

Temporal anaphora in English

1. English tenses as anaphors: Basic paradigm

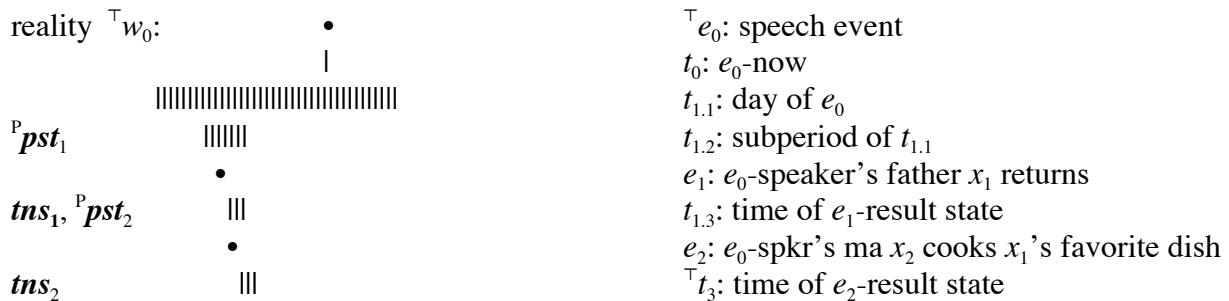
- *Start-up update*



- *Tense auxiliaries & inflections: Anaphoric presuppositions & topic time updates*

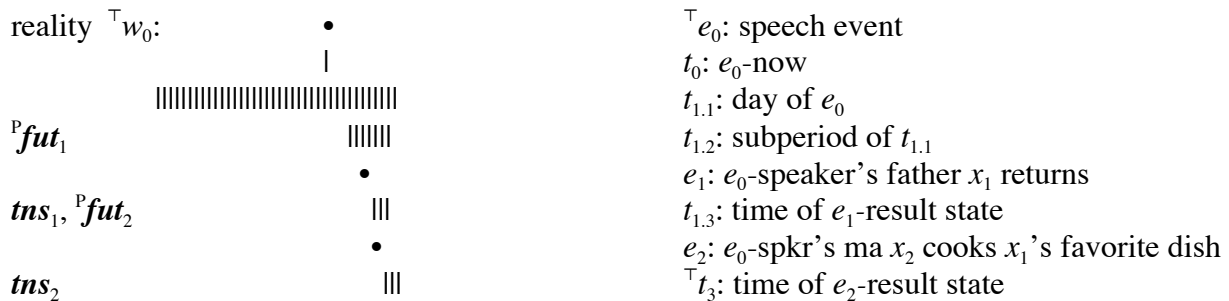
(A1) Today my father *returned* (= *pst*₁ return-*tns*₁)

(A2) My mother *cooked* (= *pst*₂ cook-*tns*₂) his favorite dish.



(B1) Today my father *will return* (= *fut*₁ return-*tns*₁)

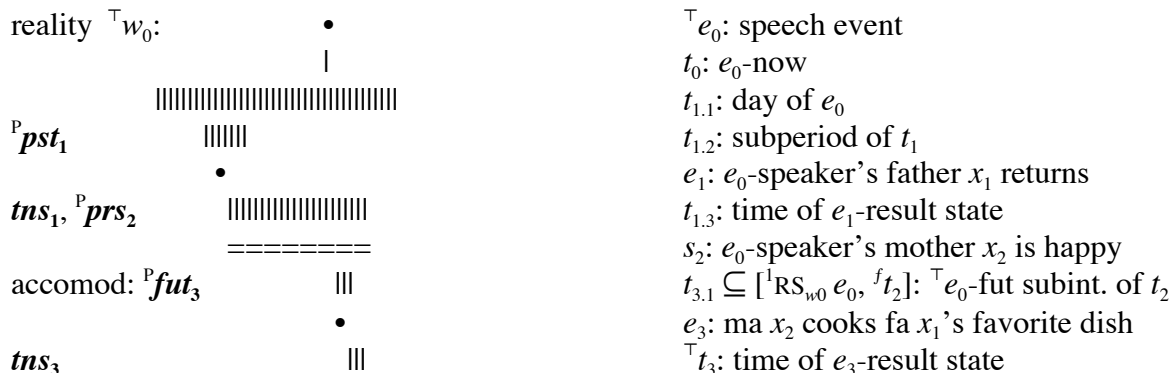
(B2) My mother *will cook* (= *fut*₂ cook-*tns*₂) his favorite dish.



(D1) Today my father *returned* (= *pst*₁ return-*tns*₁)

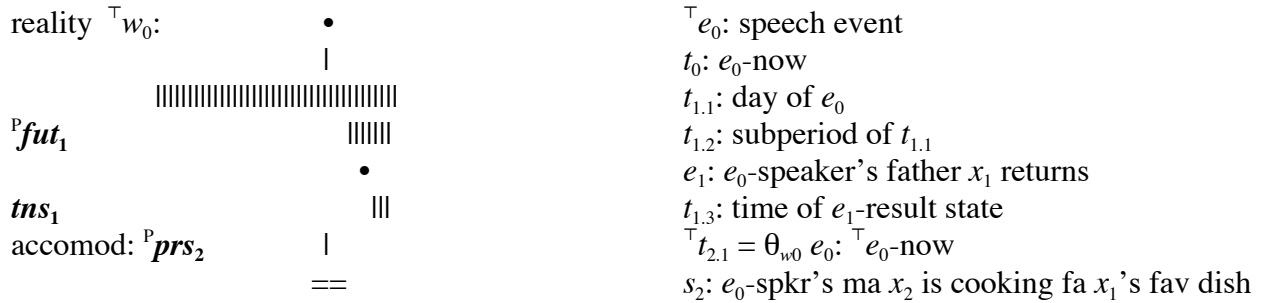
(D2) My mother *is* (= *prs*₂ be-*tns*₂) happy.

(D3) She *will cook* (= *fut*₃ cook-*tns*₃) his favorite dish.



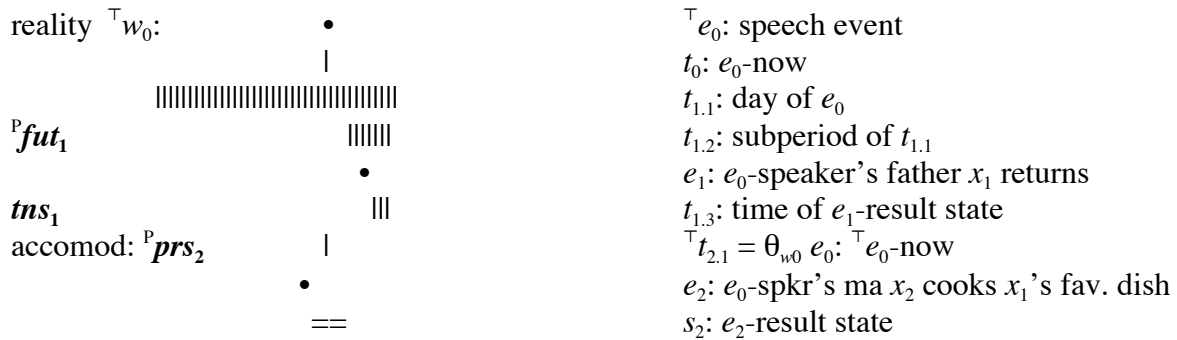
(E1) Today my father *will return* (= *fut*₁ return-*tns*₁)

(E2) My mother *is* (= *prs*₂ be-*tns*₂) cooking his favorite dish.



(F1) Today my father *will return* (= *fut*₁ return-*tns*₁)

(F2) My mother *has* (= *prs*₂ be-*tns*₂) cooked his favorite dish.



II. Ingredients for *Logic of Change* with temp. drefs (Moens & Steedman 1988, Muskens 1995)

- *Basic types*

t (truth values), ω (worlds), e (entities), τ (time periods),

ε (events), σ (states of entities), s (states of information & attention)

- *Worlds* (type ω)

w, w', w'' := $v_{0,\omega}, v_{1,\omega}, v_{2,\omega}$

W := $u_{0,\omega}$

Type **Name / Statement**

ω variables over worlds

$s\omega$ topical reality

- *Entities* (type e)

x, y, z := $v_{0,e}, v_{1,e}, v_{2,e}$

u, u' := $u_{0,e}, u_{1,e}$

e variables over entities

se topical, background entity

- *Time periods* (type τ)

t, t', t'' := $v_{0,\tau}, v_{1,\tau}, v_{2,\tau}$

T, T' := $u_{0,\tau}, u_{1,\tau}$

$t < t'$

$t \subseteq t'$:= $\forall t''(t' < t'' \rightarrow t < t'')$
 $\wedge \forall t''(t'' < t' \rightarrow t'' < t)$

τ variables over time periods

$s\tau$ topic, background time

t t is before t' (complete precedence)

t t is a subperiod of t'

- *Events* (type ε)

e, e', e'' := $v_{0,\varepsilon}, v_{1,\varepsilon}, v_{2,\varepsilon}$

E, E' := $u_{0,\varepsilon}, u_{1,\varepsilon}$

$\vartheta_w e$

$AG_w e, DA_w e$

$RS_w e$

$(e \subseteq_w t)$:= $(\vartheta_w e \subseteq t)$

$(t =_w \vartheta RS e)$:= $(t = \vartheta_w RS_w e)$

$(e: x \text{ see}_w y)$:= $\text{see } weyx$

ε variables over events

$s\varepsilon$ topical, background event

τ w -time of e

e w -agent of e , w -dative of e ('goal')

σ w -result state of e

t in w , e falls within t

t t is the w -time of the w -res. state of e

in w , e is an event in which x sees y

- *States* (type σ)

s, s', s'' := $v_{0,\sigma}, v_{1,\sigma}, v_{2,\sigma}$

S, S' := $u_{0,\sigma}, u_{1,\sigma}$

$\vartheta_w s$

$DA_w s$

$BC_w s$

$(t \subseteq_w s)$:= $(t \subseteq \vartheta_w s)$

$(t =_w \vartheta s)$:= $(t = \vartheta_w s)$

$(s: x \text{ happy}_w)$:= $\text{happy } wsx$

σ variables over states (of entities)

$s\sigma$ topical, background state

τ w -time of s

e w -dative of s (experiencer)

ε w -onset of s

t in w , s holds at t

t t is the w -time of s

in w , s is a state in which x is happy

- *Functional entities and kinds of entities* (partial functions of type ee and $\kappa := \omega(\varepsilon\nu\sigma)e$)

f, f', f'' := $v_{0,ee}, v_{1,ee}, v_{2,ee}$

F, F' := $u_{0,ee}, u_{1,ee}$

k, k', k'' := $v_{0,\kappa}, v_{1,\kappa}, v_{2,\kappa}$

K, K' := $u_{0,\kappa}, u_{1,\kappa}$

$(\text{happy } k)$:= $\forall w \in \text{Dom } k \forall s \in \text{Dom } kw$
 $(s: kws \text{ happy}_w)$

ee variables over ee -functions

$s(ee)$ topical, background ee -function

κ variables over kinds (of entities)

$s\kappa$ topical, background kind

any instance of k is the experiencer of a state of happiness

(2) My mother NOM
 $[F u \wedge u' =_w AG E, u' \in \text{Dom } F]; [! [u \wedge u \in \text{Dom } F] \Rightarrow [! Fu = ma.of u]]; [u \wedge u = Fu \wedge];$

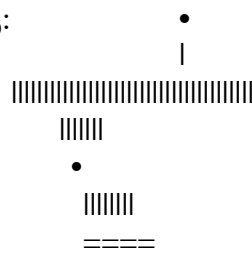
PST: ...*pst* be- -*tns* happy
 $P[! T <_w E]; [S' K \wedge u = K'WS \wedge]; [! T \subseteq_w S \wedge]; [! happy K \wedge]$

reality \top_{w_0} :

(a)

(a':*pst*)

(was)



\top_{e_0} : speech event

t_0 : e_0 -now

$t_{1.1}$: day of e_0

$t_{1.2}$: subperiod of $t_{1.1}$

e_1 : e_0 -spkr's fa x_1 returns

$\top_{t_{1.3}}$: time of e_1 -result state

s_2 : e_0 -spkr's ma x_2 is happy

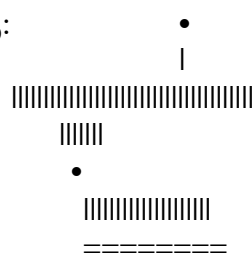
PRS: ...*prs* be- -*tns* happy
 $\bullet_1 P[! E \subseteq_w T]; [S' K \wedge u = K'WS \wedge]; [! T \subseteq_w S \wedge]; [! happy K \wedge]$

reality \top_{w_0} :

(a)

(a':*pst*)

(is)



\top_{e_0} : speech event

t_0 : e_0 -now

$t_{1.1}$: day of e_0

$t_{1.2}$: subperiod of $t_{1.1}$

e_1 : e_0 -spkr's fa x_1 returns

$\top_{t_{1.3}}$: time of e_1 -res. state

s_2 : e_0 -spkr's ma x_2 is happy

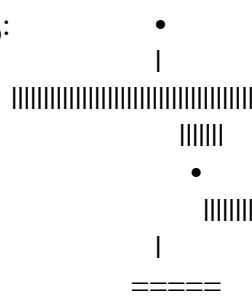
$\bullet_2 P[! T \wedge E \subseteq_w T =_w \exists E]; [S' K \wedge u = K'WS \wedge]; [! T \subseteq_w S \wedge]; [! happy K \wedge]$

reality \top_{w_0} :

(a)

(c':*fut*)

(is)



\top_{e_0} : speech event

t_0 : e_0 -now

$t_{1.1}$: day of e_0

$t_{1.2}$: subperiod of $t_{1.1}$

e_1 : e_0 -spkr's fa x_1 returns

$t_{1.3}$: time of e_1 -result state

t_0 : **accommodated** e_0 -now

s_2 : e_0 -spkr's ma x_2 is happy

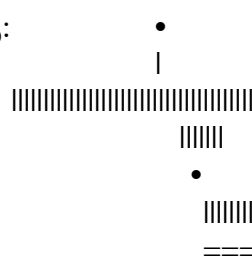
FUT: ...*will* be- -*tns* happy
 $P[! E <_w T]; [S' K \wedge u = K'WS \wedge]; [! T \subseteq_w S \wedge]; [! happy K \wedge]$

reality \top_{w_0} :

(a)

(c':*fut*)

(will be)



\top_{e_0} : speech event

t_0 : e_0 -now

$t_{1.1}$: day of e_0

$t_{1.2}$: subperiod of $t_{1.1}$

e_1 : e_0 -spkr's fa x_1 returns

$\top_{t_{1.3}}$: time of e_1 -result state

s_2 : e_0 -spkr's ma x_2 is happy

IV. Some unsolved puzzles (Kamp & Rohrer 1983, Webber 1988)• *Event-verbs without topic time update?*

(G1) Mary sang.

(G2) John accompanied her on the piano. (tr. K&R 1983:260)

(H1) The summer of that year witnessed several changes in the life of our protagonist.

(H2) François married Adèle, Jean-Louis left for Brasil, and Paul bought a house in the countryside. (tr. K&R 1983:261)

(I1) John went to the hospital.

(I2) He took a taxi, because his car was in the shop. (Webber 1988:71)

• *Complex events*

(J1) Last year Jean climbed Mt. Cervin.

(J2) The first day he climbed up to the hut at H.

(J3) He stayed there overnight.

(J4) Next he attacked the north face.

(J5) Twelve hours later he reached the summit. (tr. K&R 1983:260)

• *'Backward movement' of topic time?*

(K1) Mary climbed Mt. McKinley.

(K2) The preparations took her longer than the ascent. (Webber 1988:70)

• *Subordinate time lines?*

(L1) The telephone rang.

(L2) It was Mrs. Dupont on the phone.

(L3) Her husband had taken two aspirins, had swallowed his potion for stomach pains, ..., had put some drops in his nose, and then had lit a cigarette.

(L4) And then there had been an enormous explosion.

(L5) The doctor thought for a moment. (tr. K&R 1983:256,

(L6) Then he advised her to call the fire brigade. simpler (L3))

(M1) John went into the florist shop.

(M2) He had promised Mary some flowers.

(M3) She said she wouldn't forgive him if he forgot.

(M4) So he picked out three red roses, two white ones, and one pale pink. (Webber 1988:69)

(N1) I was at Mary's house yesterday.

(N2) We talked about her sister Jane.

(N3) She spent five weeks in Alaska with two friends.

(N4) Together, they climbed Mt. McKinley.

(N5) Mary asked whether I would want to go to Alaska some time. (Webber 1988:70)

REFERENCES

- Bittner, M. *to appear*. 'Online Update: Quantified *de se* and Polysynthesis.' In C. Barker and P. Jacobson (eds.) *Direct Compositionality*. <http://www.rci.rutgers.edu/~mbittner/ou.html>
- Kamp, H. & C. Rohrer. 1983. 'Tense in Texts'. In R. Bäuerle (ed.) *Meaning, Use, and Interpretation of Language*, 250–269. de Gruyter, Berlin. [French examples but the points K&R make apply equally well to the English translations (tr).]
- Moens, M. and M. Steedman. 1988. 'Temporal Ontology and Temporal Reference'. *Computational Linguistics* **14**:15–28.
- Muskens, R. 1995. 'Tense and the Logic of Change'. In U. Egli et al (eds.) *Lexical Knowledge in the Organization of Language*, 147–184. John Benjamins, Amsterdam.
- Stalnaker, R. 1978. 'Assertion'. In P. Cole (ed.) *Syntax and Semantics*, vol. 9, 315–332, Academic Press, New York.
- Stone, M. 1997. 'The Anaphoric Parallel between Modality and Tense.' Technical Report IRCS 97–6. <http://www.cs.rutgers.edu/~mdstone/compsem.html>
- Webber, B. 1988. 'Tense as Discourse Anaphor'. *Computational Linguistics* **14**:61–73.