

“Before” and “After” really are converses after all

Intuitively, “before” and “after” are converses. However, the received view among philosophers and linguists since Anscombe (1964) has been that they are not converses, even when the complement is veridical. Based on a distinction between lexical and sentential meanings, we argue for a restoration of intuitions, presenting a simple compositional system that accounts for a range of problematic data.

On Anscombe’s view, “A before B” means $\exists t A(t) \wedge \forall t' B(t') \rightarrow t < t'$, while “A after B” means (something logically equivalent to) $\exists t, t' A(t) \wedge B(t') \wedge t > t'$ (also Landman (1991), Ogihara (1995), Sánchez-Valencia, van der Wouden and Zwarts (1992)). In Heinämäki’s (1974) influential alternative approach, the meanings of the temporal connectives rely on independent and unrelated methods of identifying, on the basis of the intervals at which the sentential arguments hold, the time points to be ordered. As with Anscombe, the connectives are not analyzed as converses, and there is no obvious way of deriving the meaning of one from that of the other.

Two phenomena militate, on the face of it, against a converse analysis: inferential properties, studied by Anscombe, and polarity item licensing, discussed by Landman and Sanchez-Valencia et al. among others. With regard to the first, Anscombe argues that “before” is asymmetric and transitive, while “after” is neither, at least for stative sentential arguments. With regard to the second, “before” licenses NPIs, while “after” does not. The well-known non-veridical readings of “before” (Heinämäki 1972; 1974) could also be taken as evidence for the presence of a universal.

Building universal quantification into the *lexical* meaning of “before” and existential quantification into the *lexical* meaning of “after” accounts for the asymmetries, albeit in a brute force way. A direct argument against universal quantification being part of the lexical meaning of “before” can be made using measure phrases. For example, on an Anscombe-type analysis, (1) “She left exactly 5 seconds before he sang” would be incorrectly predicted to imply that she left exactly 5 seconds before every time point at which he was singing.

We show that the data can be accounted for within a theory that preserves the intuition that the connectives are converses, and in fact analyzes them as, lexically, no more than the standard orderings across time points, *earlier-than* ($<$) and *later-than* ($>$). This leads to a uniform treatment of temporal modifiers that makes no extra assumptions distinguishing between “before” and “after” clauses. The observed asymmetries arise as byproducts of the compositional build-up of sentence meanings.

The main ingredients of our analysis are as follows: (i) there is a single semantic tense, taking wide scope, (ii) untensed sentences denote sets of times, (iii) existential quantification over the main clause is standard existential closure occurring when tense is applied, not part of the semantics of the connectives, (iv) temporal modifier clauses restrict the set of times denoted by the main clause, (v) “before” and “after” require their complement to pick out a unique time point, but since the untensed complement clause denotes a set of times, a coercion operation must apply, (vi) non-veridicality of “before” arises from geometric considerations in a branching time model. We show that all the positive results of Anscombe and Heinämäki can be achieved merely by assuming that the coercion operation maps any set of times onto the first time in the set (the function *earliest*).

After showing that for the crucial cases Heinämäki’s system reduces to Anscombe’s, we prove the following proposition: if the coercion operator is *earliest*, then for any sentence “A before/after B” with achievement, activity or stative clauses and such that *earliest B* is defined, the above assumptions yield identical truth conditions to those in Anscombe’s proposal. This proposition is

sufficient to derive Anscombe’s observations on inferential properties of “after” and “before”, and to derive the NPI licensing properties. The following illustrates the compositional build-up for (2) “Claire was in America before Daniel was in America”:

$$\begin{aligned}
 X &= \text{“Claire be in America”} \\
 Y &= \text{“Daniel be in America”} \\
 \text{before} &\mapsto < \\
 Y &\mapsto \lambda t \text{ in}(d, a, t) \\
 \text{before } Y &\mapsto < \text{earliest.}\lambda t \text{ in}(d, a, t) \\
 X &\mapsto \lambda t' \text{ in}(c, a, t') \\
 X \text{ before } Y &\mapsto \lambda t' [\text{in}(c, a, t') \wedge \\
 &\quad t' < \text{earliest.}\lambda t \text{ in}(d, a, t)] \\
 \text{past}(X \text{ before } Y) &\mapsto \exists t' [\text{in}(c, a, t') \wedge t' < \text{now} \\
 &\quad t' < \text{earliest.}\lambda t \text{ in}(d, a, t)]
 \end{aligned}$$

Like Ogihara (1995), we analyze the non-veridicality of “before” analogously to the imperfective paradox. Assume main clauses are true. Since moving backwards on a time-line preserves truth in a right-branching model of time, if “A after B” is true, B is true. However, when “A before B” holds, A can be true while B is not: B may be on a side-branch. In other words, B need not hold in the world of evaluation but only in *inertial worlds*.

We end by showing how the analysis deals with cases where the arguments of “before” and “after” are accomplishments. Consider (3) “Mary left before Jane ate three apples or more” and (4) “Mary left before Jane went to work”. An Anscombe-type analysis would mistakenly predict for (3) that all apple eating must have finished when Mary left, and for (4) that Jane must have arrived at work when Mary left. In our analysis, (3) falls out on the assumption that for most accomplishments *earliest* produces the first culmination, while (4) can be analyzed using a coercion producing the first point of the interval during which the accomplishment holds, arguably a result of the part of the accomplishment on which “went to work” focuses.

In sum, we give a uniform and compositional model of temporal modification which explains problematic data concerning “before” and “after” while maintaining simple and intuitive lexical meanings.

References

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