

Are knowledge- and belief-reasoning automatic, and is this the right question?

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Title: Are knowledge- and belief-reasoning automatic, and is this the right question?

Abstract: Phillips et al. conclude that current evidence supports knowledge-, but not belief-reasoning as being automatic. We suggest four reasons why this is an oversimplified answer to a question that might not have a clear-cut answer: (i) knowledge and beliefs can be incompletely equated to perceptual states, (ii) sensitivity to mental states does not necessitate representation, (iii) automaticity is not a single categorical feature, and (iv) how we represent others minds is dependent on social context.

The target article makes an important theoretical contribution. Comparing knowledge and belief representation provides a compelling account that will shape future research significantly. Phillips et al. rightly note that research on the automaticity of adult belief and knowledge representation is contentious. We remain sceptical that knowledge vs. belief representation will ever neatly classify as automatic or not. We consider four aspects of Phillips et al.'s reasoning to illustrate this point.

Visual perspectives are not pure analogies to knowledge and belief representations

Phillips et al. invoke the distinction between level-1 and level-2 perspective taking to distinguish knowledge vs. belief representation. The strongest evidence supporting adults' automatic knowledge representation comes from a level-1 perspective taking task (Samson et al., 2010), whilst level-2 tasks are used to support the non-automaticity of belief reasoning (Surtees et al., 2012; Surtees et al., 2016a). Both sides of the analogy between visual perspectives and knowledge vs. belief are problematic, however. It is not necessarily the case that a level-1 perspective confers knowledge. Whilst *seeing is knowing* is a reasonable heuristic (Moll & Tomasello, 2007), *not seeing is not knowing* is unlikely to be. We rarely beep our horn as our neighbours reverse towards their houses without looking because we

know they *know* it is there. Regarding level-2 perspective taking, representing how someone sees something does not necessarily equate to representing their belief about the object. You can look at a number 6 from one angle, whilst we see it as a number 9 from another, without us holding differing *beliefs* about the object. By equating knowledge and belief with level-1 and level-2 perspective taking, respectively, Phillips et al. may be over-simplifying knowledge and over-complicating belief.

Mental-state sensitivity may not necessitate mental-state representation

Phillips et al. conclude evidence of automaticity based on studies documenting interference from another's perspective on judgements of one's own perspective (Kovács et al., 2010; Samson et al., 2010). We question whether the incidental sensitivity to others' mental states revealed by these altercentric-interference effects necessitates their being *represented*. Several accounts leave open the possibility that other mechanisms underlie such mental-state sensitivity. As Phillips et al. note, submentalizing accounts propose lower-level, domain-general explanations of altercentric interference (Heyes, 2014). Two-systems accounts, in contrast, posit that altercentric interference reflects domain-specific *registration* of "belief-like states" (Apperly & Butterfill, 2009). Taking cues from both of these accounts, process-dissociation accounts hold that altercentric interference is not a process-pure index of mental-state registration; rather, such effects can be decomposed into at least two component processes: calculation of the agent's perspective and detection of one's own perspective (Todd et al., 2017, 2019, in press), with the latter process likely reflecting something more domain-general (Payne, 2005). Phillips et al. reason that knowledge representation is more basic based on evidence from tasks finding altercentric interference, but this could be evidence of arbitrary correlation between "knowledge" and stimulus features, coupling to more basic mental-state-like states, or poorer discrimination from self-knowledge.

Automaticity is not categorical

Phillips et al. aim to categorise knowledge and belief representation as automatic or not. Such categorisation is likely an over-simplification of how cognitive systems operate. Automaticity is not a single feature, but rather a set of conceptually separable features that often do not co-occur (Melnikoff & Bargh, 2018; Moors & De Houwer, 2006). Thus, specifying *in what way(s)* belief and knowledge representation are automatic is crucial. The automaticity features receiving most empirical attention are goal-independence and efficiency. We agree with Phillips et al. that current evidence supports level-2 altercentric interference and process-dissociation estimates of agent-perspective calculation as consistently not-automatic. On a level-2 task, when participants only ever considered their own perspective, we showed that altercentric interference (Surtees et al., 2016a) and agent-perspective calculation (Todd et al., in press) were absent, suggesting level-2 perspective taking is goal-dependent. Using the same task, Todd et al. (2019) found that time pressure also impaired agent-perspective calculation, suggesting it is relatively inefficient. Evidence for level-1 automaticity is more equivocal. Some studies suggest level-1 altercentric interference emerges regardless of participant task goals (Conway et al., 2017; Surtees et al., 2016a); others do not (Ferguson et al., 2017; Todd et al., in press). Some studies suggest level-1 altercentric interference and agent-perspective calculation are efficient, in that they were unimpaired by time pressure (Todd et al., 2017, 2019) or a concurrent resource-consuming task (Qureshi et al., 2010); another found the opposite (Qureshi & Monk, 2018). Whilst Phillips et al. acknowledge empirical uncertainty, our view is that different mental-state representations are not necessarily categorised fully as automatic or non-automatic. The impact of context on automaticity further supports this contention.

Mental-state representation may differ in observational and interactive contexts

Processes for interaction are different when directly engaging with another person, as opposed to passively observing them (Schilbach et al., 2013). Phillips et al. largely focus on observational, “third-person” approaches to adults’ mental-state representation. It is not self-evident that the more “basic” form of mental-state reasoning in interactive and observational scenarios will be equivalent. Here, level-2 perspective taking provides an example of where they are not. Above we highlighted that level-2 perspective taking in an observational setting seems to be goal-dependent (Surtees et al., 2016a; Todd et al., in press). In a closely-matched interactive context, however, participants do suffer interference from a partner’s perspective, even if they are never asked to report it, suggesting it is goal-independent (Elekes et al., 2016; Surtees et al., 2016b). One possibility is that representations of different mental states are differentially cued by different aspects of social interaction. In this case, perhaps low-level stimulus features cue level-1 perspective taking, whereas “real” interaction or a specific goal may be required to cue level-2 perspective taking. One way to interpret this is that level-1 perspective taking is more basic, but another is to see level-2 perspective taking as linked to social interaction in a more fundamental way. Classifying knowledge or belief representation as more basic may obfuscate subtle variation with context.

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