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## Epistemic logic in the sense of the relation between modern logic and metaphysics and ontology

In this paper, I will try to introduce epistemic logic in the sense of the relation between modern logic and metaphysics and ontology. First, I will clarify disciplines such as what modern logic and epistemic logic is and then I will try to enlighten you about the relation between modern logic and metaphysics and ontology.

Logic is the discipline of correct thinking that distinguishes the reasoning between right and wrong, examining the structure of knowledge. At first, it was a field of philosophy, and then it became a discipline on its own. It was founded by Aristotle as a discipline. It was categorized in two parts by Farabi, who was influenced by Aristotle (thought and conclusion). Ibn-i Sina developed the relationship between temporality and inclusion. Frege, Russell and Wittgenstein made important contributions in contemporary times. There are number of differences between old Aristotelian or traditional and modern logic. The most important differences are as follows: Modern logic is basically a calculus and its rules of operation are determined only by the shape and not by the meaning of the symbols it employs, as in mathematics. Many logicians were affected by the "success" of mathematics, since there had been no prolonged dispute about any truly mathematical result. "Modern logic is also 'constructive' rather than 'abstractive'; i.e., rather than abstracting and formalizing theorems derived from ordinary language (or from psychological intuitions about validity), it constructs theorems by formal methods, then looks for an interpretation in ordinary language. It is entirely symbolic, meaning that even the logical constants (which the medieval logicians called 'syncategoremata') and the categoric terms are expressed in symbols" (WikiZero, n.d.).

In earlier times of philosophy, metaphysics was the department of philosophy and philosophers attempted to construct models of reality not accessible to empirical sciences. Logic is used in order to do this because of two reasons. The first reason is clear. There is no empirical tools to observe these domains. "All we have are rationally grounded inferences from what we observe, or from other inferences. This is the epistemological aspect. Second, logic is the preferred tool of philosophers for constructing models. This is the ontological aspect. Ontology really is just applied logic, and in this case we are applying it to metaphysics. For example, in the sciences we often use the notion of a 'cause', and its relation to an 'effect', and we distinguish it from 'coincidence' or mere 'correlation'. But a cause is not always observable. It needs to be inferred from its observable effects. So if A causes B, we need to use logic to infer from B to A. In addition, and more deeply, this prompts the question of what really is a 'cause'? And what really is the relation between causes and effects, or 'causation'? This is a metaphysical

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question which we use logic to attempt to describe, rendering an ontology for a model of causation. The model is then used and tested to see if it provides sufficient inferential power for our epistemological needs” (Rusnell, 2017).

On the other hand, epistemic logic is the logic of knowledge and belief. “It provides insight into the properties of individual knowers, has provided a means to model complicated scenarios involving groups of knowers and has improved our understanding of the dynamics of inquiry” (n.d., 2006). Knowledge can be broken up into three necessary parts. Generally, we consider knowledge to be true, justified, belief. That’s how Plato put it and philosophers have not changed much since then. The logic of knowledge is known as epistemic logic; epistemologic study of knowledge, epistemic logic, the logic of knowledge. “Epistemic logic gets its start with the recognition that expressions like ‘knows that’ or ‘believes that’ have systematic properties that are amenable to formal study” (n.d., 2006).

Epistemic logic starts with the acknowledgment that our regular discuss about knowing and accepting has some systematic features that we can track and consider. Epistemic scholars have examined and broadened these lights of systematic structure in interesting and critical routes since the mid 1960s. Nonetheless, for some reason, standard epistemologists have shown little curiosity. It is striking to differentiate the peripheral part of epistemic rationale in contemporary epistemology with the centrality of modal logic for metaphysicians. Epistemic logic can help us to explore through issues in a systematic fashion by revealing the rationale of the problematic ideas. It can likewise lead us to perceive issues that we had not foreseen. This is simply comparable to the part that modal logic has played in contemporary metaphysics. Epistemic logic allows formal consideration of the sort of strategies that are accessible to us in reacting to skepticism. “It permits a detailed grasp of the social and temporal character of inquiry and of course it allows us insight into the problem of defining the class of scenarios compatible with what someone knows. This last problem is itself equivalent to the problem of explicitly defining the concept of knowledge” (Hendricks and Symons, 2006).

In addition the all these, epistemic logic is the (special) logic of the terms "knowledge", "truth", "belief" and "Documentation" which are the basic terms of epistemology or information theory. The constants of this broad logic system consists of said phrases and logical constants in the narrow domain. The benefit expected from the establishment of such a logic is that all the propositions (just as in mathematics) that are correct to the meaning of the aforesaid constants can be derived in an axiomatic system. Thus, the basic concepts of knowledge theory gain a mathematical certainty and its meaning is fully enlightened. Indeed, since it is impossible to define primitive terms in terms of other terms, their meaning can only be determined with the aid of analytical propositions that can be determined by anyone using a "postulate of meaning", ie, correctness. The postulates of this meaning are axioms of a system that is logical in the broad sense. Thus, as it can be seen, the main task of analytical philosophy, "illuminating the meaning

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of primitive terms”, leads to the establishment of logic systems peculiar to various fields. Narrow logic is also the product of such a “meaning lighting” process. Indeed, the logic in the narrow sense of reasoning is based on the words “and” “or”, “not”, “all”, “some”, and the establishment of such a logic can be regarded as a result of illuminating the meaning of the words. In this sense, the first achievements of philosophers have been to establish the logic in this narrow sense. The success of the modern analytic philosophy should be sought in establishing various specialist theories such as “inductive logic”, “Deontic logic”, “Epistemic logic”. I would like to give an example of a proposition that is true for epistemic logic requirement.

(i) Ahmet knows that Ankara is the capital of Turkey. Let’s look at this proposition. Since the capital of Turkey is Ankara, the proposition is true. However, the truth value of this proposition does not depend on just another proposition such as;

(ii) Ankara is the capital of Turkey. Truth value of this first proposition does not depend on second proposition’s truth value. If the capital of Turkey had been changed, the first proposition would still be true. Thus, in the final case the second proposition would be wrong, pre-proposition of the first proposition that “Ahmed knows that Turkey’s capital is Ankara”. would be wrong to propose mandatory. (It is impossible to “know” the wrong thing.) At this point, the first proposition is analytical.

When we show that an epistemic constant, such as “knows that” in the first proposition, is concatenated according to a set of epistemic constants, we come to the conclusion that the first proposition is a “true” in the sense of epistemic logic.

After showing an example of true epistemic proposition, I would like to continue with another topic in epistemic logic. As we have covered that; “Epistemic logic gets its start with the recognition that expressions like ‘knows that’ or ‘believes that’ have systematic properties that are amenable to formal study”. Moreover, epistemic logic has numerous applications in computer science and economics.

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