts, J. (2013). Attributing false-beliefs about object identity is a signature blindspot in humans' efficient mindreading system. *Psychological Science*, 24(3), 305–311.
- Michael, J. & Christensen, W. (2016). Flexible goal attribution in early mindreading. *Psychological Review*, 123(2), 219–227.
- Michael, J., Christensen, W., & Overgaard, S. (2013). Mindreading as social expertise. *Synthese*, 191(5), 817–840.
- Moors, A. (2014). Examining the mapping problem in dual process models. In *Dual process theories of the social mind* (pp. 20–34). Guilford.
- Moors, A. & De Houwer, J. (2006). Automaticity: A Theoretical and Conceptual Analysis. *Psychological Bulletin*, 132(2), 297–326.
- Mozuraitis, M., Chambers, C. G., & Daneman, M. (2015). Privileged versus shared knowledge about object identity in real-time referential processing. *Cognition*, 142, 148–165.
- Oktay-Gür, N., Schulz, A., & Rakoczy, H. (2018). Children exhibit different performance patterns in explicit and implicit theory of mind tasks. *Cognition*, 173, 60–74.



- Premack, D. & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, 1(04), 515–526.
- Qureshi, A., Apperly, I. A., & Samson, D. (2010). Executive function is necessary for perspective selection, not level-1 visual perspective calculation: Evidence from a dual-task study of adults. *Cognition*, 117(2), 230–236.
- Schneider, D., Bayliss, A. P., Becker, S. I., & Dux, P. E. (2012). Eye movements reveal sustained implicit processing of others' mental states. *Journal of Experimental Psychology: General*, 141(3), 433–438.
- Scott, R. M., Richman, J. C., & Baillargeon, R. (2015). Infants understand deceptive intentions to implant false beliefs about identity: New evidence for early mentalistic reasoning. *Cognitive Psychology*, 82, 32–56.
- Todd, A. R., Cameron, C. D., & Simpson, A. (2016). Dissociating processes underlying level-1 visual perspective taking in adults. *Cognition*, in press.
- Todd, A. R., Cameron, C. D., & Simpson, A. J. (2020). The goal-dependence of level-1 and level-2 visual perspective calculation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, No Pagination Specified–No Pagination Specified.
- van der Wel, R. P. R. D., Sebanz, N., & Knoblich, G. (2014). Do people automatically track others' beliefs? evidence from a continuous measure. *Cognition*, 130(1), 128–133.
- Wang, B., Hadi, N. S. A., & Low, J. (2015). Limits on efficient human mindreading: Convergence across chinese adults and semai children. *British Journal of Psychology*, 106(4), 724–740.
- Wimmer, H. & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, 13, 103–128.