

Cross-linguistic Variation in *Before*-clauses

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1. The naïve analysis of *before* (inspired by Anscombe, 1964)

Before-constructions with matrix and embedded past tense in English exhibit at least the four properties listed in (1).

- (1) John watered the plant before it died.
 q = “John watered the plant”; p = “the plant died”; SP is the speech time.
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|---|-------------------------|
| (i) \implies John waters the plant prior to SP. | <i>q-factivity</i> |
| (ii) $\not\implies$ The plant dies at some point. | <i>No-p-factivity</i> |
| (iii) \implies If the plant dies, it dies prior to SP. | <i>Non-shiftability</i> |
| (iv) \implies If the plant dies, the watering precedes the dying. | <i>q-precedence</i> |

According to Anscombe (1964), ‘q before p’ is true iff there is a q-time t such that for all p-times t', t < t'. Existential quantification over q-times yields q-factivity, and universal quantification over p-times explains No-p-factivity. However, translating Anscombe’s approach into a compositional framework, taking into account both occurrences of the past tense, presents a challenge regarding Non-shiftability and q-precedence (see (2)): the starting point of the dying can be at or anywhere after the starting point of the watering. (D_i is the domain of time-intervals; *JWTP* is shorthand for $[\lambda_2 [John\ water-t_2\ the\ plant]]$ and *TPD* for $[\lambda_2 [the\ plant\ die-t_2]]$.)

- (2) a. $[[PAST^{ENG}]^g(t)(p) = True \text{ iff } \{t' \in D_i: t' < t \text{ and } p(t') = True\} \neq \emptyset$.
 b. $[[before^{Ans}]^g(t)(p)(q) = True \text{ iff } q(t) = True \text{ and } \{t' \in D_i: p(t') = True\} \subseteq \{t' \in D_i: t < t'\}$.
 c. LF of (1): $[PAST^{ENG}-t_0 [\lambda_1 [JWTP [before^{Ans}-t_1 [\lambda_3 [PAST^{ENG}-t_3 TPD]]]]]]$
 d. $\{t \in D_i: (i) t < SP; (ii) \text{ John waters the plant at } t; \text{ and } (iii) \{t' \in D_i: \{t'' \in D_i: t'' < t' \text{ and the plant dies at } t''\} \neq \emptyset\} \subseteq \{t' \in D_i: t < t'\}\} \neq \emptyset$.

In addition, (2) does not explain the cross-linguistic variation illustrated by (1), (3) and the Japanese examples in (4): the Japanese counterpart of (1) is ungrammatical, and the Japanese counterpart of the ungrammatical (3) is grammatical (see Ogihara, 1996). It also fails to predict the unicorn problem (illustrated by the oddity of (5); see Beaver & Condoravdi, 2003).

- (3) *John watered the plant before it dies.
 (4) Jon-wa [hana-ga kare-ru/*ta mae-ni] mizu-o yat-ta
 John-TOP flower-NOM wither-PRES/PAST before-at water-ACC give-PAST
 (5) #John watered the plant before a unicorn arrived.

(5) suggests that No-p-factivity is not a result of universal quantification of p-times (or time-intervals), but rather the result of a requirement imposed by *before* that p be true in a set of worlds accessible from the actual world (which resemble the actual world in certain respects, such as the lack of unicorns). Here we focus on cross-linguistic variation and, for simplicity, ignore No-p-factivity. That is to say, we pretend that the actual world is always a member of the set of accessible worlds (and that (1) entails that the plant actually died).

2. An SOT analysis (inspired by Ogihara, 1996)

Japanese present is relative, as shown by (6) (from Ogihara, 1996), so it makes sense to posit (8) for (6) and (9) for the grammatical version of (4). Non-shiftability and q-precedence are guaranteed by (10) – a variant of (2b).

- (6) Taro-wa [Hanako-ga byooki-da] -to it-ta (Taro: “Hanako is sick”)
 Taro-TOP Hanako-NOM be-sick-PRES that say-PAST
- (7) $\llbracket PRES^{JAP} \rrbracket^{\mathfrak{E}}(t)(p) = \text{True}$ iff $p(t) = \text{True}$.
- (8) $PAST^{JAP}-t_0 [\lambda_1 [Taro\ say-t_1 [\lambda_3 [PRES^{JAP}-t_3 [\lambda_2 [Hanako\ be-t_2\ sick]]]]]]]$
- (9) $PAST^{JAP}-t_0 [\lambda_1 [JWTP [before^{Ans'}-t_1 [\lambda_2 [PRES^{JAP}-t_2\ TPD]]]]]]]$
- (10) $\llbracket before^{Ans'} \rrbracket^{\mathfrak{E}}(t^*)(p)(q)$ is defined only if $\{t' \in D_i: p(t') = \text{True} \text{ and } t' \subseteq t^*\} \neq \emptyset$. When defined, $\llbracket before^{Ans'} \rrbracket^{\mathfrak{E}}(t^*)(p)(q) = \text{True}$ iff $\{t \in D_i: (i) t \subseteq t^* \text{ and } q(t) = \text{True}; \text{ and } (ii) \{t' \in D_i: p(t') = \text{True}\} \subseteq \{t' \in D_i: t < t'\}\} \neq \emptyset$.

If we assume that the embedded *PAST* in (1) is “deleted” at LF, we can posit very similar LFs for English and Japanese. This is compatible with the well-known fact that English, unlike Japanese, is an SOT (Sequence-of-Tense) language: when a tense is c-commanded by an agreeing tense in English, it is often “ignored” by the semantics; see (11). So the LF in (12) underlies (11) (see Ogihara, 1996); similarly the LF in (13) underlies (1) ($\llbracket PAST \rrbracket^{\mathfrak{E}} = \llbracket PRES^{JAP} \rrbracket^{\mathfrak{E}}$).

- (11) John said that Mary was sick. (John: “Mary is sick”)
- (12) $PAST^{ENG}-t_0 [\lambda_1 [John\ say-t_1 [\lambda_3 [PAST-t_3 [\lambda_2 [Mary\ be-t_2\ sick]]]]]]]$
- (13) $PAST^{ENG}-t_0 [\lambda_1 [JWTP [before^{Ans'}-t_1 [\lambda_3 [PAST-t_3\ TPD]]]]]]]$

It also makes sense to posit (15) as the LF of (14), assuming the English future is composed of tense+*WOLL* and *WOLL* quantifies existentially over future times: the English present is absolute (see (16a)), but may be “deleted” under agreement; see (16b) ($\llbracket PAST \rrbracket^{\mathfrak{E}} = \llbracket PRES \rrbracket^{\mathfrak{E}}$).

- (14) John will water the plant before it dies.
- (15) $PRES^{ENG}-t_0 [2 [WOLL-t_2 [\lambda_1 [JWTP [before^{Ans'}-t_1 [\lambda_3 [PRES-t_3\ TPD]]]]]]]]]$
- (16) a. John caught a fish that is alive. (Being alive overlaps SP)
 b. John will catch a fish that is alive. (Being alive need not overlap SP)

Unfortunately, this proposal still incorrectly predicts that (1) and the ungrammatical form of (4) have (17) – with two occurrences of *PAST* – as a possible LF. Notice that (17) still does not guarantee q-precedence, and must be ruled out in both English and Japanese.

- (17) $PAST^{JAP/ENG}-t_0 [\lambda_1 [JWTP [before^{Ans'}-t_1 [\lambda_2 [PAST^{JAP/ENG}-t_2\ TPD]]]]]]]$

3. An EARLIEST-based SOT analysis (inspired by Beaver & Condoravdi, 2003)

An analysis in the spirit of Beaver & Condoravdi (2003) (see also von Stechow, 2009) gives us a way to account for the wide range of tense restrictions cross-linguistically.

- (18) $\llbracket before^{B\&C} \rrbracket^{\mathfrak{E}}(t)(t^*)(p)(q)$ is defined only if $EARLIEST_t(\{t'' \in D_i: p(t'') = \text{True}\}) \subseteq t^*$.
 When defined, $\llbracket before \rrbracket^{\mathfrak{E}}(t)(t^*)(p)(q) = \text{True}$ iff $\{t' \in D_i: (i) t' \subseteq t^*; (ii) q(t') = \text{True}; \text{ and } (iii) t' < EARLIEST_t(\{t'' \in D_i: p(t'') = \text{True}\})\} \neq \emptyset$.

- (19) $\text{EARLIEST}_t(P) :=$ the largest $t^* \subseteq t$ (if there is one) such that:
 (i) $t^* \in P$; and (ii) for all $t' \subseteq t$ such that $t' \in P$,
 $\text{LEFT-EDGE}(t') = \text{LEFT-EDGE}(t^*)$ or $\text{LEFT-EDGE}(t') > \text{LEFT-EDGE}(t^*)$.

The predictions of (9) and (13) carry over; see (20) ($g(C) = C$). Crucially, (21) – the new version of (17) – is ruled out by pragmatics, because there is no $\text{EARLIEST}_C(\{t' \in D_i: \{t'' \in D_i: t'' < t' \text{ and the plant dies at } t''\} \neq \emptyset\})$ (by assumption, the set of moments is dense).

- (20) a. $PAST^{\text{ENG}}-t_0 [\lambda_1 [JWTP [before^{\text{B\&C}}_{C-t_1} [\lambda_3 [PAST-t_3 TPD]]]]]$
 b. $PAST^{\text{JAP}}-t_0 [\lambda_1 [JWTP-t_1 [before^{\text{B\&C}}_{C-t_1} [\lambda_2 [PRES^{\text{JAP}}-t_2 TPD]]]]]$
 $\{t^* \in \{t'' \in D_i: \text{EARLIEST}_C(\{t' \in D_i: \text{the plant dies at } t'\}) \subseteq t''\}: t^* < \text{SP and } \{t \in D_i: t \subseteq t^* \text{ and John waters the plant at } t \text{ and } t < \text{EARLIEST}_C(\{t' \in D_i: \text{the plant dies at } t'\})\} \neq \emptyset \neq \emptyset$.

- (21) $PAST^{\text{ENG/JAP}}-t_0 [\lambda_1 [JWTP [before^{\text{B\&C}}_{C-t_1} [\lambda_3 [PAST^{\text{ENG/JAP}}-t_3 TPD]]]]]$

Some additional welcome consequences: (3) is predicted to be ill-formed, because under $PAST^{\text{ENG}}$, $PRES^{\text{ENG}}$ always introduces a time overlapping SP, as shown by (16). $PRES^{\text{ENG}}$ can be bound only when “deleted” under agreement. As a result, (22a) is ruled out as an LF of (3). On the other hand, (22b) is ruled out because $\text{EARLIEST}_C(\{t' \in D_i: \text{the plant dies at SP}\})$ is either undefined or C; and on the assumption that C is large enough to include all contextually relevant watering times, the truth conditions of (22b) cannot be met.

- (22) a. $*PAST^{\text{ENG}}-t_0 [\lambda_1 [JWTP [before^{\text{B\&C}}_{C-t_1} [\lambda_3 [PRES^{\text{ENG}}-t_3 TPD]]]]]$
 b. $PAST^{\text{ENG}}-t_0 [\lambda_1 [JWTP [before^{\text{B\&C}}_{C-t_1} [\lambda_3 [PRES^{\text{ENG}}-t_0 TPD]]]]]$

Similarly, the present-under-future in (23a) is correctly predicted to be well-formed, whereas the future-under-future in (23b) is correctly ruled out (despite the fact that future-under-future is not always disallowed, see (24)). Here is why: the LFs in (25) and (26) underlie (23a) and (23b) respectively, but only (25) is semantically well-formed (compare (26) to (21) (there is no $\text{EARLIEST}_C(\{t' \in D_i: \{t'' \in D_i: t'' > t' \text{ and the plant dies at } t''\} \neq \emptyset\})$, and to (22b)).

- (23) a. John will water the plant before it dies.
 b. *John will water the plant before it will die.

(24) John will catch a fish that will die.

- (25) $PRES^{\text{ENG}}-t_0 [2 [WOLL-t_2 [\lambda_1 [JWTP [before^{\text{B\&C}}_{C-t_1} [\lambda_3 [PRES-t_3 [TPD]]]]]]]]]$
 $\{t^* \in \{t'' \in D_i: \text{EARLIEST}_C(\{t' \in D_i: \text{the plant dies at } t'\}) \subseteq t''\}: t^* > \text{SP and } \{t \in D_i: t \subseteq t^* \text{ and John waters the plant at } t \text{ and } t < \text{EARLIEST}_C(\{t' \in D_i: \text{the plant dies at } t'\})\} \neq \emptyset \neq \emptyset$.
 (26) $PRES^{\text{ENG}}-t_0 [2 [WOLL-t_2 [\lambda_1 [JWTP [before^{\text{B\&C}}_{C-t_1} [\lambda_3 [PRES-t_3 / PRES^{\text{ENG}}-t_0 [4 [WOLL-t_4 TPD]]]]]]]]]]]$

4. Two types of non-SOT languages

Not all non-SOT languages are alike (see Arregui & Kusumoto 1998; Ogihara & Sharvit, to appear). For example, Hebrew is considered non-SOT, based on the behavior of tenses in complement clauses of attitude verbs (which resembles that of Japanese tenses; see (27)), but tense restrictions in Hebrew *before*-clauses are English-like; see (28).

- (27) Dan xašav še Miri ohevet oto
 Dan thinks-PAST that Miri love-PRES him
 Dan: “Miri loves me”
- (28) Dan hiška et ha-cemax lifney še hu naval/*novel
 Dan water-PAST ACC the plant before that it die-PAST/PRES

To account for this, we have to assume that $PRES^{HEB}$, unlike $PRES^{JAP}$, is “simultaneous” only in attitude reports. This is supported by (28), and also by (29): as reported in Ogihara & Sharvit (to appear), in (29) the loving is forced to overlap SP (as in English: *In his childhood, John met a woman who loves traveling*); in the corresponding Japanese example in (30), the loving time need not overlap SP.

- (29) be-yalduto, pagaš Yosef iša še ohevet letayel
 in-childhood-his meet-PAST Yosef woman Comp love-PRES traveling
- (30) kodomo-no koro, Joseph-wa [ryokoo-o aisu-ru zyosei]-ni at-ta
 child-GEN time, Joseph-TOP[travelling-ACC love-PRES woman]-DAT meet-PAST

We propose (following Ogihara & Sharvit, to appear) that Hebrew is indeed non-SOT, but unlike Japanese it has pronominal tenses, *past* and *pres* (rather than the quantificational *PAST* and *PRES*). Pronominal tenses are arguments of predicates. This yields the LFs in (32) for (28).

- (31) $\llbracket past^{HEB}_{k,j} \rrbracket^g$ is defined only if $g(j) < g(k)$. Whenever defined, $\llbracket past^{HEB}_{k,j} \rrbracket^g = g(j)$.
 $\llbracket pres^{HEB}_{k,j} \rrbracket^g$ is defined only if $g(j) o g(k)$. Whenever defined, $\llbracket pres^{HEB}_{k,j} \rrbracket^g = g(j)$.
- (32) a. $\exists_1 \llbracket [\lambda_2 [Dan\ water-past^{HEB}_{0,2}\ the\ plant]] [before^{B\&C}_{C-t_1} [\lambda_3 [it\ die-past^{HEB}_{0,3}]]] \rrbracket$
 b. $\exists_1 \llbracket [\lambda_2 [Dan\ water-past^{HEB}_{0,2}\ the\ plant]] [before^{B\&C}_{C-t_1} [\lambda_3 [it\ die-pres^{HEB}_{0,3}]]] \rrbracket$

Importantly, $EARLIEST_C(\{t' \in \{t'' \in D_i; t'' < SP\}; \text{the plant dies at } t'\})$ is defined (unlike $EARLIEST_C(\{t' \in D_i; \{t'' \in D_i; t'' < t' \text{ and the plant dies at } t''\} \neq \emptyset\})$, which is not), so (32a) is ruled in. (32b) is ruled out on pragmatic grounds. We also propose that Japanese has only quantificational tenses (*PAST* and *PRES*). English has pronominal tenses (and perhaps also quantificational tenses). English pronominal tenses can be “deleted” under agreement, in which case they bear only one (bound) index (and $\llbracket past_j \rrbracket^g = \llbracket pres_j \rrbracket^g = g(j)$).

Finally, future-under-future is well-formed in Hebrew *before*-clauses (see (33); cf. (23b)), and in some dialects, future-under-past is too. We assume that the Hebrew future is a pronoun, which optionally co-occurs with the Subjunctive. The second index of *fut* can be complex and be interpreted as the result of the application of an element of $D_{<i,i>}$ to an element of D_i (in some dialects, present-under-present/future can also co-occur with the Subjunctive).

- (33) Dan hiška/yaške et ha-cemax lifney še (hu) yibol
 Dan water-PAST/FUT ACC the-plant before that it die-FUT
- (34) $\exists_1 \llbracket [\lambda_2 [Dan\ water-past/fut^{HEB}_{0,2}\ the\ plant]] [before^{B\&C}_{C-t_1} [SUBJ\ \lambda_0 [it\ die-fut^{HEB}_{0,3(0)}]]] \rrbracket$

Selected references: Anscombe, G. E. M. 1964. “Before and after.” *The Philosophical Review* 74:3-24. Arregui, Ana and Kiyomi Kusumoto. 1998. “Tense in temporal adjunct clauses.” In *Proceedings of SALT VIII*, pp. 1-18. Cornell University. Beaver, David and Cleo Condoravdi. 2003. “Before and after: A fragment.” Available at <montague.stanford.edu/~dib/Publications/salt13ho.pdf>. Ogihara, Toshiyuki. 1996. *Tense, Attitudes, and Scope*. Dordrecht and New York: Kluwer Academic Publishers. Ogihara, Toshiyuki and Yael Sharvit (to appear). “Embedded tenses.” In R. Binnick, ed., *OUP Handbook on Tense and Aspect*. von Stechow, Arnim. 2009. von Stechow, Arnim. 2009. “Tenses in compositional semantics.” Available at <http://idiom.ucsd.edu/~ivano/SemBabble/Material/Stechow_TensesInCompositionalSemantics.pdf>.