

ON THE INCOMPATIBILITY BETWEEN TENSES AND TEMPORAL ADVERBS

**INTRO.** In this talk, I consider the interaction between tenses and temporal adverbs. I present new data from English, Japanese, and Russian which reveal a theoretically unexpected incompatibility between certain tenses and temporal adverbs in complement and relative clauses. I show that this incompatibility cannot be explained if temporal adverbs are interpreted as predicates of times (or modifiers thereof). I propose that we must interpret tenses and temporal adverbs w.r.t. the same *evaluation time* whenever they occur in the same clause. I propose a new semantics for temporal adverbs and tenses that explicitly introduces their evaluation times and requires them to be identical within one clause.

**DATA.** In (1)-(4), the b-examples are anomalous despite their seeming truth-conditional equivalence with the a-examples. In both a- and b-examples, the embedded tense is interpreted w.r.t. the local “now” provided by the matrix verb. For this reason, I say that the local “now” is the *evaluation time* of the embedded tense. Observe that, in (1)-(4), the evaluation time of the embedded tense is not the utterance time (UT). The difference between the a- and b-examples is that the b-examples contain an embedded temporal adverbial modifier interpreted w.r.t. to the UT. In other words, the UT and not the local “now” is the evaluation time of the embedded adverbs in the b-examples. Thus, in the b-examples, the embedded tense and the embedded adverb have different evaluation times. This suffices to make b-examples anomalous in relative as well as in complement clauses cross-linguistically.

- (1) a. In three days, John will meet a guy who arrived two days before.  
 b. #In three days, John will meet a guy who arrived tomorrow.
- (2) a. Kazuko-wa [sinbun-o yon-dei-ru] otoko-ni at-ta  
*Kazuko-top book-acc read-prog-pres man-dat meet-pst*  
 “Kazuko met a man who was reading (*lit: is reading*) a newspaper.”  
 b. #Kazuko-wa [kinoo sinbun-o yon-dei-ru] otoko-ni at-ta  
*Kazuko-top yesterday book-acc read-prog-pres man-dat meet-pst*  
*Intended: “Kazuko met a man who was reading (*lit: is reading*) a newspaper yesterday.”*
- (3) a. In three days, John will say that Mary arrived two days before.  
 b. #In three days, John will say that Mary arrived tomorrow.
- (4) a. Dva dnja nazad Vanja skazal, čto Maša segodnja bol’na.  
*Two days ago Vanja said that Masha today is-sick*  
 “Two days ago, Vanja told me that Masha was sick then (*lit: is sick today*)”  
 b. #Dva dnja nazad Vanja skazal, čto Maša pozavčera bol’na.  
*Two days ago Vanja said that Masha the-day-before-yesterday is-sick*  
*Int: “Two days ago, Vanja said that Masha was sick (*lit: is sick*) the day before yesterday”*

**DISCUSSION.** I argue that the data in (1b)-(4b) call for a revised semantic analysis of temporal adverbs and tenses. According to, e.g. Partee 1973, Heim 1994 and Kratzer 1998, tenses are interpreted as variables over times. In turn, temporal adverbs are often treated as predicates of times or modifiers thereof (Dowty 1979, von Stechow 2009, Heim & von Stechow 2011). I illustrate this in (5)-(6):

- (5) a.  $\|Pres_i\|^{g,t,c} = g(i)$ , defined iff  $g(i)=t$     b.  $\|Past_i\|^{g,t,c} = g(i)$ , defined iff  $g(i)<t$   
 (6) a.  $\|yesterday\|^{t,c} = [\lambda t' . t' <_{1day} c(\text{time})]$     b.  $\|yesterday\|^{t,c} = [\lambda P.\lambda t' . (P(t')=1 \ \& \ t' <_{1day} c(\text{time}))]$

These accounts predict the interpretability of (1a)-(4a). For example, in (1a) with the LF in (7a) and the truth conditions in (7b), the modifier “two days before” restricts the set of times denoted by VP<sub>1</sub> to a set of times that are two days earlier than the contextually salient time of the meeting. This restricted set of times is denoted by VP<sub>2</sub>. The embedded relative Past<sub>3</sub> can provide a time which is an element of the set denoted by VP<sub>2</sub>. Hence the interpretability of (1a). (2a)-(4a) are derived similarly.

- (7) a. [TP<sub>2</sub> Pres<sub>1</sub> [VP<sub>6</sub> [PP in three days] [VP<sub>5</sub> will [VP<sub>4</sub> John [VP<sub>3</sub> meet [DP a [NP guy [RC<sub>2</sub> who ...  
 ...[RC<sub>1</sub> 4 [TP<sub>1</sub> Past<sub>3</sub> [VP<sub>2</sub> [VP<sub>1</sub> t<sub>4</sub> arrive] [AdvP two days before]]]...]  
 b.  $\|(7a)\|^{g,t,c} = 1$  iff  $\exists t'(t' >_{3days} g(1) \ \& \ \exists x(x \text{ is a guy} \ \& \ x \text{ arrive at } g(3) \ \& \ g(3) <_{2days} t' \ \& \ \dots \text{ John meet } x \text{ at } t'))$ , defined iff  $g(1) = t$  and  $g(3) < t'$ .

These accounts, however, cannot predict the contrast in (1)-(4) since they predict (1b)-(4b) to be interpretable similarly to (1a)-(4a). For example, in the interpretation of (1b), with an LF in (8a), nothing prevents the time denoted by the embedded tense from being an element of the set denoted by the VP modified by “tomorrow” (see the predicted truth conditions in (8b)):

- (8) a. [TP<sub>2</sub> Pres<sub>1</sub> [VP<sub>6</sub> [PP in three days] [VP<sub>5</sub> will [VP<sub>4</sub> John [VP<sub>3</sub> meet [DP a [NP guy [RC<sub>2</sub> who ...  
... [RC<sub>1</sub> 4 [TP<sub>1</sub> Past<sub>3</sub> [VP<sub>2</sub> [VP<sub>1</sub> t<sub>4</sub> arrive] [AdvP tomorrow]]...]]  
b.  $\|(8a)\|^{g,t,c}=1$  iff  $\exists t'(t' >_{3\text{days}} g(1) \ \& \ \exists x(x \text{ is a guy} \ \& \ x \text{ arrive at } g(3) \ \& \ g(3) >_{1\text{day}} c(\text{time}) \ \& \ \dots$   
... John meet x at t'), defined iff  $g(1) = t$  and  $g(3) < t'$ .

What is needed to account for the contrast in (1)-(4) is the following requirement:

- (9) In a clause, tenses and temporal modifiers are interpreted w.r.t. to the same evaluation time. (1b)-(4b) would violate (9) and, for this reason, be anomalous, whereas (1a)-(4a) would not violate (9) and would be interpreted. The semantics in (5)-(6) does not assume an interaction between the evaluation times of tenses and temporal adverbs and does not allow controlling for (9).

**PROPOSAL.** I propose to treat temporal adverbs as relations between times. A temporal adverb denotes a function that is characteristic of a set of ordered pairs of times. The first element in each pair is the evaluation time, as illustrated in (10) for “tomorrow”:

- (10)  $\|\text{tomorrow}\|^{g,t,c} = [\lambda t_5: t_5 = c(\text{time}) . \lambda t_6 . t_6 >_{1\text{day}} t_5]$

I also propose that tense morphemes can denote pairs of times in which the first element is the evaluation time, as illustrated in (11):

- (11) a.  $\|\text{Pres}_i\|^{g,t,c} = \langle t, g(i) \rangle$ , defined iff  $g(i)=t$       b.  $\|\text{Past}_i\|^{g,t,c} = \langle t, g(i) \rangle$ , defined iff  $g(i)<t$

Temporal adverbs (of type  $\langle i, it \rangle$ ) combine with VPs of type  $\langle i, t \rangle$  to produce modified VPs of type  $\langle i, it \rangle$ . The rule in (12) licenses such a combination. This rule is a fusion of the more familiar rules of Function Composition (Jacobson 1990) and Predicate Modification (Heim & Kratzer 1998).

- (12) If  $\alpha$  is a branching node with  $\beta$  and  $\gamma$  as its daughters, and if  $\|\beta\| \in D_{\langle \chi, \tau \rangle}$  and  $\|\gamma\| \in D_{\langle \chi, \chi \tau \rangle}$ , then, for any variables  $v, \varepsilon$  such that, for any assignment function  $g$ ,  $g(v) \in D_\chi$  and  $g(\varepsilon) \in D_\chi$ ,  $\|\alpha\| = [\lambda v . \lambda \varepsilon . (\|\beta\|(g(\varepsilon))=1 \ \& \ \|\gamma\|(v)(g(\varepsilon))=1)]$ .

Tenses, being of type  $(ixi)$  (as in (11)), combine with modified VPs of type  $\langle i, it \rangle$  to produce TPs of type  $t$ . The relevant rule of combination is given in (13). It is a version of Schönfinkelization (Heim & Kratzer 1998).

- (13) If  $\alpha$  is a branching node with  $\beta$  and  $\gamma$  as its daughters, and if  $\gamma \in D_{\langle \chi, \langle \chi, \tau \rangle \rangle}$ , and  $\|\beta\| = \langle \delta, \varepsilon \rangle$ , where  $\delta, \varepsilon \in D_\chi$ , then  $\|\alpha\| = \|\gamma\|(\delta)(\varepsilon)$ .

The crucial contribution of this rule is that the evaluation time of a tense becomes the evaluation time of a modified VP (this is how the requirement in (9) can be met).

As an illustration, consider again (1b) with the LF in (8a). The proposed analysis predicts that the evaluation time for “tomorrow” has to be  $c(\text{time})$ . By the rule in (12), we get the denotation for VP<sub>2</sub>:

- (14)  $\|\text{VP}_2\|^{g,t,c} = [\lambda t_5: t_5 = c(\text{time}) . \lambda t_6 . (t_6 >_{1\text{day}} t_5 \ \& \ (g(4) \text{ arrive at } t_6)=1)]$

The next step in the derivation of (8a) is to combine VP<sub>2</sub> with Past<sub>3</sub> (interpreted as a pair of times) by (13). The first argument of VP<sub>2</sub> (i.e. the evaluation time for Past<sub>3</sub>) is required to be equal to  $c(\text{time})$ . This restriction on the evaluation time of Past<sub>3</sub> would not allow Past<sub>3</sub> to become relative to the future time provided by the matrix “will”. As a result, impossible truth conditions are predicted for (8a):

- (15)  $\|(8a)\|^{g,t,c}=1$  iff  $\exists t'(t' >_{3\text{days}} g(1) \ \& \ \exists x(x \text{ is a guy} \ \& \ x \text{ arrive at } g(3) \ \& \ g(3) >_{1\text{day}} c(\text{time}) \ \& \ \dots$   
... John meet x at t'), defined iff  $g(1) = t$  and  $g(3) < t'$  and  $t' = c(\text{time})$ .

The anomalies in (2b)-(4b) are derived similarly. (1a)-(4a) have no such conflicts and are predicted to be interpretable. Hence the contrast observed in (1)-(4).

**FURTHER PREDICTIONS.** At the end of my talk, I will also consider cases of relative future under past with indexical modifiers like “yesterday”, which seem to be counterexamples to the predictions made by the proposed analysis. I will show that such cases are only seemingly problematic, and actually follow from the proposed account, given the possibility of *de re* readings for tenses (Abusch 1994) and the existence of an anaphoric component to the future auxiliary.