

Epistemic logic is an umbrella term for a species of modal logics whose main objects of study are *knowledge* and *belief* - intentional states of particular importance in reasoning. As a field of study, epistemic logic uses modal logic and mathematical tools to formalize, clarify, and solve the questions that drive (formal) epistemology, and its applications extend not only to philosophy, but also to theoretical computer science, artificial intelligence, and economics. Initiated by Hintikka's *Knowledge and Belief: An Introduction to the Logic of the Two Notions* (1962) - inspired by insights in von Wright's *An Essay in Modal Logic* (1951) - research in epistemic logic has widely advanced based on the formal ground of normal modal logics and standard possible world semantics based on (relational) Kripke structures as they provide a natural, mathematically elegant yet still relatively easy way of modelling epistemic logics. However, as already flagged by Hintikka, the standard Kripke semantics possesses features that make the notions of knowledge and belief it implements too strong, leading to the problem of logical omniscience: the agents represented know/believe all logical truths, and know/believe all logical consequences of what they know/believe. These agents are obviously highly idealized reasoners, far away from having realistic cognitive powers and bounds. While such epistemic systems can be defended to work well for derivative attitudes such as what one *ought to know* given what one knows, what one *potentially knows* given a certain body of information etc., they do not provide a satisfactory formalism for arbitrary *non-omniscient* agents and the knowledge attitude *per se*. Thus, we ask: what is the *logic of the knowledge attitude per se for arbitrary agents*? This is one of the questions that have been keeping Peter, Franz, and myself busy in the last couple of months.

The formal theory of aboutness and subject matter Peter surveyed last time in the [issue of February, 2018](#) is of great help here. To be more specific: Franz and Peter have been developing in several LoC outputs - Franz's *Aboutness in Imagination* (2017: Philosophical Studies) and *Simple Hyperintensional Belief Revision* (2018: Erkenntnis), and Peter's *Theories of Aboutness* (2017: Australasian Journal of Philosophy) - a theory of propositional content that supplements the truth set of a sentence with its *subject matter* or *topic* as a component of its meaning. Intuitively then, knowing what a sentence *A* means boils down to knowing *what it is about*, i.e., *having grasped its topic*, and *what it says about that topic*. This more refined account of content - when taken on board together with the claim of Seth Yalcin's claim that epistemic states are topic sensitive (2016: *Belief as Question Sensitive*, Philosophy and Phenomenological Research) - helps us to break some patterns of strong logical closure that lead to the problem of logical omniscience. The resulting logic, for example, can account for some hyperintensional distinctions: one can know that " $2+2=4$ " without knowing that "equilateral triangles are equiangular" although they are true at exactly the same possible worlds, namely all of them. Another intuitive example for the failure of strong closure goes as follows. "If 113 guests attended the ball, then the number of guests is prime" is a logical truth, yet one can know that "113 guests attended the ball" without knowing that "the number of guests is prime": *one can grasp claims about the number 113 without being able to grasp claims about primeness*.

The topic-sensitivity of epistemic states does not seem to explain the entire logical omniscience story, especially with respect to the failure of closure under *known* implications though.

DISSEMINATION CORNER

The Logic of Conceivability

The [Logic of Conceivability](#) (LoC) project aims to address a limitation of the standard treatment of intentional states based on possible worlds semantics: the so-called *problem of logical omniscience*. I here motivate how the formal tools so far developed in the LoC project - when combined with tools and techniques from epistemic logic - can help to tackle this problem. Let us first take a step back and briefly mention what epistemic logic is about, and what causes the problem of logical omniscience in such logics to arise.



Another explanatory factor we are drawn to - as, e.g., Lewis (1982: *Logic for Equivocators*, *Noûs*, Volume 16, No. 3, 431-441), Stalnaker (1984: *Inquiry*, MIT Press), Fagin & Halpern (1988: *Belief, Awareness, and Limited Reasoning*, *Artificial Intelligence*, Volume 34, No. 1, 39-76), Yalcin (2016) have for belief - is that an agent's knowledge state is fragmented across various 'frames of mind'. We store information in different fragments of our minds and, sometimes, it is hard to put two and two together and get to know what is entailed by what we know: Jones knows that Mary lives in New York, that Fred lives in Boston and that Boston is north of New York. Yet Jones fails to infer the obvious: that Mary will have to travel north to visit Fred (Braddon-Mitchell & Jackson, 2007: *The Philosophy of Mind and Cognition: An Introduction*, Blackwell Publishers, p. 199). Fragmentation of *belief states* (rather than knowledge states) can further account for the fact that an arbitrary agent can hold mutually inconsistent beliefs in non-interacting frames of minds: one might believe that monotremes lay eggs yet also believe that only non-mammals lay eggs.

Combining topic sensitivity and fragmentation of epistemic states results in a logic of the knowledge attitude per se for arbitrary, non-omniscient agents that complements, if not competes with, some of the previous proposals to solve the problem of logical omniscience in epistemic logic using, for example, *impossible worlds semantics* and *awareness structures*.

One note regarding the *dynamics* of knowledge and belief. The above mentioned logical framework naturally expands the array of dynamic attitudes *Dynamic Epistemic Logic* (DEL for short) studies. Roughly speaking, DEL extends (the so-called static) epistemic logics by inclusion of operators that describe informative events that lead to changes in knowledge and belief of the agents in question. Arguably, in a framework that makes subject matter of sentences part of their meanings and epistemic states topic sensitive, the dynamic knowledge update and belief revision operators should capture not only the changes in the intension but also the topic of the agents' epistemic state. This is what we are after now: *topic-sensitive dynamic epistemic logics for arbitrary agents*.

Further details and results are to follow as LoC outputs, please stay tuned!

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