Universal vs. Existential: the Semantics of Negation and Existential Predicate

This paper argues that sentential negation, standardly treated as a truth-functional operator, has a semantics similar to that of universal adjectives in the sense of Kamp and Rossdeutscher 1994 (hensefroth, K&R) such as *healthy*.

The evidence in its favor comes from the valid inference illustrated in (1), which parallels in structure to the valid inference in (2) whose proof was given by K&R.

The standard analysis that treats sentential negation as a truth-functional operator coupled with its downward-entailingness (DE) (Ladusaw 1979) cannot account for the validity of the inference in (1). Given that the set of black stains is a subset of the set of stains, we can infer from the second premise that after three hours, there aren't black stains on the table. Since this derived proposition does not denote a result state, we cannot infer the conclusion, which requires a result state from which the change of state is inferred.

These valid inferences are in contrast to the apparently symmetric but invalid arguments involving existential statement in (3) and an existential adjective in (4).

Building on K&R's definitions of a universal adjective *healthy* in (5) and its existential counterpart *sick* in (7), I propose the semantics of negation as defined in (6) and the existential predicate in (8).

In (5), an individual x is said to be healthy in a state s if x and an aliment w is in the result-state relation (RES(CURE)(x, w) in s, i.e., a state resulting from x being cured of w) if x is separated from w (i.e., x either doesn't have or no longer has w). Similarly, in (6), an individual x is said to have the property of not P in a state s if x and an eventuality e are in the result-state relation (RES(BECOME(¬P))(x, e) in s, i.e., a state resulting from a change of state from P(x, e) to not P(x, e)) if x is separated from e (i.e., P(x, e) doesn't or no longer hold(s)). The existential predicate is defined in terms of the existence of an individual that is in a pre-state of disappearing. The definitions given in (6) and (8) correctly account for the validity of (1) and the invalidity of (4) as follows.

The proof of (1): Premise 1 expresses a change of state from non-existence of black stains to its existence, from which we infer that there are black stains on the table from the onset of their appearance and onward. By the semantics defined in (4), Premise 2 is translated as: s: ∀e[∃x[STAIN(x, e) ∧ ON(x, the-table, e)] → RES(BECOME(¬∃x [STAIN(x) ∧ ON(x, the-table)])(e)], where the state overlaps with the coda of the three-hour period. By the existential entailment from Premise 1 and Universal Instantiation, we infer that s: RES(BECOME(¬∃x[BLACK(x) ∧ STAIN(x) ∧ ON(x, the-table)])(e)(i.e., a state resulting from a change of state from the existence of black stains to their non-existence). Since the state denoted by the existence of black stains precedes (without overlap with) the result state denoted by RES(BECOME(¬∃x[BLACK(x) ∧ STAIN(x) ∧ ON(x, the-table)])(e), we infer that there is an event e' such that e': BECOME(¬∃x [BLACK(x) ∧ STAIN(x) ∧ ON(x, the-table)]), which is equivalent to: 'black stains disappear from the table'. This event takes place sometime within the three-hour period. This is inferred via the temporal relation between the two states: the state where there are black stains exclusively precedes the result state within the three-hour period. From this, we infer that the event of the disappearance takes place within this period.

The fact that the inference involving the existential predicate in (3) is invalid is attributed to the failure of the application of Universal Instantiation (UI) since the second premise is existential in nature, which cannot be the right input for UI. Consequently, we cannot derive the desired conclusion.

DATA

(1) **Inference 1: Negation**
1. Black stains appear on the table.
2. After three hours, there aren't stains on the table.

∴ Black stains disappear from the table in these three hours.

(2) **Inference 2: Universal Adjective 'healthy'**
1. A tourist comes down with typhoid.
2. After three weeks, he is healthy.

∴ The tourist recovers from typhoid in these three weeks.

(3) **Inference 4: Existential**
1. Black stains disappear from the table.
2. After three hours, there are stains on the table.

∴ Black stains appear on the table in these three hours.

(4) **Inference 1: Existential Adjective 'sick'**
1. A tourist recovers from typhoid.
2. After three weeks, he is sick.

∴ The tourist comes down with typhoid in these three weeks.

(5) $\forall s \forall x[\textit{healthy}(x) \rightarrow s: \forall w[\text{AILMENT}(w) \rightarrow \text{RES}(\text{CURE})(x, w)]]$

(6) $\forall s \forall x \forall P[\textit{not}(P(x)) \rightarrow s: \forall e[P(x, e) \rightarrow \text{RES}(\text{BECOME}(\neg P))(x, e)]]$

(7) $\forall s \forall x[\textit{sick}(x) \rightarrow s: \exists w[\text{AILMENT}(w) \wedge \text{PRE}(\text{CURE})(x, w)]]$

(8) $\forall s \forall x \forall P[\textit{there-be}(P(x)) \rightarrow s: \exists e.\exists x P(x, e) \wedge \text{PRE}(\text{BECOME}(\neg P))(x, e)]]$

REFERENCES

Kamp, H and A. Rossdeutscher 1994. "DRS-Construction and Lexically Driven Inference", *Theoretical Linguistics* **20**: 165-235.

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