On the Cross-Linguistic Interpretation
of Embedded Tenses

Yusuke Kubota, Jungmee Lee, Anastasia Smirnova
and Judith Tonhauser
Department of Linguistics
The Ohio State University
{kubota,jlee,smirnova,judith}@ling.osu.edu

Abstract

We propose a semantic analysis of cross-linguistic variation in the distribution and interpretation of tenses embedded in propositional attitude complements and temporal adjunct clauses in English, Japanese and Russian. We compare our analysis to previous ones proposed by Ogihara (1994, 1996) and Arregui and Kusumoto (1998), which attribute the variation to syntactic differences between the languages, and argue that the semantic analysis is preferable on both empirical and conceptual grounds.

1   Introduction

This paper develops a semantic analysis of the distribution and interpretation of tenses embedded in propositional attitude complements (PACs) and temporal adjunct clauses (TACs) in English, Japanese and Russian. English examples illustrating the two types of clauses are given in (1):

(1) a. Ken said <u>that Anna was sick</u>.   (PAC)
     b. Anna left <u>before Ken arrived</u>.   (TAC)

The variation observed is that tenses in English and Russian TACs exhibit the same distribution (in contrast to Japanese tenses) whereas the interpretations of tenses are parallel in Russian and Japanese PACs (but different for English). Despite tense interpretation being a semantic phenomenon, previous analyses of (parts of) this cross-linguistic variation attribute the variation primarily to syntactic differences between the languages (cf. Ogihara 1994, 1996; Arregui and Kusumoto 1998). The current paper considers a broader set of languages and constructions

than any single previous work, and demonstrates that a purely semantic analysis of the variation is possible once the fact that PACs and TACs impose distinct constraints on the interpretation of embedded tenses is taken into consideration. A comparison of the semantic analysis to the previous ones reveals empirical and conceptual advantages of the semantic analysis.

2   Tenses in embedded clauses

We assume that each of the three languages has a past and a non-past tense. The data in (2) show the (bold-faced) past tenses of the three languages: in matrix clauses, they result in interpretations where the eventuality denoted by the verb is temporally located prior to the speech time.[1]

(2)   a.   Ken arriv**ed** yesterday/#now/#tomorrow.
       b.   Japanese

             Ken-ga   kinoo/#ima/#asita   ki-**ta**.
             Ken-NOM yesterday/now/tomorrow arrive-PAST

             'Ken arrived yesterday/#now/#tomorrow.'
       c.   Russian

             Ken pri-exa-**l**   včera/#sejčas#zavtra.
             Ken PERF-arrive-PAST.MASC yesterday/now/tomorrow

             'Ken arrived yesterday/#now/#tomorrow.'

Each language also has a tense form which (in matrix clauses) is compatible with non-past time reference, cf. (3). (These non-past tenses receive slightly different interpretations in the three languages depending on the Aktionsart of the proposition; we ignore these differences here since tenses are our primary concern.)

(3)   a.   Anna **is** in her office #yesterday/now/tomorrow.
       b.   Japanese

             Anna-wa   #kinoo/ima/asita   Tookyoo-ni i-**ru**.
             Anna-TOP yesterday/now/tomorrow Tokyo-at   be-NPST

             'Anna is/will be in Tokyo now/tomorrow.'
       c.   Russian

             Anna #včera/sejčas/zavtra   poj-**ot**.
             Anna yesterday/now/tomorrow sing-NPST

             'Anna is singing now/Anna will sing tomorrow.'

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[1]We use the following glosses in this paper: COMPL = complementizer, FEM = feminine gender, INSTR = instrumental case, MASC = masculine gender, NOM = nominative case, NPST = non-past tense, PAST = past tense, PERF = perfective aspect, TOP = topic.

English, Japanese and Russian differ in the distribution of tenses in TACs. We restrict our discussion here to 'before'-clauses with past tense matrix clauses; comparable points can be made for 'after'-clauses (cf. e.g. Ogihara 1994; Arregui and Kusumoto 1998). In (4), the TACs are enclosed in brackets:

(4)   a.   Anna left [before Ken arriv**ed**/#arriv**es**].
       b.   Japanese

            [Ken-ga   #ki-**ta**/ku-**ru**   mae-ni]   Anna-ga   kaet-ta.
            Ken-NOM arrive-PAST/arrive-NPST before-at Anna-NOM leave-PAST

            'Anna left before Ken arrived.'
       c.   Russian

            Anna u-exa-l-a   [pered tem,   kak Ken
            Anna PERF-leave-PAST-FEM before that.INSTR as   Ken
            pri-exa-**l**/#pri-ed-**et**].
            PERF-arrive-PAST.MASC/PERF-arrive-NPST

            'Anna left before Ken arrived.'

The matrix clauses in (4) are interpreted in the past of the speech time. In English (4-a) and Russian (4-c), past tenses are obligatory in the 'before'-TACs whereas in Japanese the non-past tense is required (4-b). If the temporal connectives of all three languages locate the time at which the matrix clause is interpreted prior to the time at which the TAC is interpreted, the distribution of tenses in (4) points to differences in the interpretation of tenses in English/Russian versus Japanese TACs. In particular, the English and Russian TACs seem to be interpreted at the speech time since the interpretation of the embedded past tense is compatible with the meaning of the temporal connective: if the TACs were interpreted at the matrix event time,[2] the embedded past tenses would locate the TACs prior to the matrix event time, thereby contradicting the meaning of the temporal connectives. The Japanese TAC, on the other hand, seems to be interpreted at the matrix event time since the interpretation of the non-past tense is compatible with the meaning of the temporal connective.[3]

Traditionally, a tense that is interpreted at the speech time is called an ABSOLUTE tense whereas one that is interpreted at a time supplied by the linguistic context (and which may differ from the speech time) is called a RELATIVE tense (Comrie 1985). Thus, the data in (4) suggest that English and Russian tenses are absolute while those of Japanese are relative. We return to this below.

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[2]The term 'matrix event time' refers to the situation time of the eventuality denoted by the matrix clause.

[3]If English and Russian TACs are interpreted at the speech time, the non-past tenses should also be acceptable in 'before'-TACs (contrary to fact), resulting in an interpretation of e.g. (4-a) according to which Anna's past leaving is followed by Ken's arrival at or after the speech time. We argue in Kubota et al. (2009) that the unavailability of such interpretations is due to a pragmatic constraint on temporal interpretation.

In PACs, both past and non-past tenses are permitted in the three languages but the languages differ in the interpretations the tenses realize. In (5), past tenses occur in the PACs and the matrix clauses. The English PAC in (5-a) is ambiguous between an interpretation where the time of Anna's being sick precedes the time of Ken's saying (the 'back-shifted' interpretation) and an interpretation where the time of Anna's being sick overlaps with the time of Ken's saying (the 'overlapping' interpretation). The Japanese and Russian examples in (5-b) and (5-c), respectively, only receive the back-shifted interpretation.[4]

(5)   a.   Ken said [that Anna **was** sick].
       b.   Japanese
             Ken-wa   [Anna-ga   byooki dat-**ta**   to]   it-ta.
             Ken-TOP Anna-NOM sick   be-PAST COMPL say-PAST
             'Ken said that Anna had been sick.'
       c.   Russian
             Ken skaza-l   [čto Anna bole-**l**-a].
             Ken say-PAST.MASC that Anna be.sick-PAST-FEM
             'Ken said that Anna had been sick.'

In (6), we find non-past tenses in the PACs. The Japanese and Russian PACs in (6-b) and (6-c), respectively, receive an overlapping interpretation while the English PAC in (6-a) has the 'double-access' reading (Abusch 1997a).

(6)   a.   Ken said that Anna **is** sick.
       b.   Japanese
             Ken-wa   [Anna-ga   byooki da   to]   it-ta.
             Ken-TOP Anna-NOM sick   be.NPST COMPL say-PAST
             'Ken said that Anna was sick (at the time of saying).'
       c.   Russian
             Ken skaza-l   [čto Anna bole-**et**].
             Ken say-PAST.MASC that Anna be.sick-NPST
             'Ken said that Anna was sick (at the time of saying).'

The English PAC in (6-a) differs from the Japanese and Russian PACs in that for (6-a) to be true it is not sufficient for Ken to have said at a time in the past that Anna was sick at that past time (the overlapping interpretation); the interpretation of the PAC in (6-a) seems to additionally involve the speech time (hence the name 'double-access' reading). This additional meaning of (6-a) is not just the assertion that Ken said at some time in the past that Anna would be sick

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[4]Altshuler (2008) points out that Russian past-under-past PACs can receive an overlapping interpretation in certain discourse contexts. We leave open the question of how such examples could be accounted for in the analysis we propose here.

at the speech time. For speakers who accept (6-a), the sentence means something along the lines that, according to Ken's belief, Anna was sick at the time he make his remark, and that his belief was such that the speaker could attribute to him an additional, consequential belief that, if everything took the normal course of events, then Anna would still be sick at the speech time.

Assuming that the matrix clause verbs in the three languages make the same contributions to the temporal interpretation of the embedded clauses, the variation observed in (5) and (6) again suggests differences in the interpretations of embedded tenses in the three languages. In particular, the Japanese and Russian PACs seem to be interpreted with respect to the matrix event time, which, on the traditional classification, means that they are relative tenses. But now Russian presents a problem for the traditional classification: TACs motivate that Russian tenses are absolute while PACs motivate that they are relative. English likewise poses a problem since the non-past tense in PACs needs to be interpreted at the speech time and the matrix event time—simply saying that it is relative (or absolute, or both) is not satisfying. Thus, the traditional classification of tenses into relative and absolute tenses is inadequate. We return to this in §3.3.

3   A semantic analysis of the variation

This section develops a semantic analysis of the variation in temporal interpretation observed above. The notion of LOCAL EVALUATION TIME, which is the time at which a tense is interpreted, plays a key role in our analysis. For matrix clause tenses, the local evaluation time is always the speech time. For embedded tenses, our proposal, in short, is that there is variation both among languages and among constructions as to which time is identified as the local evaluation time.[5] For PACs, we argue that, due to the fact that PACs denote mental attitudes ascribed to some attitude holder who does not have access to the speech time, the local evaluation time of tenses embedded in PACs cannot be the speech time. This semantic constraint limits possible cross-linguistic variation in the interpretation of tenses embedded in PACs. By contrast, TACs are just adverbial clauses that restrict the denotation of the matrix clause. Unlike PACs, TACs do not impose semantic restrictions on how to determine the local evaluation time of the embedded clause, and there is cross-linguistic variation in this respect.

3.1   Variation in temporal adjunct clauses (TACs)

Recall from §2 that the past tense occurs in English and Russian 'before'-TACs (with a past tense matrix clause) whereas the non-past tense occurs in the Japanese

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[5]The idea that a time (potentially) distinct from the speech time is useful for the interpretation of embedded tenses is also present in e.g. Gennari (2003) on English, Ogihara (1996) on Japanese (and English), Yoon (1996) on Korean and Smirnova (2009) on Bulgarian.

counterparts. This variation can be accounted for semantically by allowing for variation in what time a temporal connective of a particular language specifies as the local evaluation time of the embedded tense. This is illustrated in detail in Kubota et al. (2009). For Japanese, we follow Ogihara (1994, 1996), who derives the distribution of tenses in TACs from the meanings of tenses and temporal connectives. Consider (7-a) and its translation in (7-b), where **past** is the contribution of the matrix clause past tense and **npst** that of the embedded non-past tense.[6]

(7)　　a.　[Ken-ga　ku-ru　　　mae-ni]　Anna-ga　　kaet-ta.　　(Japanese)
　　　　　　Ken-NOM arrive-NPST before-at Anna-NOM leave-PAST

　　　　　　'Anna left before Ken arrived.'
　　　　b.　$\exists t[\mathbf{past}(t) \wedge \mathbf{AT}(t, leave'(a))$
　　　　　　　　　　$\wedge \mathbf{AT}(t, \exists t_1[\mathbf{npst}(t_1) \wedge \mathbf{AT}(t_1, arrive'(k)) \wedge t < t_1])]$

According to (7-b), (7-a) is true if and only if there is a time t prior to the speech time s^* at which Anna leaves (contribution of the matrix past tense) and there is a time t_1 that is non-past with respect to t and at which Ken arrives (contribution of the embedded non-past tense), and t precedes t_1 (contribution of the connective *mae* 'before'). The time t is located prior to the speech time since the local evaluation time of the matrix clause past tense is the speech time s^*. The local evaluation time for the embedded tense, however, is the matrix event time t as specified by the AT predicate.[7] Therefore, the embedded non-past tense locates the time t_1 of Ken's arrival at or in the future of the time t of Anna's leaving. Since the temporal connective requires t to precede t_1, it is correctly predicted that (7-a) means that Anna left before Ken arrived. The key to this analysis is the lexical entry of the temporal connective *mae* 'before': it specifies (using the AT predicate) that the local evaluation time of the embedded clause P is the event time t of the matrix clause Q:[8]

(8)　　*mae* 'before' $\Rightarrow \lambda P \lambda Q \lambda t[Q(t) \wedge \mathbf{AT}(t, \exists t_1[P(t_1) \wedge t < t_1])]$

　　　This analysis (originally due to Ogihara) also predicts that the past tense is unacceptable in Japanese *mae* 'before' clauses since a contradiction arises between the interpretation of the embedded past tense (which locates t_1 prior to t) and the interpretation of the temporal connective (which requires that t precede t_1):

(9)　　a. #[Ken-ga　ki-ta　　　mae-ni]　Anna-ga　　kaet-ta.　　(Japanese)
　　　　　　Ken-NOM arrive-PAST before-at Anna-NOM leave-PAST
　　　　　　Intended: 'Anna left before Ken arrived.'

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[6] $[\![\mathbf{past}(\zeta)]\!]^{M,i,g} = 1$ iff $[\![\zeta]\!]^{M,i,g} < i$; $[\![\mathbf{npst}(\zeta)]\!]^{M,i,g} = 1$ iff $i \leq [\![\zeta]\!]^{M,i,g}$.

[7] The AT predicate is defined as: $[\![\mathbf{AT}(\zeta, P)]\!]^{M,i,g} = 1$ iff $[\![P]\!]^{M,i',s} = 1$ where $i' = [\![\zeta]\!]^{M,i,g}$

[8] As it stands, the analysis incorrectly predicts there is a time at which the eventuality denoted by a 'before'-clause is true, i.e. that the 'before'-clause is veridical. We assume that our analysis can be adapted along the lines of Beaver and Condoravdi (2003) to account for the non-veridical readings of 'before'-TACs.

b. $\exists t[\mathbf{past}(t) \wedge \mathbf{AT}(t, leave'(a))$
$\wedge \mathbf{AT}(t, \exists t_1[\mathbf{past}(t_1) \wedge \mathbf{AT}(t_1, arrive'(k)) \wedge t < t_1])]$

We do not follow Ogihara in his analysis of English TACs, which, as discussed in §4, relies on syntactic differences between English and Japanese. Instead, we account for the distribution of tenses in English and Russian TACs by specifying that the local evaluation time of the embedded clause is the speech time rather than the matrix event time (cf. Stump (1985) for English). (10) gives the relevant lexical entries for the temporal connectives:

(10)   English *before*/Russian *pered* 'before' $\Rightarrow \lambda P \lambda Q \lambda t[\exists t_1(Q(t) \wedge P(t_1) \wedge t < t_1)]$

In contrast to the lexical entry of Japanese 'before' in (8), the denotation of the embedded clause (again, represented by the variable P) is not embedded under an AT predicate in (10). Thus, the local evaluation time of the embedded clause is the speech time. This correctly predicts that the past tense is acceptable in English and Russian 'before'-TACs, as illustrated in (11) for English:

(11)   a.   Anna left before Ken arrived.
        b. $\exists t \exists t_1[\mathbf{past}(t) \wedge \mathbf{AT}(t, leave'(a))$
$\wedge \mathbf{past}(t_1) \wedge \mathbf{AT}(t_1, arrive'(k)) \wedge t < t_1]$

According to (11-b), (11-a) is true if and only if there is a time t in the past of the speech time at which Anna leaves and a time t_1 in the past of the speech time at which Ken arrives, and t precedes t_1.

In sum, we account for cross-linguistic variation in English, Japanese and Russian TACs semantically. Our analysis is a synthesis (and modest extension) of Ogihara's (1994, 1996) relative tense analysis of Japanese TACs and Stump's (1985) absolute tense analysis of English TACs. (Cf. Kubota et al. (2009) for a rebuttal of Ogihara's criticism of a Stump-style analysis of English TACs.) Crucially, TACs themselves do not impose any constraint on how the local evaluation time of the embedded clause should be identified, thus allowing for variation such as that observed with English and Russian versus Japanese.

3.2   Variation in propositional attitude complements (PACs)

In contrast to TACs, the semantics of PACs imposes a constraint on the interpretation of embedded tense. More specifically, due to the fact that PACs express a mental attitude held by an individual who does not necessarily have access to the utterance event in which his/her mental attitude is reported, PACs cannot in principle contain indexical expressions that refer to the speech time (cf. e.g. von Stechow 1995; Ogihara 1996). What this means with respect to tenses occurring inside PACs is that they can't have interpretations that make reference to the speech time; in other words, setting the local evaluation time to the speech time is

not an option for tenses inside PACs. Instead, tenses in PACs are interpreted with respect to the time that the attitude holder takes to be the current time. We call this time the 'attitude holder's now', adapting Abusch's (1997b) term 'believer's now'. Since this property of PACs is a consequence of what it means to ascribe a mental attitude to some individual, this is a constraint that any language observes:

(12)   The 'attitude holder's now' is identified with the local evaluation time of the PAC (von Stechow 1995; Abusch 1997b; Gennari 2003).

It follows from (12) that, cross-linguistically, the local evaluation time of a PAC invariably is the matrix event time (in the belief worlds of the attitude holder). Thus, an embedded past tense locates the eventuality denoted by the embedded clause at a time prior to the time of the matrix event whereas an embedded non-past tense locates it at (or after) the matrix event time. This is the pattern observed in §2 for Japanese and Russian PACs. Consider the Japanese examples in (13-a) and (14-a), together with their translations:[9]

(13)   a.   Ken-wa   [Anna-ga   byooki dat-**ta**   to]   sinzi-ta.
              Ken-TOP Anna-NOM sick   be-PAST COMPL believe-PAST
              'Ken believed that Anna had been sick.'
        b. $\exists t[\mathbf{AT}(t, believe'(k, ^\wedge \exists t'[\mathbf{AT}(t', sick'(a)) \wedge \mathbf{past}(t')])) \wedge \mathbf{past}(t)]$

(14)   a.   Ken-wa   [Anna-ga   byooki da   to]   sinzi-ta.
              Ken-TOP Anna-NOM sick   be.NPST COMPL believe-PAST
              'Ken believed that Anna was sick (at the time of his belief).'
        b. $\exists t[\mathbf{AT}(t, believe'(k, ^\wedge \exists t'[\mathbf{AT}(t', sick'(a)) \wedge \mathbf{npst}(t')])) \wedge \mathbf{past}(t)]$

(13-a) is true if and only if there is some time t prior to the speech time at which Ken believes that there is some time t' prior to the time of his utterance at which Anna is sick. (14-a) is true if and only if there is some time t prior to the speech time at which Ken believes that there is some time t' not prior to the time of his utterance at which Anna is sick. This analysis of Japanese PACs is essentially that of Ogihara (1989, 1996). The same semantic analysis accounts for Russian PACs.

English seems to pose a problem for this analysis of PACs: If no cross-linguistic variation with respect to the identity of the local evaluation time is allowed in PACs, why is it that English does not pattern like Japanese and Russian? Recall that English PACs embedded under a past tense matrix clause differ from

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[9]We assume that PACs denote propositions (sets of world-time pairs), such that e.g. for an individual to believe the proposition p in w at i is to say that for all of the pairs of w' and t' that could be the actual world and the current time according to this individual's belief in w at i, p is true in w' at t'.

(i) $[\![believe']\!]^{M,i,g}(\delta, p) = 1$ iff for all world-time pairs $\langle w', t' \rangle$ compatible with the belief held by δ in w at i, $p(\langle w', t' \rangle) = 1$.

Japanese/Russian ones in two ways: First, English past tense stative PACs may receive both an overlapping and a back-shifted interpretation; second, non-past PACs receive a double-access interpretation. We follow Gennari (1999, 2001, 2003) in assuming that these two facts are not independent: in short, her insight is that English past tense stative PACs are compatible with a wider set of interpretations than their Japanese/Russian counterparts because of the fact that English non-past PACs receive a double-access rather than a simple overlapping interpretation. Gennari proposes that the English non-past tense in PACs is exceptional compared to other English tenses and tenses in other languages in that it is both indexical and anaphoric: it is indexical since it refers to the speech time and it is anaphoric since it also imposes a constraint on the relation between the event time and the evaluation time.

      Adopting Gennari's (1999) analysis, the meaning of $\mathbf{npst}_E$, the English non-past tense in PACs, can be defined as follows:[10]

(15) $[\![\mathbf{npst}_E(\zeta)]\!]^{M,i,g} = 1$ iff $[\![\zeta]\!]^{M,i,g} \cap i \neq \emptyset$ and $\neg([\![\zeta]\!]^{M,i,g} < s^*)$

This definition contains a direct reference to the speech time by means of the distinguished free variable s^*. As a consequence, English examples with non-past tense PACs, like (16-a), should, strictly speaking, be semantically uninterpretable given the constraint in (12): the problem is that the translation in (16-b) would ascribe to the attitude holder a mental attitude about a time whose location is unknown to her/him. More specifically, when interpreting the semantic contribution of the embedded non-past tense in (15), one cannot make sense of the s^* designating the speech time as part of the belief attributed to the attitude holder.

(16)   a.   Ken believed that Anna is sick.
           b. $\exists t[\mathbf{AT}(t, \mathbf{believe}(\mathbf{k},{}^\wedge\exists t_1[\mathbf{AT}(t_1, \mathbf{sick}(\mathbf{a})) \wedge \mathbf{npst}_E(t_1)]) \wedge \mathbf{past}(t))]$

Gennari solves this problem by arguing that PACs (in English) do not directly denote mental attitudes held by the attitude holder, but rather that they denote 'implicit attitudes'—attitudes ascribed to attitude holders *from the perspective of the reporter of the attitude.* The idea is that when we talk about an attitude held by some individual, we are really talking about an augmented variant of the original attitude of the attitude holder with our own interpretation 'superimposed' on it, so to speak. We allow ourselves to talk as if the original attitude holder actually held that augmented variant of his/her own belief. Since the reporter of the attitude has access to the speech time, the 'interpretation' of the original attitude can of course make reference to the speech time. At the same time, since the non-past tense is interpreted with respect to the attitude holder's now, the anaphoric part of the meaning of the non-past tense in PACs requires temporal overlap of the event times of the embedded and the matrix clause. Thus, Gennari's analysis correctly

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[10]Thus, the meaning of the English non-past tense realized in PACs differs from the non-past tense in TACs, cf. footnote 6.

captures native speakers' intuitions that a sentence like (16-a) is infelicitous if, for example, it was uttered a month after Ken had a belief that Anna was sick but he also believed that she would get better in a week. One of the only requirements that need to be satisfied for (16-a) to be uttered felicitously is that a reasonable interpretation of Ken's belief be such that he would have accepted as also believing that Anna would be sick at the speech time had he been demanded to explicate his belief more precisely at the time he held that belief. Thus, in Gennari's analysis, (16-a) is true if Ken at some past time held the belief that Anna was sick at that time and the reporter of Ken's attitude has reason to believe that Ken would also have believed that Anna would be sick at the speech time.

Gennari's (2003) key insight is that the fact that English non-past PACs receive an unexpected interpretation has repercussions for the interpretation of English past tense PACs. She argues that English past tense stative PACs can receive an overlapping interpretation (in contrast to those of Japanese and Russian) since English non-past PACs like (16-a) cannot express a purely overlapping interpretation, i.e. one where Anna is sick at the past time of Ken's belief but not necessarily at the speech time. Gennari's analysis makes use of the superinterval property,[11] a pragmatic inference available for states (but not events) according to which a stative proposition is implicated to be true at a proper super-interval of the interval for which it is asserted to be true (Dowty 1986). Gennari accounts for the overlapping interpretation of past under past English PACs as follows. In English (just as in Japanese and Russian), the truth-conditional meaning of a past tense embedded in a PAC gives rise to the back-shifted interpretation. The interval at which a past tense stative PAC is true may be implicated to be a larger interval, one that includes the attitude holder's now, such that past tense stative PACs may receive an overlapping interpretation. This implicature arises in English since the overlapping interpretation is unavailable in English with an embedded non-past tense; the overlapping reading is blocked for Japanese and Russian past under past PACs since a non-past PAC realizes this meaning. Gennari's analysis also predicts that the overlapping interpretation is not available for past tense eventive PACs since eventive predicates do not have the superinterval property (but see Kusumoto (1999), who argues that the overlapping interpretation is available with some eventive predicates).

In sum, Gennari (1999, 2003) shows that the seemingly anomalous interpretations of English past and non-past PACs can be systematically explained once the relevant factors (Aktionsart, tense) are teased apart carefully. This means that we can maintain our thesis that the local evaluation time of PACs is uniformly the attitude holder's now. Cross-linguistic variation in the interpretation of tense in

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[11]A stative proposition, due to its homogeneity, has the entailment that it is true of all of the subintervals I' of an interval I at which it is true. Thus, for any of the subintervals I' there is a proper super-interval at which the proposition is true. But then, given any interval at which a stative proposition is true, it is implicated that there is a (proper) super-interval at which the proposition is also true.

PACs is not variation in how the local evaluation time of an embedded tense is set but rather results from the existence of an exceptional tense (such as the English non-past) whose meaning does not involve just the local evaluation time but also an indexical reference to the speech time.

3.3   Summary

We have provided a purely semantic analysis of cross-linguistic variation in the distribution and interpretation of tenses in PACs and TACs in English, Japanese and Russian. Crucial to the analysis is the observation that PACs but not TACs impose constraints on how the local evaluation time is determined. The cross-linguistic variation in the distribution of tenses in TACs can then be attributed to the fact that the local evaluation time can be either the speech time or the matrix event time. In PACs, on the other hand, the local evaluation time is always the matrix event time; variation nevertheless arises from differences in tense systems.

A consequence of our analysis is that all tenses are anaphoric, i.e. interpreted with respect to the local evaluation time (the English non-past tense in PACs additionally is indexical). Differences in how tenses are interpreted do not arise from the meaning of the tenses themselves but rather from the way in which the local evaluation time is set by constructions in which tenses occur. This stands in contrast to the traditional absolute/relative classification of tenses where differences in interpretation seem to be attributed to the tenses themselves (cf. §2). A conceptual advantage of the former way of characterizing cross-linguistic variation in tense systems is that e.g. the tenses of Russian are unproblematic. Recall that, under the traditional characterization, data from TACs motivated that Russian tenses are absolute while PACs motivated that Russian tenses are relative. In our approach, Russian tenses are uniformly anaphoric—what differs is that the local evaluation time is the speech time in TACs and the matrix event time in PACs. Thus, we argue that the traditional classification of tenses as absolute or relative is merely an epiphenomenon of differences in the identity of the local evaluation time across languages and constructions.

4   Comparison with previous proposals

In this section we compare our semantic analysis of the variation to that of Ogihara (1989, 1996, 1994) and Arregui and Kusumoto (1998).

4.1   Ogihara (1989, 1996, 1994)

Ogihara is concerned with variation in English and Japanese PACs and TACs. As discussed above, we adopt his analysis of Japanese TACs and PACs, according to which the local evaluation time of the embedded tense is the matrix event time. Our proposal differs from his in how English TACs and PACs are interpreted. For

English TACs, Ogihara assumes that the local evaluation time of embedded tenses is the matrix event time, too, just like in Japanese. To account for the observed variation between English and Japanese, Ogihara relies on the Sequence-of-Tense (SOT) rule, which operates at Logical Form (LF) and deletes an embedded tense that is c-commanded by an identical matrix tense. He assumes that this rule does not apply in Japanese TACs or PACs (where embedded tenses are always inter-preted at the matrix event time) but applies obligatorily in English TACs. Thus, past tense *before*-clauses are acceptable in English since the backward shifting contribution of the past tense is eliminated by the SOT rule.

Ogihara also relies on the SOT rule to account for the interpretations of past tense PACs with past matrix clauses. In contrast to TACs, the SOT rule applies optionally in PACs: a past tense PAC in English receives a back-shifted interpretation if the SOT rule does not apply and an overlapping interpretation if the SOT rule applies. Ogihara (1996) accounts for the double-access interpretation of non-past tense PACs (with past matrix clauses) by assuming that the embedded non-past tense is interpreted *de re*, i.e. outside the scope of the attitude verb in the matrix clause (cf. also Abusch 1997b for a closely related approach). The translation of the structure that results after the embedded non-past tense has moved is given in (17-a), cf. Ogihara (1996, 212). The sentence *Ken believed that Anna is sick* receives the translation in (17-b):

(17) a. $[_{CP}\text{PRES}_n \ S] \Rightarrow \lambda t_3 \lambda t_2 \exists s_n [\mathbf{pres}_n(t_2)(t_3) \wedge exist'(t_2)(s_n) \wedge \exists t_5 (\mathbf{S}(s^*)(t_5))]$
      b. $\exists s[exist'(s^*, s) \wedge \exists t[t < s^* \wedge believe'(t, k, s, {}^{\wedge}\lambda t_3 \lambda s_1 [sick'(s_1, a)])]]$

According to (17-b) and the truth conditions Ogihara proposes for *de re* attitude verbs, *Ken believed that Anna is sick* is true if and only if there exists a state s that includes the speech time s^* and there is an acquaintance relation R that connects Ken to s in the actual world at the past time t, and, in all of Ken's doxastic alternatives $\langle w', t' \rangle$ in the actual world w and at t, the state to which Ken is acquainted via R in w' at t' has the property of Anna being sick. Hence, the acquaintance relation and the meaning of *believe* defined in terms of it account for the temporal overlap of s with the matrix event time t, whereas the overlap of s with the speech time is contributed by the $exist'$ predicate, which comes from the definition of the *de re* non-past tense in (17-a).

Ogihara's analysis of cross-linguistic variation in English and Japanese TACs and PACs faces both empirical and conceptual problems:

1. Since the SOT rule applies at the level of LF, Ogihara's analysis can only be couched in theories that have a syntactic level of representation at which c-command is definable and deletion operations are permissible.

2. Ogihara's analysis of PACs treats as separate and unrelated phenomena the fact that English past under past PACs may receive an overlapping interpre-tation and the fact that non-past under past PACs receive the double-access interpretation. Thus, in contrast to Gennari, Ogihara does not predict that

only if a language induces double-access readings for the non-past tense can past under past PACs receive an overlapping interpretation.[12]

3. It is unclear whether Ogihara's analysis extends to languages such as Russian. Arregui and Kusumoto (1998) point out that Polish (which is like Russian in all relevant respects) behaves like English with respect to TACs but like Japanese with respect to PACs. Thus, if one assumes (as is the null hypothesis in an SOT-based account) that a language either has the SOT rule or does not have it, Ogihara's analysis cannot be extended to Polish and Russian. (See Kubota et al. (2009) for further discussion of this point.)

4. As pointed out by Gennari (1999, 2003) it remains unclear under Ogihara's account why the overlapping interpretation of past under past PACs and the double-access reading is only available for embedded stative predicates (whereas this falls out naturally from Gennari's analysis).

5. Gennari (1999, 2003) provides several arguments against *de re* analyses of the double-access interpretation. For example, as Gennari (1999) shows, for a sentence with a double-access reading to be felicitous, there does not necessarily have to be any state of affairs that obtains throughout an interval containing both the embedded event time and the speech time in the actual world. Ogihara's analysis, however, as well as that of Abusch (1997b), require the existence of such an interval.

4.2 Arregui and Kusumoto (1998)

Arregui and Kusumoto (1998) (henceforth A&K) analyze variation among English, Japanese and Polish TACs (where Polish behaves like Russian in the relevant respects). We refer the reader to Kubota et al. (2009) for detailed comparison of our analysis with A&K. The central assumption of A&K's analysis is that English and Polish TACs have a different syntactic structure than Japanese TACs; in particular, the temporal connectives of English and Polish TACs select for a CP while that of Japanese selects for a TP. Since the speech time is assumed to be realized in the head of CP, a consequence of the syntactic variation is that English and Polish tenses in TACs are interpreted with respect to the speech time while that of Japanese TACs are interpreted with respect to the matrix event time. This correctly predicts that, with past tense matrix clauses, the past tenses occur in English and Polish TACs (cf. (4-a) and (4-c)) while Japanese TACs require the non-past tense (4-b).

As discussed by A&K, these syntactic differences do not suffice to exclude the past tense from Japanese *mae* 'before' clauses. To remedy the situation, A&K propose that Japanese *mae* 'before' bears a binder index and, hence, can occur

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[12]Recall that, in Gennari's analysis, the latter fact is a consequence of the former. To account for this fact in the context of an analysis of PACs along the lines of Ogihara (1996), one would need to introduce an additional mechanism such as Sharvit's (2003) Embeddability Principle.

with a present tense (a variable), but not with past tense (a temporal abstract modifier of type $\langle\langle i, t\rangle, \langle i, t\rangle\rangle$). Thus, in short, the analysis of the cross-linguistic variation in TACs proposed by A&K relies on a non-uniform syntax/semantics of the temporal connectives in Japanese, as well as a non-uniform syntax/semantics of the past and non-past tenses of the three languages.

5   Conclusion

Cross-linguistic analyses of the distribution and interpretation of tenses embedded in TACs and PACs sit squarely at the interface of the syntactic and semantic components of grammar. These analyses differ in the extent to which they attribute the variation to syntactic or semantic similarities and differences between languages. The comparison of previous analyses of (parts of) the variation to the semantic analysis developed in §3 has shown that, all other things being equal, the semantic analysis is more straightforward since it only relies on the semantic contributions of the expressions and constructions involved. By contrast, Ogihara's and A&K's analyses involve syntactic differences between the languages, e.g. with respect to the tenses, the structure of TACs or the interface with semantics. We maintain that a semantic analysis of a semantic phenomenon (tense interpretation) is generally preferable. Additionally, we conclude that the semantic analysis of the variation is not only a viable alternative to the previous, syntactic analyses but advantageous for empirical, conceptual and theoretical reasons.

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