

## Dependencies in Temporal Adjunct Clauses

DATA: This paper deals with the ambiguity in sentences like the following observed in Artstein (2005):

- (1) A secretary cried after each executive resigned.

On the ‘single-time’ reading, one secretary cried once after the resignation of all the executives. On the ‘dependent-time’ reading, each resignation is followed by the crying of a possibly different secretary. In the second reading the quantificational noun phrase (QNP) in the temporal adjunct clause takes scope over that in the matrix clause, in an apparent violation of locality constraint. The ambiguity arises only in temporal adjunct clauses (TACs) such as *after/before/when*-clauses, and not in non-temporal ones such as *if/because/although*-clauses.

PROPOSAL: I argue that the ambiguity is due to the movement of the entire subordinating clause (*each executive resigned* in case of (1)) over the matrix clause, and propose the formal semantic analysis to derive the relevant readings. I assume that VPs denote properties of times, and that tenses are temporal variables that saturate the temporal argument slot of the verb they attach to, which is later existentially bound. In TACs, an implicit temporal operator is generated under a covert PP that modifies the VP. This operator moves to the clause initial position (cf. Larson 1990).

- (2)  $[_{TP} OP_j \exists k \text{ past}_k [_{VP} \text{ Sue arrived}] [_{PP} \text{ at } t_j]]$

The operator movement is a solution to the ambiguity in sentences like the following, noted in Geis (1970):

- (3) I saw Mary in New York before she claimed that she would arrive.

The sentence is ambiguous between the short-distance reading that says that I saw Mary before the time she made the claim and the long-distance reading in which I saw Mary before her claimed time of arrival. Larson (1990) resolves this ambiguity by generating a temporal operator in different positions in TACs.

- (4) a. I saw Mary in New York before  $OP_i$  [she claimed  $t_i$  [that she would arrive]]  
 b. I saw Mary in New York before  $OP_i$  [she claimed [that she would arrive  $t_i$ ]]

These operators are semantically empty, but indices that is created by their movement act as lambda abstractor over the indices of their traces (Heim and Kratzer 1998). Thus the operator movement is semantically motivated since it creates the right semantic type for temporal prepositions such as *after*, whose semantics is given below:

- (5)  $[[\text{after}]] = \lambda P_{\langle i, t \rangle} \lambda t \exists t' [P(t') \ \& \ t' < t]$

The following structure yields the dependent-time reading of (1) shown below:

- (6) a.  $[_{TP4} OP_n \text{ each executive}_k [_{TP3} [_{TP2} \exists m \text{ past}_m x_k \text{ resign at } t_n]_j [_{TP1} \exists i \text{ past}_i [_{VP1} [_{VP2} \text{ a secretary cry}] [_{PP} \text{ after } T_j]]]]]]]$

- b.  $TP4 = \forall x[\text{executive}(x) \rightarrow \exists t'[t' \subseteq t_{\text{past}} \& \exists y[\text{secretary}(y) \& \text{cry}(y)(t') \& \exists t''\exists'''[t''' \subseteq t_{\text{past}} \& \text{resign}(x)(t''') \& t''' = t'' \& t'' < t']]$

CONSEQUENCES: The analysis correctly predicts that when a variable bound by the matrix QNP is embedded in the TAC, the dependent-time reading is prohibited, as shown below:

- (7) a. A secretary<sub>i</sub> cried after each executive hit him<sub>i</sub>.  
 b. [[each executive hit him<sub>i</sub>]<sub>j</sub> [[a secretary]<sub>i</sub> cried [after t<sub>j</sub>]]]

According to our analysis, the TAC has to move in order to yield the dependent-time read, which makes it impossible for the pronoun *him* to be bound by the matrix QNP.

It also predicts that dependent-time readings do not arise in non-TACs. For instance, the standard analysis of *if*-clauses says that they are restrictors of covert quantifiers or modals which quantify over propositions. A simplified structure of the sentence *each executive resigned if a secretary cried* looks like the following:

- (8)  $\forall w [(if) \text{ each executive resigned}(w)] [a \text{ secretary cried}(w)]$

When the *if*-clause moves to take scope over the matrix clause in order to yield the dependent-time reading, such a movement makes the world variable in the *if*-clause unbound, yielding an illegitimate semantic representation.

Finally, there are languages like German that lack both dependent-time readings and long-distance readings. The current analysis also predicts such correlation, assuming that in languages that lack long-distance readings, temporal operator movement is not employed, and the temporal interpretation of TACs is dependent on the interpretation of temporal prepositions or the matrix tenses, which makes it impossible for the subordinating clauses to move above the matrix clauses.

ALTERNATIVES: I compare the proposed analysis with two alternatives. One is Artstein (2005), in which temporal adjunct clauses are analyzed as temporal generalized quantifiers which take scope over matrix clauses. I show that his analysis of *after* cannot be easily extended to *before*-clauses and that it does not derive the long-distance reading in a principled manner.

The other alternative is a simple quantifier raising approach, according to which the QNP (e.g. *each executive*) moves out of the temporal adjunct clauses and takes scope over the matrix QNP. Such movement seems to violate the locality constraint on QR. I show that such violation is only apparent if Fox (1995) is correct in claiming that long-distance QR is allowed when each derivation is semantically motivated. Nonetheless, this approach does not capture the fact that dependent-time readings are only available in TACs.

## References

- Artstein, Ron (2005) Quantificational Arguments in Temporal Adjunct Clauses, *Linguistics and Philosophy* 28, 541-597.  
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