Information structure and the temporal reference of participial XADJs

(1) a Jumping on a horse, grandma headed for her dad's house.

b Grandma headed for her dad's house jumping on a horse.

mean two different things: there is a clear difference in the temporal relations between the two events denoted by *jump* and *head*. Yet, the two sentences have nearly identical f-structures: the only thing we can link the difference in temporal interpretation to, is the fact that in the first sentence, *jumping on a horse* is an f-structure topic, by virtue of appearing in a grammaticalized topic position. In other words, information structure can influence the semantic interpretation of a sentence via the f-structure.

Nor are such effects limited to cases where the information structure is grammaticalized in the f-structure. In Ancient Greek, there is a correlation between word order and information structure: the finite verb marks the beginning of the background domain, whereas topics and foci appear in front of the verb, but there are no grammaticalized positions for discourse funtions. Still, the temporal interpretation of participial XADJs differ according to the position in the sentence:

(2) *prosêlthôn* *êgeiren* *autên* *kratêsas*
come.PFV.PTCP.NOM.SG. raise up.PFV.PST.3.SG her.ACC.SG. grab.PFC.PTCP.NOM.SG
tês *kheiros*
the.GEN.SG. hand.GEN.SG.
'He came and raised her up grabbing her by the hand.'

The correct generalisation for Hellenistic Greek seems to be that the event expressed by perfective participles that appear *in front of* the finite verb are interpreted as standing in a temporal relation of *anteriority* to the event of the finite verb, while the event denoted by participles which appear *after* the finite verb are interpreted as to have happened *during* the event of the finite verb.

The two participles are indistinguishable at f-structure despite the semantic differences, both being members of the set of XADJs. Intuitively, the first participle is similar to a temporal adverb - it says something about the time interval at which the sentence is evaluated - and the second more like a manner adverbial - since it gives a more precise description of part of the matrix event.[1] The same holds for the English examples 1 (a) and (b).

In my paper, I formalise this intuition in event semantics, exploiting Klein's analysis of tense and aspect, based on the notion of *assertion time*(T_{AST}) and *situation time* (T_{SIT}). T_{AST} is that interval about which the speaker makes an assertion. Aspect relates T_{AST} and T_{SIT} so that with imperfective aspect, $T_{\mathrm{AST}} \subset T_{\mathrm{SIT}}$ and with perfetive aspect, $T_{\mathrm{AST}} \supseteq T_{\mathrm{SIT}}$ (Klein 1995, "A Time Relational Analysis of Russian Aspect", *Language* 71:669-695).

At one level in the semantic derivation, then, the temporal aspect of a every verb's meaning is a set of ordered pairs $< T_{\mathrm{AST}}, T_{\mathrm{SIT}} >$ constrained by aspect, tense and adverbials. But in the final analysis we have only one assertion and thus only one assertion time: this means that non-finite verbs (and subordinate clause verbs) do not have their own assertion times, but instead 'hook up' to one of the intervals provided by the main verb. In example 2, *proselthôn* by virtue of being a stage topic, hooks up to the *assertion time* via the relation supplied by its aspectual morphology so that we have $T_{\mathrm{AST}} \supset T_{proselthon}$. *kratêsas* on the other hand, picks up the *event time* of *êgeiren*, so we have $T_{egeiren} \supset T_{kratesas}$.

Technically, we can model this by associating the semantics of sentences with two semantic structures $f_\sigma T_{\mathrm{AST}}$ and $f_\sigma T_{\mathrm{SIT}}$ where $f_\sigma T_{\mathrm{AST}}$ includes information about the assertion time (typically provided by tense and by temporal adverbs) and $f_\sigma T_{\mathrm{SIT}}$ includes information about the situation

[1] We leave aside for the moment the question whether the event expressed by the manner adverbial is in some sense 'the same event' as the matrix event (the Anscombe thesis).

time (typically provided by the lexical entry of the verb as well as by manner adverbs).[2] The typical meaning of a sentential f-structure before existential closure will be:

$$\mathbf{f}_\sigma : \lambda e.\lambda t.[P(e \times t)] : f_\sigma T_{\mathrm{SIT}} \multimap f_\sigma T_{\mathrm{AST}} \multimap f_\sigma T_{\mathrm{SIT}} \otimes f_\sigma T_{\mathrm{AST}} \tag{3}$$

Aspect will modify the relation between t and e:

$$\begin{array}{rl} \mathrm{PFV}_\sigma : & \lambda e.\lambda t.[P(e \times t) \wedge t \supseteq e] : \\ & [f_\sigma T_{\mathrm{SIT}} \multimap f_\sigma T_{\mathrm{AST}} \multimap (f_\sigma T_{\mathrm{SIT}} \otimes f_\sigma T_{\mathrm{AST}})] \multimap \\ & [f_\sigma T_{\mathrm{SIT}} \multimap f_\sigma T_{\mathrm{AST}} \multimap (f_\sigma T_{\mathrm{SIT}} \otimes f_\sigma T_{\mathrm{AST}})] \end{array} \tag{4}$$

$$\begin{array}{rl} \mathrm{IPF}_\sigma : & \lambda e.\lambda t.[P(e \times t) \wedge t \subset e] : \\ & [f_\sigma T_{\mathrm{SIT}} \multimap f_\sigma T_{\mathrm{AST}} \multimap (f_\sigma T_{\mathrm{SIT}} \otimes f_\sigma T_{\mathrm{AST}})] \multimap \\ & [f_\sigma T_{\mathrm{SIT}} \multimap f_\sigma T_{\mathrm{AST}} \multimap (f_\sigma T_{\mathrm{SIT}} \otimes f_\sigma T_{\mathrm{AST}})] \end{array} \tag{5}$$

Temporal adverbials will modify the assertion time:

$$\begin{array}{rl} \mathrm{ADJ}_\sigma : & \lambda Q.\lambda P.\lambda t.[P(t) \wedge Q(t)] : \\ & [(\downarrow_\sigma PRED) \multimap (\downarrow_\sigma PRED)] \multimap ((ADJ \in \downarrow)_\sigma T_{\mathrm{AST}}) \multimap ((ADJ \in \downarrow)_\sigma T_{\mathrm{AST}}) \end{array} \tag{6}$$

Manner adverbials will be modifiers of the situation time:

$$\begin{array}{rl} \mathrm{ADJ}_\sigma : & \lambda Q.\lambda P.\lambda e.[P(e) \wedge Q(e)] : \\ & [(\downarrow_\sigma PRED) \multimap (\downarrow_\sigma PRED)] \multimap ((ADJ \in \downarrow)_\sigma T_{\mathrm{SIT}}) \multimap ((ADJ \in \downarrow)_\sigma T_{\mathrm{SIT}}) \end{array} \tag{7}$$

The only difference between the two types of adverbials resides in the glue.[3] ADJ must therefore associated with two different composition procedures, which are lexically selected.

Participial adjuncts start out as pairs $< T_{\mathrm{AST}}, T_{\mathrm{SIT}} >$. Their XADJ function turns them into modifiers of the event or the assertion time of the matrix clause by hooking their T_{AST} up to either the event or the assertion time of the matrix clause:

$$\begin{array}{rl} \mathrm{XADJ}_\sigma : & \lambda P.\lambda Q.\lambda R.\lambda e'.\lambda t'.\lambda t.[P(e') \wedge Q(t') = R(t)] : \\ & [(\downarrow_\sigma f_\sigma T_{\mathrm{SIT}}) \multimap (\downarrow_\sigma f_\sigma T_{\mathrm{SIT}})] \multimap [(\downarrow_\sigma f_\sigma T_{\mathrm{AST}}) \multimap (\downarrow_\sigma f_\sigma T_{\mathrm{AST}})] \multimap \\ & [((XADJ \in \downarrow)_\sigma T_{\mathrm{AST}}) \multimap ((XADJ \in \downarrow)_\sigma T_{\mathrm{AST}})] \end{array} \tag{8}$$

$$\begin{array}{rl} \mathrm{XADJ}_\sigma : & \lambda P.\lambda Q.\lambda R.\lambda e'.\lambda t'.\lambda e.[P(e') \wedge Q(t') = R(e)] : \\ & [(\downarrow_\sigma f_\sigma T_{\mathrm{SIT}}) \multimap (\downarrow_\sigma f_\sigma T_{\mathrm{SIT}})] \multimap [(\downarrow_\sigma f_\sigma T_{\mathrm{AST}}) \multimap (\downarrow_\sigma f_\sigma T_{\mathrm{AST}})] \multimap \\ & [((XADJ \in \downarrow)_\sigma T_{\mathrm{SIT}}) \multimap ((XADJ \in \downarrow)_\sigma T_{\mathrm{SIT}})] \end{array} \tag{9}$$

Again, the only difference between the two versions lies in the glue, which decides whether the assertion time of the XADJ predication is unified with the the assertion or the event time of the main clause. The selection is obviously based on i-structure: topic XADJs pick up the matrix clause assertion time and background XADJs pick up the event time.[4] In our example then, this gives the desired result that the events described by *prosêlthon* and *êgeiren* are included in the topic time of the sentence, and the event time of *kratêsas* is included in the event time of *êgeiren*. Notice that this does not specify any temporal relation between *prosêlthon* and *êgeiren*: this must be inferred via the discourse relation `narration` vel sim. (Nicholas Asher and Alex Lascarides, *Logics of conversation*, Cambridge 2003). A discourse relation will probably have to be inferred between *êgeiren* and *kratêsas* as well, although here the choice will be limited to relations which are compatible with temporal inclusion. This invites `elaboration`, perhaps implying event identity and vindicating the Anscombe thesis after all.

[2] Because manner adverbs will share their time reference with the verb. On a neo-Davidsonian approach, one could put everything which does not relate to the topic time (including the arguments of the verb) in a semantic structure $f_\sigma EV$ and use a measure funtion τ to access the temporal information, but we ignore this question here.

[3] Notice in particular that there is no type difference between t and e - they are both variables over entities and are distinguished here only for the sake of clarity.

[4] Given the uncertainty as to how i-structure should be represented, I do not attempt to formalize the interaction between i-structure and glue, but note the interesting parallel with quantifier scope in German, where information structure also plays a crucial role in the composition/scoping (Cook and Payne 2006, "Information Structure and Scope in German", *Proceedings of the LFG06 Conference*).