ABSTRACTS

A2.11 Philosophical Logic

Assertion and the logic of common knowledge
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I propose a characterization of common knowledge (i.e. CGφ) in terms of the knowledge account of assertion in the framework of epistemic logic:

(CKA) \( CG\phi \leftrightarrow EG(\phi \land A\phi) \).

That is, \( \phi \) is common knowledge for a group \( G \) of agents iff everyone (in \( G \)) knows that \( \phi \) is true and \( \phi \) is an assertion, where one asserts \( \phi \) (i.e. A\( \phi \)) only if one knows \( \phi \) (i.e. K\( \phi \)) in all accessible states with some specified conditions.

I start with an examination of misgivings over current accounts of common knowledge in the orthodox logic of common knowledge, including the iterated account, fixed-point account and the shared-environment approach. Special attention will be paid to a Davidsonian challenge which observes that the logic of common knowledge contains formulas of three proto-types-K\( \phi \), KiKi\( \phi \), and KiK\( \phi \) (i?) but they are treated indifferently. A Davidsonian would insist that they are three varieties of knowledge: (i) Ki\( \phi \)-factual knowledge, (ii) KiKi\( \phi \)-self-knowledge; and (iii) KiK\( \phi \) (i?)-knowledge of other minds. Any characterization of common knowledge should explain the differences involved.

I next show that failure of the iterated account (CG\( \phi \) \leftrightarrow (\( \phi \land EG\phi \land EGEG\phi \land ..., ad infinitum)) and the fix-point account (CG\( \phi \) \leftrightarrow EG(\( \phi \land CG\phi \)) suggests a promising approach by appealing to some modality, say X, weaker than CG\( \phi \) but stronger than EG...EG\( \phi \), so that CG\( \phi \) \rightarrow EG\( X\phi \) and EG\( X\phi \) \rightarrow (EG...EG)\( \phi \) (for any n-iterated EG) hold. Moreover, X\( \phi \) should signify some outwardly observable, or perceptible, action of human agents in a certain shared situation so that the required complete transparency can be guaranteed. I then argue that the knowledge account of assertion should be the best candidate for X\( \phi \) as the proposed thesis (CKA) shows.

Finally, I present a justification for (CKA) in the framework of a kind of models (referred to as TWA-models) for logic of knowledge with assertion. Semantic rules for CG\( \phi \), EG\( \phi \) and A\( \phi \) will be specified; basic presuppositions will be formulated explicitly so that the difference of the aforementioned three varieties of knowledge involved in common knowledge can be illuminated.

Dynamic justification logic
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The present talk aims at introducing and discussing systems of dynamic justification logic apt to characterize possible evolutions of the knowledge set available to an epistemic agent. The sources of evolution of an agent, modeled as a dynamic system embedded in a specific environment, are both of evidential kind (observations) and of inferential kind (computations). A straightforward way to capture these basic sources is to introduce a set of epistemic actions (\( Ri \)) and a set of modal operators (Pi,Poss), plus the operator of explicit knowledge K, so to enrich the modal language with sentences like Pi(KA), stating that A is in some knowledge state after having applied \( Ri \), and Poss(KA), stating that A is implicitly known, i.e. achievable after the application of one of the actions in (\( Ri \)). This approach, initially proposed by Duc (1995) can be developed in at least two ways. Firstly, the model including the knowledge state obtained after any action can be updated in such a way that all the states that are inconsistent with the given one are eliminated, following the approach of the dynamic epistemic logic, (van Ditmarsch et al. 2006; van Benthem 2011). Secondly, the epistemic actions can be construed as actions on epistemic justifiers, thus interpreting the actions as acquisitions or constructions of justifications. This is the approach pursued here. The resultant logic allows us (1) to improve justification logic (Artemov 2008; Fitting 2006) by introducing a crucial distinction between implicit and explicit justifiers, and a further distinction between directly and indirectly accessible justifiers; (2) to obtain a more in-depth insight into the structure of epistemic actions. In particular, implicit knowledge of A can be further analyzed as the current availability of the means for constructing a dependable justification of A. [References: Artemov 2008. The Logic of Justification. Review of Symbolic Logic, 1: 477-513. Duc 1995. Logical Omniscience vs. Logical Ignorance on a Dilemma of Epistemic Logic. LNCS 990, pp. 237-248, Berlin: Springer. Fitting (2005). The logic of proofs,
P. Geach (1967, 628) introduced the sentence "Hob thinks a witch has blighted Bob’s mare, and Nob wonders whether she (the same witch) has killed Cob’s sow", and called for a formalization fulfilling the following conditions: (i) No existentially committing de re constructions (to avoid ontological commitment to witches); (ii) No specifying de re constructions (to keep the object term ‘a witch’ indefinite); (iii) no iteration of epistemic operators (to avoid thoughts about thoughts); (iv) variable-binding across the sentential connective (to model the anaphoric link between ‘a witch’ and ‘she’). In this survey I briefly evaluate the efforts to formalize this sentence in the Hintikka-style quantified epistemic logic. Five proposals by seven writers have been put forth in print: three game-theoretical and two employing the so-called world-line method introduced in Hintikka (1969). Surprisingly the writers do not refer to one another and hence there has been no proper debate over the matter.

Hintikka (1974, 104 & fn. 9) notes briefly that the key to the correct formalization is to deal with “ill behaving world-lines”. In Hintikka’s system world-lines are functions from epistemically possible worlds to extensions and they provide individuals for quantifiers to range over. Their “ill-behavior” in this case is that they fail to pick out individuals from the actual world. These remarks imply the following simple formalization *(Ex)(THOB B(x) & WNOB K(x)) in which Ex is a perspectival quantifier introduced in Hintikka (1969). It is, among other things, a device to distinguish reporter’s ontology from the agents’ ontology. The subsequent writers have developed considerably more complex formalizations than * but I argue that * is nevertheless the most promising due to its elegance. * violates (ii) to some extent but all the subsequent solutions also either violate (i) – (iv) or reduce to *.

An analysis of the problem of logical omniscience of epistemic logic
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Epistemic logic as an important tool for reasoning about an intellectual agent’s epistemic states has suffered from the so-called logical omniscience problem since the beginning of its introduction. The problem indicates an idealized assumption on the part of the agent presented by a formalism of such kind. Although alternative epistemic formalisms have been proposed for dealing with the problem, there is no sight of that the problem is settled. Thus in this talk I will try my hand firstly to give an analysis of the problem, hopefully to pin down the source of the problem, and then accordingly provide an advice as what is the right direction of solving the problem. The analysis shows that there are three aspects that we expect that a designed epistemic formalism can meet at once. Firstly, epistemic logic must deal with explicit knowledge, the knowledge that the reasoned agent can use in his/her decision making process. Secondly, the formalism should be able to reflect the intelligent agent’s reasoning ability; that is, the agent is supposed to be able to increase his knowledge by performing deductive reasoning. Finally, the agent, though intelligent, can’t be logical omniscient and hence explicitly knowing all the consequences that the agent’s reasoning ability will lead him to know. However, these three aspects can’t be woven together seamlessly in the epistemic formalisms of the traditional way. And hence in this talk I will suggest that in order to incorporate the three aspects, what we need is not a formalism with a machinery that can limit what is known by the agent, but one with more powerful expressivity such that the resource that an agent will consume in the course of his/her reasoning, such as the temporal duration, can be explicitly stated.