

1. Naming and Necessity

A book by American philosopher Saul A. Kripke. It was initially given as a series of three lectures to the Princeton University Philosophy Department in January, 1970. Since its publication as an article in an anthology, it has been the single most influential work in analytic philosophy of language, logic, mind, and metaphysics. It offers the first sustained philosophical discussion of modality free from the influences of the logical positivists and other empiricists. It argues inter alia for the following claims: (1) identity is necessary; (2) proper names are not descriptive; (3) natural-kind terms are not descriptive; (4) proper names are "de jure rigid designators"; (5) natural-kind terms are "de jure rigid designators"; (6) there are real essences; (7) there are necessary a posteriori truths; (8) there are contingent a priori truths; (9) the causal "picture" of reference.

In the tradition of analytic philosophy, it was widely believed until 1960's that the reference of a proper name was a matter of fit with an associated (cluster of) definite description(s). For example, the reference of 'Aristotle' was said to be determined by, say, 'the teacher of Alexander the Great'; whoever is the denotation of the definite description is the referent of the name. According to Kripke, this is fundamentally wrong. If 'Aristotle' and 'the teacher of Alexander the Great' are semantically equivalent, then 'Necessarily Aristotle is Aristotle' is true if and only if 'Necessarily Aristotle is the teacher of Alexander the Great' is. But the first is true and the second false. Therefore, 'Aristotle' and 'the teacher of Alexander the Great' are not semantically equivalent. In the possible-worlds terminology, 'Aristotle' refers to one and the same man, viz., Aristotle, in every possible world, whereas 'the teacher of Alexander the Great' denotes different people in different possible worlds. In this sense, proper names, unlike definite descriptions, are "rigid designators."

Similarly with natural-kind terms. For example, 'gold' is a "rigid designator," referring to a particular substance, viz., gold, whereas, say, 'the precious metal used as the basis for the international monetary system' is not. One might say, however, that 'the element with atomic number 79' is also a "rigid designator" that refers to gold in every possible world; having the atomic number 79 is an "essential property" of gold. Why is 'gold' not semantically equivalent to this definite description then? Because if it was, that gold has atomic number 79 would not have been an a posteriori discovery but an a priori truth. Here we have an example of the distinction between rigidity de jure and rigidity de facto. 'Gold' is a de jure rigid designator of gold; it refers to gold by stipulation. On the other hand, 'the element with atomic number 79' is a de facto rigid designator of gold; it refers to gold because gold is in fact the element with atomic number 79. Other examples of necessary a

posteriori truths according to Kripke include 'Water is H₂O,' 'Heat is mean molecular energy,' 'Lightening is electrical discharge.' Kripke broke the by the logical positivists' stronghold doctrine that all that is necessary is a priori and all that is a priori is necessary.

As for contingent a posteriori truths, Kripke gives 'S is one meter long,' where S is the standard meter rod, as an example. Even though it is clear that it is not necessary that S is one meter long, it is less clear that it is a priori that S is one meter long. The fact that one meter is stipulated to be the length of S may not be enough to make it a priori. David Kaplan have offered 'I am here' and 'I exist' as contingent a priori.

Kripke further claims that individuals also have essential properties. For example, it is necessary that a person comes from the parents from whom s/he in fact came from (necessity of origin). Also, it is necessary that an artifact, e.g., a table, is constituted by the hunk of matter of which it is in fact constituted (necessity of constitution).

The underlying main theme of the book is the necessity of identity; for any x and any y, if x=y, then necessarily x=y. This constitutes a powerful attack on the materialist claim, which was popular in the mid twentieth century, that mind-body identity is merely contingent.

2. Modal Logic

Logic of necessity and possibility. The topic goes back to Leibniz, and through medieval logicians even to Aristotle, but its rigorous formal development had to wait until 1940's. Georg von Wright, Rudolf Carnap, Krister Segerberg, Arthur Prior, Jaakko Hintikka, E. J. Lemmon, Saul Kripke, Hans Kamp, David Lewis, Kit Fine are among the contributors to the field.

Syntactically, propositional modal logic is obtained by adding two sentential operators, \Box ("necessarily") and \Diamond ("possibly"), to propositional logic. The standard propositional modal logic is S5, characterized by the following axioms in addition to all tautologies: $\Box P \rightarrow P$ ("If necessarily P, then P"); $\Diamond P \rightarrow \Box \Diamond P$; $\Box(P \rightarrow Q) \rightarrow (\Box P \rightarrow \Box Q)$; $\Diamond P \leftrightarrow \sim \Box \sim P$. The rules of inference are "Derive $\Box P$ from P" (the rule of necessitation), and "Derive Q from P and $P \rightarrow Q$ " (modus ponens). Semantically, truth is defined relative to a model $\langle U, R, S \rangle$, where U is a set of possible worlds, R a dyadic relation between possible worlds (an accessibility relation), and S an infinite sequence of subsets of U. A sentence is said to be true in a possible world under a model. In particular, atomic sentential letter 'P' is true in w under $\langle U, R, S \rangle$ if and only if w is a member of the member of S assigned to 'P.' $\Box P$ is true in possible world w1 under $\langle U, R, S \rangle$ if and only if for every world w2 in U such that Rw_1w_2 , 'P' is true in w2 under $\langle U, R, S \rangle$. S5 is complete if R is an equivalence relation. If we add classical first-order quantification theory to S5, we obtain the standard first-order quantified modal logic (QML).

Modal logic provides a useful tool to philosophy. For example, it helps clarify the distinction, which apparently goes back to Aristotle, between the two readings of, say, 'Necessarily the teacher of Alexander the Great was a teacher.' One reading (the de dicto reading) says that the proposition that the teacher of Alexander the Great was a teacher is necessarily true, whereas the other reading (the de re reading) says that the teacher of Alexander the Great was such that his having being a teacher is necessary. The first is true, and the second false. This distinction is clearly exhibited in modal logic as a scope distinction. When the necessity operator has the wide scope ($\Box(\text{The teacher of Alexander the Great was a teacher})$), it is de dicto and the sentence is true in w1 if and only if for every world w2 accessible from w1, the teacher of Alexander the Great in w2 was a teacher in w2. When the necessity operator has the narrow scope ($\Box(\text{he was a teacher})$), it is de re and the sentence is true in w1 if and only if the teacher of Alexander the Great in w1 was such that for every world w2 accessible from w1, he was a teacher in w2. Interestingly, this gives rise to an important question: How should one make sense of de re modality? For example, in order to determine whether the de re reading of the above sentence is true in the actual world, one needs to determine whether the actual teacher of Alexander the Great, viz.,

Aristotle, was such that he was a teacher in every world accessible from the actual world. How does one identify Aristotle from one world to another? This is the problem of transworld identity. According to Saul Kripke, it is a pseudo-problem; transworld identity is stipulated rather than discovered. According to David Lewis, on the other hand, transworld identity never holds, for every entity is world-bound. Instead, entities have counterparts in other worlds and the counterpart relation is a similarity relation; Aristotle was necessarily a teacher if and only if in every accessible world, his counterpart in that world was a teacher. Another problem is that QML entails ' $\diamond(\exists x)Fx \rightarrow (\exists x)\diamond Fx$ ' (the Barcan formula). But the Barcan formula seems false in the actual world. It is possible that there is something that is Aristotle's twin brother; in some possible world accessible from the actual world Aristotle had a twin brother. On the other hand, it seems false that there is someone who is possibly Aristotle's twin brother; it seems false that someone in the actual world was such that in some possible world accessible from the actual world he was Aristotle's twin brother. Thus, the treatment of the Barcan formula is an important problem, giving rise to competing theories. One approach is to read the existential quantifier as quantifying over not only actual things but also possible things. The Barcan formula then is no longer false. Such a possibilist quantifier forces philosophical questions about the nature of possibilia.

If one reads ' $\Box P$ ' as "Always P" and ' $\diamond P$ ' as "Sometimes P," one obtains tense logic. If one reads ' $\Box P$ ' as "It is obligatory that P" and ' $\diamond P$ ' as "It is permissible that P," one obtains deontic logic. Thus, tense logic and deontic logic are formally indistinguishable from modal logic.

3. Saul A. Kripke

1940 - . An American philosopher. Born to a family of a Jewish rabbi in a suburb of New York City. He received B.A. from Harvard University in 1962 and has been McCosh Professor of Philosophy at Princeton University since 1976. His first work was in logic. He proposed what later came to be known as Kripke models for modal logic when he was 18 years old. It was published as "A Completeness Theorem in Modal Logic" in The Journal of Symbolic Logic vol. 24 (1959). He has since produced various results in model theory at large. His "An Outline of a Theory of Truth" (19) is a widely discussed technical paper in the field of truth theory. In it, he offers a mathematically rigorous definition of the notion of ungrounded truth, as exemplified in the liar sentence 'I am lying.' His main philosophical achievement so far, however, has been Naming and Necessity (1972), in which he argued against Fregean descriptive theories of reference for proper names and natural-kind terms. It has revolutionized analytic philosophy of language, mind, and metaphysics. A strong realist, anti-verificationist, anti-conventionalist, anti-pragmatist, and anti-materialist sentiment permeates it. Frege postulated senses (Sinne) to explain why 'a=b' is informative even if 'a' and 'b' are coreferential proper names. But if, as Kripke says, the reference of proper names is independent of conceptual contents associated with them, such a Fregean explanation is unavailable. The question then is: How is the informativeness in question to be explained? Kripke addresses this difficult problem in "A Puzzle About Belief" (1979), in which he argues that the problem does not arise specifically from his anti-Fregean theory of names. This article has been a locus classicus in the field of semantics of belief sentences, a lively intersection of philosophy of language, logic, mind, and metaphysics. His other book, Wittgenstein on Rules and Private Language (1982), examines later Wittgenstein's analysis of the notion of following a rule, but is not as revolutionary or influential as his first book. His unpublished work is believed to be rich and wide in scope, ranging from philosophy of time to semantics of fiction.

4. Essentialism

There are two kinds of essentialism. They correspond to the two readings of the sentence 'Necessarily every teacher of a king is a teacher.' The first reading says, "It is necessarily the case that for any entity x , if x is a teacher of a king, then x is a teacher" (the de dicto reading). This asserts a necessary connection between two kinds, i.e., that being a teacher of a king necessarily entails being a teacher. Saul A. Kripke has argued for essential properties of some natural kinds in this sense: e.g., being water necessarily entails being H_2O , being gold necessarily entails having atomic number 79; being lightning necessarily entails being electric discharge. The second, more controversial reading says, "For any entity x , if x is a teacher of a king, then necessarily x is a teacher" (the de re reading). It asserts a necessary possession of a certain property by individual entities of a certain kind, i.e., everything that is in fact a teacher of a king necessarily has the property of being a teacher. Essentialism in this de re sense is also known as Aristotelian essentialism, as coined by Quine, but it is debatable whether Aristotle in fact held it. For instance, take a particular teacher of a king, say, Aristotle. According to the de re reading above, Aristotle necessarily has the property of being a teacher. This is false. That is, being a teacher is not an essential property of Aristotle, even though he is in fact a teacher of a king. What properties are essential to Aristotle is a difficult question. Given that Aristotle is a human being, many would agree that being animate is essential to Aristotle; he could not have been, say, a tricycle or a natural number. Many would agree that being a human is essential to him, too. Saul Kripke has argued further that being an offspring of the people who are his actual parents is also essential to him, and in fact, coming from the very zygote from which he actually came from is essential to him (necessity of origin). Kripke also maintains that the actual constitution of an artifact is essential to it: e.g., if Tom is a table made of wood, then being made of wood is essential to Tom, and indeed, being made of that particular hunk of wood Tom is actually made of is essential to Tom (necessity of constitution). There are two standard definitions of necessary property possession. One uses identity, while the other uses existence. The first says that for x to be F necessarily is for it to be the case that nothing could be identical with x unless it is F . The second says that for x to be F necessarily is for it be the case that x could not exist unless it is F .

5. Montague Grammar

Grammatical theories of natural languages proposed by American philosopher Richard Montague between 1955 and 1970. The development of Montague's work roughly coincided with the development of intensional logic, in particular, modal logic. It also coincided with the development of generative transformational grammar in linguistics. Montague was more deeply influenced by the former than by the latter. Montague conceived of grammar as a branch of mathematics, not psychology. This is a major difference between Montague and the dominant community of contemporary linguists. The standard quantification theory in logic provided the starting point for him, but Montague went far beyond it, extending the syntax to be more faithful to English, adding new functions as semantic values in the model theory, and formally developing a new discipline of pragmatics. For example, the standard logic does not distinguish adjectives and adverbs, grouping them together as predicates. Montague assigns them to different syntactic categories with different kinds of functions as semantic values. Russell's theory of description sacrifices the surface structure of English sentences of the form 'The F is G' for the sake of austere ontology, but Montague regards these sentences as having the same (singular term-cum-predicate) structure as 'a is G,' where 'a' is a proper name. Pragmatics in Montague's sense is part of semantics. It is semantics for indexicals: e.g., 'I,' 'you,' 'here,' 'now.' Semantic evaluation of an indexical is relative to a context of use: e.g., the referent of 'I' is the person uttering the word.