Meaning, Reference and Modality
Exercises 5-6-7*

Kripke (1972, Lecture I)

Against Essentialism

Kripke (1972, pp. 42 - 43) argues against the relationship between so-called *essential properties* and *identity across possible worlds*. Kripke observes that giving a set of necessary and sufficient conditions for identity across possible worlds is easier for mathematics, but quite difficult for material objects or people.

Discuss two examples, a mathematical one, where such conditions can be (tentatively) given, and another one, involving for instance an individual, where the inadequacy of some alleged conditions emerges more clearly.

Rigid vs Strongly Rigid

Kripke (1972, p. 48) distinguishes between a *nonrigid designator*, a *rigid designator* and a *strongly rigid designator*. Explain the difference, and give an example for each of them.

Indexicals

Kripke (1972, pp. 54-56) argues that (1) is an example of a *contigent a priori*. Why?

(1) The length of stick S at time t_0 is *one meter*.

In (1), the expression *one meter* is associated with a description, which fixes the reference of *one meter*. Consider now statements involving indexicals:

(2) The speaker of the context is I.

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(3) The place of the context is *here*

(2) and (3) show that indexicals can be associated with a description. Are (2) and (3) also cases of contingent a priori?

Kripke (1972, Lecture II)

Contingent Identities

Kripke (1972, pp. 97 – 105) argues that identity statements are *necessary*. He observes that there are cases, like (4), of identity statements which are *knowable a posteriori*.

(4) Hesperus is Phosphorus.

In his argument, Kripke observes that 'it could have turned out that Hesperus wasn't Phosphorus.' But 'it could have turned out that $\neg p$' seems to entail 'it is possible that $\neg p$'. So (4) is not necessary after all?

What would be Kripke's reply to the idea that (4) seems to be contingent given the above?

The *Meaning* of Names

Kripke claims that (5a) is necessary and a priori, while (5b) is necessary but a posteriori.

(5) a. Hesperus is Hesperus.

b. Hesperus is Phosphorus.

Consider now the following line of reasoning.

Kripke argues that names are rigid designators. You might then conclude that, after all, the *meaning* of a name consists in its referent, and that all names with the same referent have the same meaning.

But then, by the principle of compositionality, the proposition in (5a) has the same meaning as the proposition in (5b). Now, (5a) is known a priori, and since (5a) and (5b) have the same meaning, then (5b) must also be known a priori.

What is wrong with this line of reasoning?

Quine (1948)

Quine (1948, pp. 3–4) observes that if we take existence to include also non-actual, non-spatio-temporal entities, as Wyman does, we end up with a messy and overpopulated ontology. In particular, Quine notes that we might conclude

the concept of identity is simply inapplicable to unactualized possibles. Why is it so?

Modal Predicate Logic

Validity and Modal Operators

For each statement below, determine if it is strictly valid $\models_s$, tolerantly valid $\models_t$ with a hard $\Box_h$ or friendly $\Box_f$ modality (you need to check 4 cases). If it is valid, prove it. Otherwise, provide a counterexample.

1. $\Box(Fa \wedge Fb) \models \Box Fb$
2. $\models \Box(Fa \wedge Fb) \rightarrow \Box Fb$
3. $\Box Fa \vee \Box Fb \models \Box(Fa \vee Fb)$
4. $\models (\Box Fa \vee \Box Fb) \rightarrow \Box(Fa \vee Fb)$

For additional exercises, prove the results listed in slide 27.

Barcan Formula

(60) $\forall x \Box Fx \rightarrow \Box \forall x Fx$

Question 1: Prove the results in slide 35. Show that the Barcan Formula in (60) is valid on a frame with decreasing domains; and it is not valid on a frame with properly increasing domains (give a counterexample).

Question 2: On which class of frames (reflexive, symmetric, transitive, ...) the Barcan formula (B) and the converse Barcan formula (CB) are equivalent (i.e., $B \leftrightarrow CB$)?

'Barcan Formula' Again

Check if the following is valid or not valid. If relevant, consider the role of the domains (increasing, decreasing, ...).

$$\Box \forall x \Box Fx \rightarrow \forall x \Box \Box Fx$$