Origins of Mind: Lecture 07

s.butterfill@warwick.ac.uk

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.

2. Mindreading: First Puzzle

2.1. Theory of mind cognition is hard

Conceptually demanding:

- Acquisition takes several years (Wimmer & Perner 1983; Wellman et al. 2001)
- Tied to the development of executive function (Perner & Lang 1999; Sabbagh 2006) and language (Astington & Baird 2005)
- Development facilitated by explicit training (Slaughter & Gopnik 1996) and siblings (Clements et al. 2000; Hughes & Leekam 2004)

Cognitively demanding:

- Requires attention and working memory in fully competent adults (Apperly et al. 2008b; McKinnon & Moscovitch 2007)

3. Mindreading: Second Puzzle

Are human adults' abilities to represent beliefs automatic?

There is evidence for (Kovács et al. 2010; Schneider et al. 2011) and against (Apperly et al. 2008a, 2010b).

4. Modules and Cognitive Efficiency

How could mindreading ever (but not always) be automatic?

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. 2008a, 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)

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.

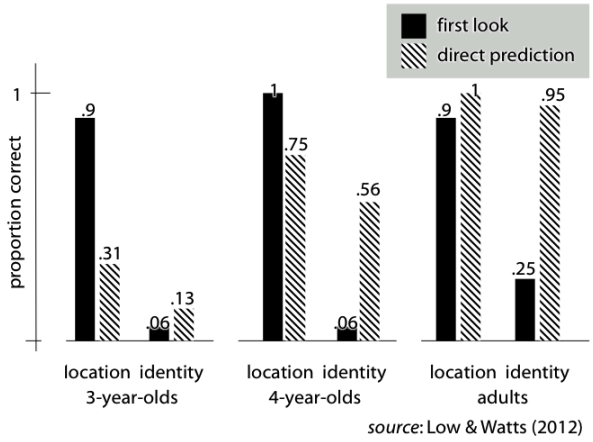
Applications: 12-month-olds point to inform depending on their informants' goals and ignorance (Liszkowski et al. 2008); chimps retrieve food when a dominant is misinformed about its location (Hare et al. 2001); scrub-jays observed caching food by a competitor later re-cache in private (Clayton et al. 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; Buttelmann et al. 2009).

6. Signature Limits Generate Predictions

	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)

References

Apperly, I., Back, E., Samson, D., & France, L. (2008a). 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., Carroll, D., Samson, D., Humphreys, G., Qureshi, A., & Moffitt, G. (2010a). 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*(6), 1201–1217.

Apperly, I., Samson, D., Chiavarino, C., & Humphreys, G. (2004). Frontal and temporo-parietal lobe contributions to theory of mind: Neuropsychological evidence from a false-belief task with reduced language and executive demands. *Journal of Cognitive Neuroscience*, *16*(10), 1773–1784.

Apperly, I. A., Back, E., Samson, D., & France, L. (2008b). The cost of thinking about false beliefs: Evidence from adults' performance on a non-inferential theory of mind task. *Cognition*, *106*, 1093–1108.

Apperly, I. A., Carroll, D. J., Samson, D., Humphreys, G. W., Qureshi, A., & Moffitt, G. (2010b). 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.

Apperly, I. A., Samson, D., & Humphreys, G. W. (2009). Studies of adults can inform accounts of theory of mind development. *Developmental Psychology*, *45*(1), 190–201.

Astington, J. & Baird, J. A. (Eds.). (2005). *Why Language Matters for Theory of Mind*. Oxford: Oxford University Press.

Bull, R., Phillips, L., & Conway, C. (2008). The role of control functions in mentalizing: Dual-task studies of theory of mind and executive function. *Cognition*, *107*(2), 663–672.

Buttelmann, D., Carpenter, M., & Tomasello, M. (2009). Eighteen-month-old infants show false belief understanding in an active helping paradigm. *Cognition*, *112*(2), 337–342.

Clayton, N. S., Dally, J. M., & Emery, N. J. (2007). Social cognition by food-caching corvids. the western scrub-jay as a natural psychologist. *Philosophical Transactions of the Royal Society B*, *362*, 507–552.

Clements, W., Rustin, C., & McCallum, S. (2000). Promoting the transition from implicit to explicit understanding: a training study of false belief. *Developmental Science*, *3*(1), 81–92.

Dally, J. M., Emery, N. J., & Clayton, N. S. (2004). Cache protection strategies by western scrub-jays (aphelocoma californica): hiding food in the shade. *Proceedings of the Royal Society B: Biological Sciences*, *271*(0), S387–S390–S387–S390.

Emery, N. J. & Clayton, N. S. (2007). How to build a scrub-jay that reads minds. In S. Itakura & K. Fujita (Eds.), *Origins of the Social Mind: Evolutionary and Developmental Perspectives*. Tokyo: Springer.

Hare, B., Call, J., & Tomasello, M. (2001). Do chimpanzees know what conspecifics know? *Animal Behaviour*, *61*(1), 139–151.

Hughes, C. & Leekam, S. (2004). What are the links between theory of mind and social relations? review, reflections and new directions for studies of typical and atypical development. *Social Development*, *13*(4), 590–619.

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.

Lin, S., Keysar, B., & Epley, N. (2010). Reflexively mindblind: Using theory of mind to interpret behavior requires effortful attention. *Journal of Experimental Social Psychology*, *46*(3), 551–556.

Liszkowski, U., Carpenter, M., & Tomasello, M. (2008). Twelve-month-olds communicate helpfully and appropriately for knowledgeable and ignorant partners. *Cognition*, *108*(3), 732–739.

McKinnon, M. C. & Moscovitch, M. (2007). Domain-general contributions to social reasoning: Theory of mind and deontic reasoning re-explored. *Cognition*, *102*(2), 179–218.

Onishi, K. H. & Baillargeon, R. (2005). Do 15-month-old infants understand false beliefs? *Science*, *308*(8), 255–258.

Perner, J. & Lang, B. (1999). Development of theory of mind and executive control. *Trends in Cognitive Sciences*, *3*(9), 337–344.

Premack, D. & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, *1*(04), 515–526.

Sabbagh, M. (2006). Executive functioning and preschoolers' understanding of false beliefs, false photographs, and false signs. *Child Development*, *77*(4), 1034–1049.

Samson, D., Apperly, I., Kathirgamanathan, U., & Humphreys, G. (2005). Seeing it my way: a case of a selective deficit in inhibiting self-perspective. *Brain*, *128*(5), 1102–1111.

Schneider, D., Bayliss, A. P., Becker, S. I., & Dux, P. E. (2011). Eye movements reveal sustained implicit processing of others' mental states. *Journal of Experimental Psychology: General, advance online*.

Slaughter, V. & Gopnik, A. (1996). Conceptual coherence in the child's theory of mind: Training children to understand belief. *Child Development*, *67*, 2967–2988.

Southgate, V., Senju, A., & Csibra, G. (2007). Action anticipation through attribution of false belief by two-year-olds. *Psychological Science*, *18*(7), 587–592.

Wellman, H., Cross, D., & Watson, J. (2001). Meta-analysis of theory of mind development: The truth about false-belief. *Child Development*, *72*(3), 655–684.

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.