

## On the Syntax and Semantics of Temporal *When*-Clauses

**THREE PUZZLES.** Temporal *when*-clauses are non-interrogative subordinate clauses introduced by the wh-word *when* as exemplified by the bracketed clause in (1).

1) I came to visit you [when she left].

**(i) Two readings.** The ability to paraphrase *when*-clauses with nominals highlights two distinct readings: one anchored to a time interval (2), the other anchored to an occasion (3). The visiting in (1) can happen at the time of the physical leaving event, in a situation where I am walking in the door as she is walking out the door. In this case, the *when*-clause is anchored to a time interval. However, the visiting event can also happen sometime after the physical leaving event, in a situation where she is gone and I come to visit perhaps the next day, while she is gone. In this case the *when*-clause is anchored to an occasion.

2) I came to visit you [at the time she left for London].

3) I came to visit you [the time she left for London].

It is also possible to have both kinds of *when*-clauses occurring within the same matrix clause. In (4), the left-most *when*-clause is interpreted as denoting the occasion in which they went hiking together, whereas the other *when*-clause is interpreted as denoting a time point/interval at which the sun rose.

4) [When they went hiking together], she got up [when the sun was still down].

**(ii) Aspectual properties.** The available readings of temporal *when*-clauses appear to be sensitive to the aspectual properties of both the matrix and the *when*-clause predicates. The time interval reading is unavailable if the matrix predicate is an accomplishment predicate and the *when* predicate is an achievement predicate as exemplified in (5). In (5) the only available interpretation is the occasion reading, where the baking event occurs after the arriving event. This is to be contrasted with having an activity predicate in the matrix and the same achievement predicate in the *when*-clause as in (6). Here the arriving event has to be contained in the baking event, in other words, the only available interpretation is the time interval reading.

5) I baked a cake [when you arrived from London].

6) I was baking a cake [when you arrived from London].

**(iii) Free relatives?** Temporal *when*-clauses have been analyzed by syntacticians as free relatives with the wh-word *when* licensing a gap since at least the 1970s (Grimshaw 1977, Bresnan and Grimshaw 1978, a.o.). On the other hand, semanticists have ignored the free relative nature of temporal *when*-clauses and have analyzed *when* as a two-place relation that takes two clausal arguments and returns the value true if a certain temporal relation holds between the two events associated with the two clausal arguments, much like the temporal connectives *before* and *after* (Moens and Steedman 1988, Bonomi 1997, Vikner 2004).

**PROPOSAL.** In this paper we argue for a semantic analysis of temporal *when*-clauses that matches the previous syntactic analyses and treats temporal *when*-clauses as free relatives. We also show that the three puzzles above can be handled by our analysis, while they are problematic for the previous semantic analyses.

As free relatives (Jacobson 1995 a.o.), *when*-clauses end up denoting a maximal “temporal” individual by lambda-abstraction over the variable that the wh-word *when* licenses (and restricts), and then type-shifting. The *when*-clause semantically combines with the matrix clause in the very same way as temporal adverbial nominals like *the time*, *the day*, *the moment*, *yesterday*: through a preposition that is silent most of the time (McCawley 1988, Caponigro and Pearl 2009). (7) shows the basic syntactic

structure we are assuming for (1), with a silent preposition taking the whole *when*-clause as its complement and another silent preposition taking the *wh*-trace as its complement. (8) gives the logical translation of the *when*-clause in (1), where  $\iota$  is the type shifting operator that takes a set and returns its maximal individual. (9-10) show the corresponding temporal adverbial nominals.

- 7) I came to visit you [<sub>pp</sub> [<sub>p</sub> e] [<sub>when<sub>m</sub></sub> she left [<sub>p</sub> e] <sub>t<sub>m</sub></sub> ]]].
- 8) [<sub>when</sub> she left]  $\sim \iota x$ [TEMPORAL(x)  $\wedge$  **leave**(AT(x))(she)  $\wedge$  PAST(x)]
- 9) I arrived from London [the moment she left].
- 10) I arrived from London [the day she left].

Our analysis straightforwardly accounts for why temporal *when*-clauses look like free relative, since we treat them as free relatives both syntactically and semantically. It also shows that the account for these temporal alignment facts does not hinge on anything specific to *when*-clauses but depends on general aspectual restrictions and on general semantic properties of the silent preposition that takes either *when*-clauses or adverbial NPs as its complement. On other hand, the previous semantic analyses have problems handling these facts. Since they put the burden of the temporal relation between the two clauses on the meaning of the *wh*-word *when*, whenever there's a variation in the temporal relation, it should be due to a change of the meaning of *when*. But a multiple ambiguity of *when* is not only stipulative, but also needs to be linked to the aspectual properties of the predicates of both clauses, which is not straightforward at all.

The ambiguity of the *when*-clause in (1) or the different interpretations of the two *when*-clauses in (4) result from the fact that the *wh*-word *when* allows the variable it licenses to range over both occasions and time intervals, with instants being an extreme case of an interval (Bonomi 1997 makes a similar point, though his analysis is radically different). Variety in the range of the variable is attested in other free relatives as well. For instance, free relatives introduced by *what* can range at least over inanimate concrete/abstract atomic/non-atomic individuals, including propositions as in (11). Also, the temporal pronominal *then* appears to range over both occasions and time intervals as illustrated in (12) where *then* refers to an occasion and (13) where *then* refers to a time interval.

- 11) I don't like [what you cooked/said/thought/imagined/felt].
- 12) Remember that time we went camping? I had so much fun then.
- 13) I leave work at 5:30. Will you be free then?

**FUTURE RESEARCH.** Our analysis of temporal *when*-clauses as free relatives may be extendible to atemporal / conditional *when*-clauses as discussed in Farkas and Sugioka (1983) among many others. These *when*-clauses are characterized by their ability to be paraphrased with an *if*-clause as in (14). It is possible that these are special cases of temporal *when*-clauses that are anchored to occasions, with the added conditionality coming from higher level discourse reasoning. This would be a welcome result as it would provide a unified analysis for temporal and atemporal/conditional *when*-clauses.

- 14) Canaries are expensive [<sub>when/if</sub> they are rare].

**REFERENCES:** Bonomi (1997) Aspect, Quantification, and When-Clauses in Italian. Bresnan & Grimshaw (1978). The Syntax of Free Relatives in English. Caponigro and Pearl (2009) The nominal nature of where, when, and how: Evidence from free relatives. Farkas and Sugioka (1983) Restrictive If/When Clauses. Grimshaw (1977). English Wh-Constructions and the Theory of Grammar. Jacobson (1995) On the quantificational force of English free relatives. McCawley (1988) Adverbial NPs: Bare or clad in see-through garb? Moens and Steedman (1988) Temporal Ontology and Temporal Reference. Ritchie (1979) Temporal Clauses in English. Vikner (2004) The semantics of Scandinavian 'when'-clauses.