

# how to construct a Minimal Theory of Mind

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## 1. Background: Davidson's Problem

"We are stuck with our two main ways of describing and explaining things, one which treats objects and events as mindless, and the other which treats objects and events as having propositional attitudes. I see no way of bridging the gap by introducing an intermediate vocabulary."<sup>1</sup>

"chimpanzees understand ... intentions ... perception and knowledge ... Moreover, they understand how these psychological states work together to produce intentional action."<sup>23</sup>

"our [typical adult humans'] fundamental conception of what it is to know that P is itself an explanatory conception [...] we think of S's knowledge that P as something that can properly be explained by reference to what S has perceived or remembered or proved or ..."<sup>23, 24</sup>

"When infants watch an agent act in a scene, SS1 enables them to attribute ... *motivational* states, which specify the agent's motivation in the scene (e.g. goals, dispositions) and *reality-congruent informational* states ... SS2 extends SS1 and enables infants to attribute to agents *reality-incongruent informational* states; these include false beliefs"<sup>25</sup>

## 2. Abilities vs. cognition

A theory of mind *ability* is an ability that exists in part because exercising it brings benefits obtaining which depends on exploiting or influencing facts about others' mental states.

Theory of mind *cognition* paradigmatically involves ascribing propositional attitudes such as beliefs, desires and intentions to give rationalising causal explanations of action.

## 3. Theory of mind abilities are widespread

Children in their second year use pointing to provide information to others<sup>2</sup> in ways that reflect their partners' ignorance or knowledge<sup>3</sup>; provide more information to ignorant than knowledgeable partners when making requests<sup>4</sup>; predict actions of agents with false beliefs about the locations of objects<sup>5, 6</sup>; and select different ways of helping others depending on whether their beliefs are true or false<sup>7</sup>

Scrub-jays selectively re-cache their food in ways that prevent competitors from knowing its location<sup>8</sup>

Chimpanzees select routes to approach food which conceal them from a competitor's view<sup>9</sup> and retrieve food using strategies that optimise their return given what a dominant competitor has seen.<sup>10</sup>

## 4. Question

What could two-year-olds, scrub-jays and chimpanzees represent that would enable them, within limits, to track others' propositional attitudes?

## 5. Representing propositional attitudes is hard

(a) Conceptually demanding:

- Acquisition takes several years<sup>11, 12</sup>
- Tied to the development of executive function<sup>13, 14</sup> and language<sup>15</sup>
- Development facilitated by explicit training<sup>16</sup> and siblings<sup>17, 18</sup>

(b) Cognitively demanding:

- Requires attention and working memory in fully competent adults<sup>19, 20</sup>

## 6. What makes representing propositional attitudes conceptually & cognitively demanding?

It involves abductive reasoning about uncodifiably complex causal interactions among states and events individuated by their propositional contents and normative roles.<sup>21, 22</sup>

## 7. Pure behaviour reading

Pure behaviour reading = segmenting a stream of bodily movement into chunks and discerning relations among chunks on the basis of statistical patterns and other cues not intentions or goals.

*Object-directed* Behaviour reading involves motor actions that are object-directed such as grasping an object or placing an object. They are object-directed in the sense that their specification involves an object whose properties control how the action is executed

## 8. How to construct a minimal theory of mind

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

An agent *encounters* an object = it is in her field

*Goal-directed action* = a sequence of object-directed actions, which (1) has an outcome that is an outcome of the whole sequence and not any of its constituents, and (2) occurs in order to bring about this outcome.

Principle 3: one can't goal-directedly act on an object unless one has encountered it.

Application: the "uninformed" condition of Hare et. al's 2001 experiment with food hiding.<sup>10</sup>

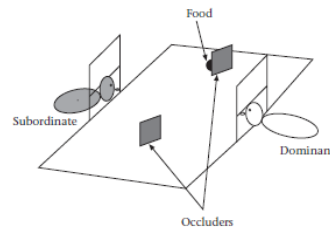
Application: scrub-jays, after being observed caching food by a competitor, will re-cache that food when in private.<sup>8, 26</sup>

An agent *registers* an object at a location [first approximation =] she most recently encountered the object at that location.

*Correct registration* the object is at the location it is registered at.

Principle 4: correct registration is a condition of successful action.

Applications: 12-month-olds point to inform depending on their informants' goals and ignorance<sup>3</sup>; also the "misinformed" condition of Hare et. al's 2001;<sup>10</sup> scrub-jays, after being observed caching food by a competitor, re-cache that food.<sup>8, 26</sup>



(Hare, Call and Tomasello 2001: 142, fig. 1)

Principle 5: 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.

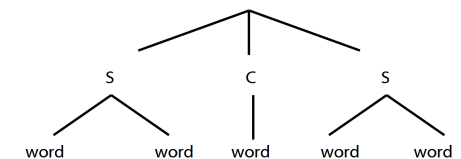
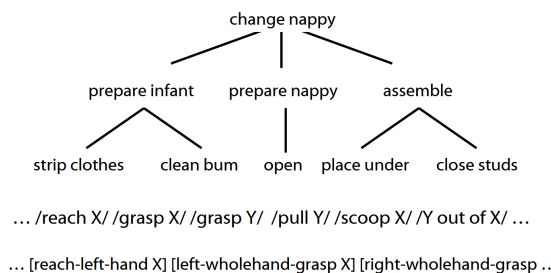
Applications: false belief tasks<sup>5-7</sup>

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