REBUILDING EPISTEMIC LOGIC

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All three foundational pillars on which Epistemic Logic rests: modal language, Kripke-style semantics, and proof theory need rebuilding and modernization.

1. Modal language alone does not support such central topics in Epistemology as "knowledge vs. justified true belief" discussion, (cf. [7, 5, 6], etc.) due to a lack of justification objects in epistemic logic. Situation is gradually improving with the introduction of Justification Logic ([1, 2]) but there is still a long way to go. We provide examples of situations in which Justification Logic methods offer a superior epistemic analysis. In a more general setting, it is the Justification Logic framework which has introduced much needed hyperintensionality into Epistemology [4].

2. Kripke semantics of possible worlds for epistemic logic is based on a hidden assumption of common knowledge of the model, *CKM*, manifested in the condition "if a sentence is valid at all possible states, then it is known". In social scenarios, however, agents may possess asymmetric knowledge of the situation and *CKM* as a uniform assumption should be resisted. What we need here is a new theory of epistemic modeling in a general setting without assuming common knowledge of the model. We introduce epistemic models which do not rely on *CKM* [3]. Conceptually, such general epistemic models can be viewed as *observable fragments* of comprehensive Kripke models.

3. A well-principled notion of *epistemic theory* as an axiomatic description of a given scenario incorporated into the possible worlds environment is conspicuously absent. Moreover, given an informal verbal description of a situation, a typical epistemic user cherry-picks a "natural model" and simple-mindedly regards it as a formalization of the original description, i.e. uses a model in lieu of a theory and ignores the fact that there might be different "natural models" of the same description. In this respect, a systematic confusion of a theory and a model in Epistemic Logic resembles the pre-Gödelian state of mathematical logic, without a clear distinction between theories and models. We describe a framework of *hypertheories* for epistemic reasoning with partial information. Remarkably, natural semantic counterparts of hypertheories are epistemic models from (2), not Kripke models.

Together with epistemic models, hypertheories provide a new and balanced syntactic/semantic foundation for epistemic reasoning.

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