Three cognitive mechanisms for knowledge tracking

Dora Kampis[1] & Gergely Csibra[2]

[1]Department of Psychology, University of Copenhagen; [2]Department of Cognitive Science, Central European University

e-mail: [1]dk@psy.ku.dk; [2]csibrag@ceu.edu

*This commentary, submitted to Behavioral and Brain Sciences, has not yet undergone editorial review.

Target article: Phillips, J., Buckwalter, W., Cushman, F., Friedman, O., Martin, A., Turri, J., Santos, L., & Knobe, J. (2020). Knowledge before belief. *Behavioral and Brain Sciences*, 1-37

Abstract:

We welcome Phillips et al.'s proposal to separate the understanding of 'knowledge' from that of 'beliefs'. We argue that this distinction is best specified at the level of the cognitive mechanisms. Three distinct mechanisms are discussed: tagging one's own representations with those who share the same reality; representing others' representations (metarepresenting knowledge); and attributing dispositions to provide useful information.

Main text:

In the target article at least two meanings of "knowledge" are mixed together: 'episodic' knowledge (being informed about some state of affairs in the world) and instrumental or semantic competence (being a potential source of information). While neither of these notions necessarily implies representational mental states (such as beliefs), they are not equal to each other, and should not be expected to be implemented by the same cognitive mechanisms.

With regard to episodic epistemic states, the knowledge-belief distinction may indeed reflect different mechanisms for tracking mental states. Unlike belief attribution, which metarepresents others' mental states, assigning episodic knowledge to others may not require creating a separate representation (Martin & Santos, 2016). An alternative cognitive mechanism is *tagging* one's own representation of reality by symbols of those who have also had access to the state of affairs that gave rise to the representation in question.

Such a tag could be attached to a representation when an episode is co-witnessed with someone (say, agent X), and can be removed when the content of the representation changes in the absence of X. This system can track [i] factive representations (own representations of reality), linking the states of affairs to X only when [ii] there is evidence that X has witnessed them (not just happens to believe them) and only until the states remain unchanged, [iii] without preserving the modality that triggered the tagging. Thus, such representations satisfy 3 of the 4 criteria for knowledge prescribed by Phillips et al. Furthermore, this tagging mechanism could also explain why 'true belief' attributions are difficult in certain cases: once X's tag is removed from a representation, it may not be possible to re-attach to it, giving rise to the Gettier-problem (Kaminski et al., 2008; Horschler et al., 2019). In addition, such a tagging system may also implicitly track altercentric ignorance: a representation that is not tagged by X is knowledge not accessible to X.

However, a cognitive mechanism relying on tagging is unable to generate knowledge representations corresponding to egocentric ignorance (see below for further discussion) and would not be able to account for cases of altercentric interference (produced by a representation attributed to someone else), and aspectuality-based inferences (when the way someone perceives an object leads to representing a different number of entities). We suspect that such phenomena, some of which may be present early in infancy (Kovács et al., 2010; Kampis & Kovács, 2020), are to be explained by the same metarepresentational mechanisms that implement belief attribution proper. We agree with Phillips et al.

that the representational format underlying many cases of episodic 'knowledge' tracking (i.e., tagging) is simpler than what underlies belief attributions. However, the former cannot constitute the basis of the latter because metarepresentations cannot simply emerge from knowledge ascriptions (tagged representations of reality). Rather, tagging may serve as informational input for when attributions of representations become necessary.

While the tagging system we have outlined above would explain some phenomena of non-belief-based knowledge tracking, it does not support establishing egocentric ignorance, which serves as crucial evidence for Phillips et al.'s conjecture that the main function of knowledge tracking is to promote social learning. However, we believe that the examples of egocentric ignorance listed in the target article either arise from the same attribution system that underlies belief tracking, or represent a completely different notion of knowledge: competence.

This notion comes from the fact that actions of agents carry information about the world: instrumental actions are adjusted to the environment; communicative actions are designed to produce information. Querying such information sources does not require portraying them as agents possessing episodic knowledge. Instead, an observer may attribute to them a disposition that their instrumental or communicative actions will be informative by reducing the uncertainty of the observer. Such an expectation may be characterized as 'egocentric ignorance,' yet it entails an entirely different underlying cognitive mechanism from 'attributing knowledge' in an episodic sense.

The evidence that Phillips et al. bring forward to support egocentric ignorance in apes is the study by Krachun et al. (2009), where the subjects inferred the location of the bait from the actions of a competitor. However, the pattern of results suggests that they did so without considering what information was available to the competitor: they simply assumed that he acted competently (cf. Wood et al., 2007). In the same study, human children did indeed attribute episodic knowledge to the competitor when they themselves were ignorant—but they did so also when the competitor had a false belief, suggesting that they relied on a metarepresentational mechanism in tracking the epistemic state of the other. From about 3-4 years of age, children who are ignorant themselves can report on the knowledge of another individual based on their episodic epistemic access (Pillow, 1989; Pratt & Bryant, 1990, Woolley & Wellman, 1993; Sodian et al., 2006), most likely reflecting metarepresentational strategies also employed in verbal false belief tasks.

However, Phillips et al.'s further examples of egocentric ignorance simply require children to portray the putative source of knowledge as being competent to communicate semantic information (e.g., Kovács et al., 2014). By default, young children may assume that adults are competent in supplying them with information, but can also fine-tune this assumption on the basis of evidence gathered about potential sources (Begus & Southgate, 2012*).* When they do so, they do not adjust the amount of "knowledge" attributed to sources, but modulate the sources' expected disposition to produce useful information. This kind of competence attribution indeed promotes learning, but relies on different cognitive mechanisms from those that underlie tracking episodic knowledge. When seeking (or being provided with) information, infants may take the stance that others are competent, but when they provide information to others, they consider the episodic epistemic access of their social partner (Liszkowski et al., 2008).

In sum: from the perspective of cognitive mechanisms, knowledge is not 'before,' but 'next to' belief, and it should, in fact, be a plural term.

Conflict of interest: none

References

Begus, K., & Southgate, V. (2012). Infant pointing serves an interrogative function. *Developmental Science*, 15(5), 611-617.

Horschler, D. J., Santos, L. R., & MacLean, E. L. (2019). Do non-human primates really represent others' ignorance? A test of the awareness relations hypothesis. *Cognition*, 190, 72- 80

Kaminski, J., Call, J., & Tomasello, M. (2008). Chimpanzees know what others know, but not what they believe. *Cognition*, 109, 224–234.

Kampis, D., & Kovács, Á. M. (2020). Seeing the world from others' perspective: 14-month-olds show altercentric modulation effects by others' beliefs. (psyarxiv.com/an7h3/download?format=pdf)

Kovàcs, Á. M., Téglás, E., & Endress, A. D. (2010). The social sense: susceptibly to others' beliefs in human infants and adults. *Science*, 330, 1830–1834.

Kovács, Á. M., Tauzin, T., Téglás, E., Gergely, G., & Csibra, G. (2014). Pointing as epistemic request: 12- month- olds point to receive new information. *Infancy*, 19(6), 543-557.

Krachun, C., Carpenter, M., Call, J., & Tomasello, M. (2009). A competitive nonverbal false belief task for children and apes. *Developmental Science*, 12(4), 521–535.

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

Martin, A., & Santos, L. R. (2016). What cognitive representations support primate theory of mind?. *Trends in cognitive sciences*, *20*(5), 375-382.

Pillow, B. H. (1989). Early understanding of perception as a source of knowledge. *Journal of Experimental Child Psychology*, 47(1), 116-129

Pratt, C., & Bryant, P. (1990). Young children understand that looking leads to knowing (so long as they are looking into a single barrel). *Child Development*, 61(4), 973-982.

Sodian, B., Thoermer, C., & Dietrich, N. (2006). Two-to four-year-old children's differentiation of knowing and guessing in a non-verbal task. *European Journal of Developmental Psychology*, 3(3), 222-237.

Woolley, J. D., & Wellman, H. M. (1993). Origin and truth: Young children's understanding of imaginary mental representations. *Child Development*, 64(1), 1-17.