Logic

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Logic is often conceived as the study of valid or correct reasoning. Valid reasoning can be standardly defined as truth-preservation: if we start from a set of truths, the conclusion to which we come by valid reasoning should also be true. That definition uncovers the main areas of logical interest.

First, logic includes a general study of truth for a defined logical language. It comprises a definition of a general form of expressions (sentences) that can be true, and a definition of general conditions for a sentence to be true. On that ground, logic studies which sentences can and which cannot be true together (satisfiability, unsatisfiability), as well as which sentences are always true if some (other) sentences are true (semantic consequence relation). In particular, logic studies semantic models, which in a sense represent general features of the reality to which truth corresponds. Properties and relations, domains, types and hierarchy of domains, modal-logical relational structures (with possible worlds as valuation points) do not only constitute mathematical structures, but also represent most general ontological structures.

Second, logic studies how to represent valid reasoning by a purely formal proof system, and investigates whether such a system is sound and complete with respect to the (semantic) consequence relation under consideration. Besides, logic studies the computability and the complexity of procedures by which questions of logical validity can be decided. In addition, logic can focus on provability and computability questions by including justification (evidence) by proofs as well as computation in model-theoretical structures themselves (e.g., some interpretations of intuitionistic logic, logic of provability, dynamic logic). All those topics are of mathematical (proof-theoretical), computational, and epistemological (philosophical) interest.

Logic is in fact a vast plurality of logics, each with its own language, consequence relation, and deductive system. Paraconsistent logics, for example, study ways of non-arbitrary reasoning from inconsistent assumptions. Logics of action and imperative logics involve the study of reasoning about the acts that change states of affairs and produce new truths. Universal logic, finally, includes the study of common features of logics and the study of translations between logics.

According to a strong tradition in the history of logic, logic should be a part of philosophy. Nevertheless, from the second half of the 19th century on, logic is seemingly on a way to formally separate itself from the rest of what is now officially called philosophy, similarly as natural sciences separated themselves from the rest of philosophy in the time span from the 16th to the 18th century. That possible prospect does not mean the exclusion of philosophical questions from the subject of logic, but has primarily something to do with the deep change of methodology and its strong formalization.

Logic is today positioned in an interdisciplinary field where mathematics, computer science with artificial intelligence, and philosophy meet. Logic certainly still addresses philosophical problems (truth, structure of language and reality, justification of knowledge). Moreover, the development of the logical study of concepts such as necessity, time, knowledge, belief, action, and obligation opens up the perspective of extending logical research to virtually any philosophical question. With the modern scientific transformation of logic, the old ideal of the transformation of philosophy into science (Aristotle, Leibniz, Kant, and others) seems to be at least a little closer to its fulfillment.