

# Two Systems and Two Theories of Mind

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## 1. Terminology

*Mindreading* is the process of identifying mental states and actions as the mental states and actions of a particular subject on the basis, ultimately, of bodily movements and their absence, somewhat as reading is the process of identifying propositions on the basis of inscriptions.<sup>5</sup>

## 2. Infant false-belief tracking abilities

One-year-old children predict actions of agents with false beliefs about the locations of objects<sup>19,36,46</sup> and about the contents of containers,<sup>25</sup> taking into account verbal communication.<sup>44,42</sup> They will also choose ways of helping<sup>14</sup> and communicating<sup>30,45</sup> with others depending on whether their beliefs are true or false. And in much the way that irrelevant facts about the contents of others' beliefs modulate adult subjects' response times, such facts also affect how long 7-month-old infants look at some stimuli.<sup>31</sup>

## 3. Three-year-olds fail false belief tasks

Three-year-olds systematically fail to predict actions<sup>50</sup> and desires<sup>9</sup> based on false beliefs; they similarly fail to retrodict beliefs<sup>49</sup> and to select arguments suitable for agents with false beliefs.<sup>11</sup> They fail some nonverbal false belief tasks;<sup>16,34</sup>

they fail whether the question concerns others' or their own (past) false beliefs;<sup>23</sup> and they fail whether they are interacting or observing.<sup>17</sup>

## 4. A-tasks and B-tasks

Call the tasks children typically pass before their third birthday *A-tasks*.

By stipulation, *B-tasks* have these features:

- Children tend to pass them some time after their third birthday.
- Abilities to pass these tasks has a protracted developmental course stretching over months if not years.
- Success on these tasks is correlated with developments in executive function<sup>37,38</sup> and language.<sup>8</sup>
- Success on these tasks is facilitated by explicit training<sup>43</sup> and environmental factors such as siblings.<sup>20,27</sup>
- Abilities to succeed on these tasks typically emerge from extensive participation in social interactions.<sup>26</sup>

The pattern of failure indicates a single developmental transition.<sup>48</sup>

## 5. First Puzzle

1. There are subjects who can pass A-tasks but cannot pass B-tasks.

2. These subjects' success on A-tasks is explained by the fact that they can represent (false) beliefs
3. These subjects' failure on B-tasks is explained by the fact that they cannot represent (false) beliefs

## 6. Second Puzzle

A process is *automatic* if whether it occurs is to a significant degree independent of its relevance to the particulars of the subject's motives and aims. (A process may occur spontaneously without thereby being automatic.)

Are human adults' abilities to represent beliefs automatic? There is evidence for<sup>31,41</sup> and against.<sup>1,6</sup>

Representing perceptions and beliefs as such—and even merely holding in mind what another believes, where no inference is required—involves a measurable processing cost<sup>1,2</sup>, consumes attention and working memory in fully competent adults,<sup>7,32,35</sup> may require inhibition<sup>13</sup> and makes demands on executive function.<sup>4,39</sup>

## 7. Mindreading is flexible but demanding

Impaired executive processes can lead to severe egocentrism.<sup>39</sup>

Belief reasoning requires cognitive control.<sup>13</sup>

Belief inferences are not made automatically.<sup>3,10</sup>

Belief inferences are not used automatically.<sup>29,6</sup>

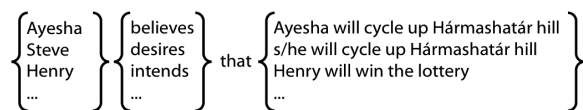
Holding false beliefs briefly in mind has a measurable processing cost.<sup>1</sup>

Recursion (e.g., beliefs about beliefs) remains challenging.<sup>35</sup>

## 8. Mindreading is efficient but inflexible

There is involuntary altercentric inference from others' visual perspectives<sup>40</sup>, spatial frames of reference<sup>51</sup> and false beliefs.<sup>31</sup> Such interference sometimes occurs without explicit awareness,<sup>41</sup> and without a need for executive control.<sup>41</sup>

## 9. Mental States



Subject

Attitude

Content

## 10. Defining belief: normativity

'For any p: One ought to believe that p only if p.

'the holding of this norm is one of the defining features of the notion of belief [...]. The truth is what you ought to believe, whether or not you know how to go about it, and whether or not you know if you have attained it. That, in my view, is what makes it the state that it is.'<sup>12</sup>

'belief must be characterized, not just as the attitude having the motivational role, but rather as a truth directed species of that attitude: to believe a proposition is to regard it as true with the aim of thereby accepting a truth.'<sup>47</sup>

'Aside from our purposes in forming beliefs or in using beliefs as guides to action, there is nothing they should or shouldn't be. ... The only fault with fallacious reasoning, the only thing wrong or bad about mistaken judgements, is that, generally speaking, we don't like them. We do our best to avoid them. They do not—most of the time at least—serve our purposes'<sup>22</sup>

'The payments true ideas bring are the sole why of our duty to follow them. Identical whys exist in the case of wealth and health. Truth makes no other kind of claim and imposes no other kind of ought than health and wealth do.'<sup>28</sup>

## 11. Minimal theory of mind<sup>15</sup>

An agent's *field* is a set of objects related to the agent by proximity, orientation, lighting and other factors.

An agent *encounters* an object just if it is in her field.

A *goal* is an outcome to which one or more actions are, or might be, directed. (Not to be confused with a *goal-state*, which is an intention or other state of an agent linking an action to a particular goal to which it is directed.)

**Principle 1:** one can't goal-directedly act on an object unless one has encountered it.

Applications: subordinate chimps retrieve food when a dominant is not informed of its location;<sup>24</sup> when observed scrub-jays prefer to cache in shady, distant and occluded locations.<sup>21,18</sup>

An agent *registers* an object at a location [first ap-

proximation] just if she most recently encountered the object at that location.

A registration is *correct* just if the object is at the location it is registered at.

**Principle 2:** correct registration is a condition of successful action.

Applications: 12-month-olds point to inform depending on their informants' goals and ignorance;<sup>33</sup> chimps retrieve food when a dominant is misinformed about its location;<sup>24</sup> scrub-jays observed caching food by a competitor later re-cache in private.<sup>18</sup>

**Principle 3:** when an agent performs a goal-directed action and the goal specifies an object, the agent will act as if the object were actually in the location she registers it at.

Applications: some false belief tasks<sup>36,46,14</sup>

## 12. Signature limits

	Propositional attitude	Relational attitude
level-1 perspective taking	Y	Y
level-2 perspective taking	Y	N
false beliefs about non-existence	Y	N
false beliefs about location	Y	Y
false beliefs about identity	Y	N

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