Lecture 07

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1. Knowledge of Mind

Mindreading is the process of identifying mental states and purposive actions as the mental states and purposive actions of a particular subject.

'In saying that an individual has a theory of mind, we mean that the individual imputes mental states to himself and to others' (Premack & Woodruff 1978, p. 515)

In a standard *false belief task*, '[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.

Three-year-olds systematically fail to predict actions (Wimmer & Perner 1983) and desires (Astington & Gopnik 1991) based on false beliefs; they similarly fail to retrodict beliefs (Wimmer & Mayringer 1998) and to select arguments suitable for agents with false beliefs (Bartsch & London 2000). They fail some low-verbal and non-verbal false belief tasks Call & Tomasello 1999; Low 2010; Krachun et al. 2009, 2010; they fail whether the question concerns others' or their own (past) false beliefs (Gopnik & Slaughter 1991); and they fail whether they are interacting or observing (Chandler et al. 1989).

2. Infants Track False Beliefs

One-year-old children predict actions of agents with false beliefs about the locations of objects (Clements & Perner 1994; Onishi & Baillargeon 2005; Southgate et al. 2007), and about the contents of containers (He et al. 2011), taking into account verbal communication (Song et al. 2008; Scott et al. 2012). They will also choose ways of helping (Buttelmann et al. 2009) and communicating (Knudsen & Liszkowski 2012; Southgate et al. 2010) 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 (Kovács et al. 2010).

3. Mindreading: a Developmental Puzzle

An *A-Task* is any false belief task that children tend to fail until around three to five years of age.

1. Children fail A-tasks because they rely on a model of minds and actions that does not incorporate beliefs.

2. Children pass non-A-tasks by relying on a model of minds and actions that does incorporate beliefs.

3. At any time, the child has a single model of minds and actions.

For adults (and children who can do this), 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 (Apperly et al. 2008, 2010a), consumes attention and working memory in fully competent adults Apperly et al. 2009; Lin et al. 2010; McKinnon & Moscovitch 2007, may require inhibition (Bull et al. 2008) and makes demands on executive function (Apperly et al. 2004; Samson et al. 2005).

4. Mindreading in Adults: Dual Processes

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), and that not all mindreading in human adults is (Apperly et al. 2008, 2010b; 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.

'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)

Dual Process Theory of Mindreading. Automatic and nonautomatic mindreading processes are independent in this sense: different conditions influence whether they occur and which ascriptions they generate (e.g. Todd et al. 2016; Qureshi et al. 2010).

5. Minimal Theory of Mind

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

First approximation: 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.

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 (Hare et al. 2001); when observed scrub-jays prefer to cache in shady, distant and occluded locations (Dally et al. 2004; Clayton et al. 2007).

First approximation: an agent *registers* an object at a location 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 (Liszkowski et al. 2008); chimps retrieve food when a dominant is misinformed about its location (Hare et al. 2001); scrub-jays observed caching food by a competitor later re-cache in private (Clayton et al. 2007; Emery & Clayton 2007).
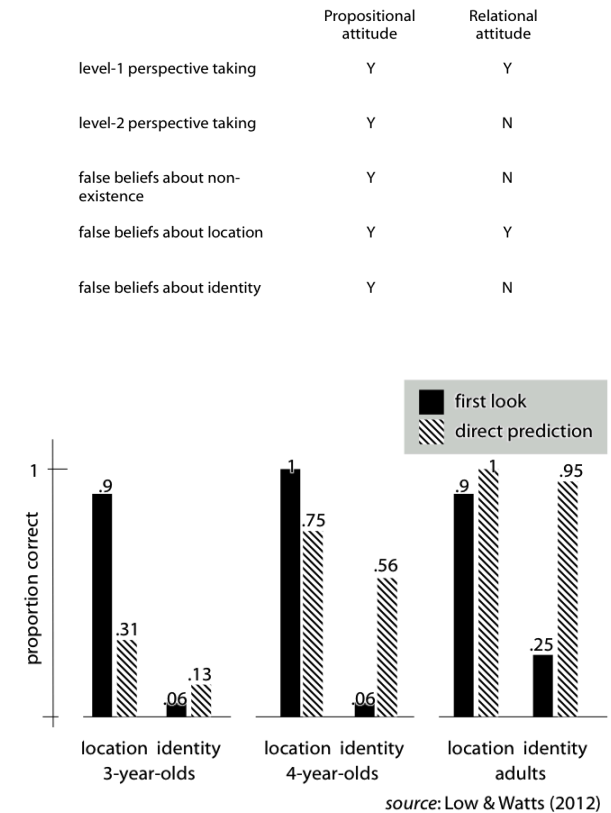
Principle 3: when an agent performs a goal-directed action and the goal specifies an object, the agent will act as if the object were actually in the location she registers it at.

Applications: some false belief tasks (Onishi & Baillargeon 2005; Southgate et al. 2007; Buttel-

mann et al. 2009).

6. Signature Limits

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; contrast Scott et al. 2015).

	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

source: Low & Watts (2012)

Objection: 'the theoretical arguments offered [...] are [...] unconvincing, and [...] the data can be explained in other terms' (Carruthers 2015b; see also Carruthers 2015a).

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