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POSSIBLE WORLDS SEMANTICS

A.D. Dibrov
Academic advisors: DSc.(Philos.) E.V.Borisov, E.V.Vychuzhanina
Tomsk State University

1. Modal logic studies such expressions as «It is necessary that... » or «It is possible that... » and formalizes them. To formalize these expressions, it has a special notational system. It uses the symbol «□» for the necessity and the symbol «◊» for the possibility. If we draw the parallels with Kant's classification of judgments by its modality, «□P» stands for an apodictic judgment, «◊P» stands for a problematic judgment and «P» stands for an assertoric judgment. There are different logics in the modal family. The best known is K-logic [3]. It differs from classical propositional logic, in that it contains a modal rule and a modal axiom:

a) Necessitation Rule: If *A* is a theorem of **K**, then so is □*A*. This rule tells that any theorem of K is necessary.

b) Distribution Axiom: □(*A*→*B*) → (□*A*→□*B*). It tells that if it is necessary that if A then B, then if necessarily A, then necessarily B.

All the other logics are constructed from K-logic by adding some rules to it. There are such logics as T-logic, B-logic, S4-logic, S5-logic.

2. There are different formal semantic theories in modal logic. One of them is possible worlds semantics. Why do we need it? A formal logical system should be sound and complete. For a logician it is important to know that the system with which she deals is sound and complete. To say that a system is sound is to say that it cannot prove any invalid formula, i.e. if A has a proof, then A is valid [3. §6: possible worlds semantics]. To say that a system is complete means that every valid formula has a proof in that system. To demonstrate that a system is both sound and complete the concept of validity should be used. The way to represent such concepts in propositional logic is truth tables. A valid argument is one where every truth table line that makes its premises true also makes its conclusion true [3]. There are no truth tables for such expressions like «it is possible that... » or «it is necessary that... ». Semantics in modal logic could be defined by means of the notion of possible world. We evaluate the truth value of the statement relatively to possible worlds from the set of possible worlds W (so the truth value for q in possible world b may differ from the truth value for q in possible world b').

3. There are some basic notions of possible worlds semantics. For possible worlds semantics the notions of a frame, possible world, the accessibility relation, and modal model are crucial. A frame is a pair which consists of two parts: a non-empty set G whose members are possible worlds and a binary relation R on G which is called the accessibility relation. We symbolize possible worlds using Greek letters such as «α»,

«β», «γ». We construct a modal model by adding one more element to the frame – valuation – the relation which specifies the truth value for the atomic formula (propositional letter) in possible worlds and we symbolize it «⊩» for T or «⊮» for F [1. P.12].

4. After the notions of possible world, frame, accessibility relation, and model were defined, we can give the definitions of valid formula in a model, valid formula in a frame and valid formula in a set of frames. A formula X is valid in a model <G, R, ⊩> if it is true at every world of G. A formula X is valid in a frame if it is valid in every model based on that frame. If L is a collection of frames, X is L-valid if X is valid in every frame in L [1. P.18].

5. The possible worlds semantics has some important applications in logic. First, it produces rigorous definitions for the intentional entities such as properties, relations and propositions. Second, it helps in analyzing the difference between de re and de dicto modalities [2].

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