

Tense as temporal centering

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Abstract

According to an influential theory, English tenses are anaphoric to an aforementioned reference point. This point is sometimes construed as a time (e.g. Reichenbach 1947, Partee 1973, Stone 1997) and sometimes as an event (e.g. Kamp 1979, 1981, Webber 1988). Moreover, some researchers draw semantic parallels between tenses and pronouns (e.g. Partee 1973, 1984, Stone 1997), whereas others draw parallels between tenses and anaphorically anchored (in)definite descriptions (e.g. Webber 1988, Moens and Steedman 1988; see also Kamp and Reyle 1993).

A competing approach views tenses as purely indefinite temporal descriptions, indexically anchored to the speech time but not anaphoric to prior discourse. On this view, tenses introduce new times into discourse. Any relation to aforementioned times or events is a by-product of independent pragmatic processes that establish discourse coherence, because coherence relations may imply temporal relations. For example, causal relations (such as *Result* or *Explanation*) imply that the cause event precedes the effect. Parallel relations (such as *Elaboration* or *Contrast*) typically imply temporal overlap or proximity, with no particular temporal order (e.g. Lascarides and Asher 1993, Kehler 2002).

In this talk, I draw a new parallel, between grammatical tense systems and grammatical centering systems for nominal discourse reference. I propose that in languages with grammatical tense systems, verbs have temporal arguments for reference times, in addition to nominal arguments for subjects and objects. Grammatical TENSE markers saturate the reference time argument with a *top-level temporal anaphor*. This refers to an aforementioned *time*, or the time of an *event*, that is currently top-ranked in the center of attention or top-ranked in the background. In pronominal argument languages (e.g. Mandarin Chinese, Kalaallisut, Polish), grammatical PERSON markers or features saturate the subject and/or object argument with a *top-level nominal anaphor*—i.e. a discourse anaphor that refers to an *individual* (e.g. 3SG, 3PL), or participant in an *event* (e.g. 1SG, 2SG), that is currently top-ranked center-stage or top-ranked in the background.

Outline

1. Grammatical centering systems
2. Mandarin in *Simple Update with Centering* (UC₀)
3. Polish in UC₀ with(out) temporal centering
4. English in UC₀ with temporal centering (UC_τ)
5. Centering as semantic universal

1 GRAMMATICAL CENTERING SYSTEMS

• TENTATIVE UNIVERSALS

Obs. 1 *Centering systems* disambiguate anaphora by grammatically tracking the current center & background of attention. (cf. focal vs. peripheral vision).

Obs. 2 Anaphors refer to the *top-ranked discourse referent* on the relevant tier—e.g. *top-ranked center-stage* (T-dref) or *top-ranked in the background* (⊥-dref).

Obs. 3 Nominal centering distinguishes *subcategorized arguments*—i.e. subjects, objects, and possessors. (Optional adjuncts are not eligible for top rank on any tier)

• MANDARIN CHINESE: main unit of discourse is a *topic chain*—i.e. chain of clauses sharing the same topic (T-dref)—not a sentence (Tsao 1979, Chu 1998, Li 2005).

- (1) [[_i topic-update (np^T), comment₁ (τ-n)]
[[_{ii} comment₂ (τ-v), comment₃ (τ-v)]]_{T-chain}
- i. Xiǎoli niánqīng piàoliang, gōnzuò yě hǎo.
Xiaoli^T young pretty, τ-job also good
Xiaoli^T is young and pretty. She_τ has a good job, too.
- ii. Suīrán yǒu ge nán péngyou, kěshì bù xiǎng jié hūn.
although τ-have CL boyfriend, but τ-NOT wish get.married
She_τ has a boyfriend, but τ-doesn't wish to get married. [Li:185]
- (2) [[_s topic-update (np^T), comment₁ (τ-n), comment₂ (τ-n), comment₃ (np⁺ v_τ)]
[[_{sii} comment₄ (⊥ v_τ), comment₅ (⊥ v_τ), comment₆ (⊥ v_τ), comment₇ (⊥ v_τ)]]_{T-chain}
- i. Nà-liàng chē, jiàqián tài guì, yánsè yě bù hǎo, Lisi bù xǐhuan.
that-CL car^T, τ-price too high, τ-color also NOT good, Lisi⁺ NOT like_τ
That car^T is too expensive and it_τ's an ugly color. Lisi⁺ doesn't like it_τ.
- ii. Zuótiān qù kàn-le, hái kāi-le yíhuìr, háishì bù xǐhuan,
yesterday ⊥go look_τ-PNC, even ⊥drive_τ-PNC M_{a,while}, still NOT ⊥like_τ,
méi mǎi.
NOT ⊥buy_τ
Yesterday he_⊥ went to take a look at it_τ. He_⊥ even took it_τ out for a spin,
but he_⊥ still didn't like it_τ. He_⊥ didn't buy it_τ. [Li:2]+[fw]

• KALAALLISUT: arguments expressed as *pronominal affixes* (pn); two forms of 3rd person pn-arguments: *proximate* for \top v. *obviative* for \perp (e.g. *-ni* '3S \top ' v. *-a* '3S \perp '); full np's interpreted as re-centering updates, setting local context for pn-arguments.

Context for (3)-(3'): Yesterday the children \top had a dog-sled race.

- (3) *Ole-p ikinnnguta-a ajugaa-ga-mi nuannaar-pu-q.*
 Ole-ERG \perp [friend-3S \perp] \top win-FCT \top -3S \top happy-DEC \top -3S
 Ole \perp 's friend \top won, so she \top (= friend) was happy.
- (3') *Ole-p ikinnngun-ni ajugaa-mm-at nuannaar-pu-q.*
 Ole-ERG \top [friend-3S \top] \perp win-FCT \perp -3S \perp happy-DEC \top -3S
 Ole \top 's friend \perp won, so she \top (= Ole) was happy.
- (4)i. *llaanni anguti-tuqa-p nulia-ni kisimi-i-qatig(i-p)a-a*
 once man-old-ERG \top [wife-3S \top] \perp alone-be-with-DEC \top \perp -3S.3S
 Once an old man \top was alone with his \top wife \perp ,
irnir-tik piniar-riar-sima-mm-at.
 [son-3P \perp] \perp hunt-go-prf-FCT \perp -3S \perp
 because their \top \perp son \perp was away on a hunting trip.
- ii. *Aavi-rsuaq isissaa-lir-mm-at*
 walrus-big \perp visible-begin-FCT \perp -3S \perp
 When a big walrus \perp showed up,
piniar-niar-llu-qu qain-ni atir-vigi-lir-pa-a.
 hunt-intend-ELA \top -3S \perp kayak-3S \top go.down-to-begin-DEC \top \perp -3S.3S
 (ELA \top : elaboration of \top)
 he \top headed down to his \top kayak to go after it \perp (*lit.* \top intending to ...).
- iii. *Nuli-ata inirtir-aluar-pa-a*
 [wife-3S \perp .ERG] \top forbid-in.vain-DEC \top \perp -3S.3S
 His \perp wife \top tried to stop him \perp ,
kisimi-i-mm-at avala-qqu-na-gu.
 alone-be-FCT \perp -3S \perp set.out-tell-not.ELA \top -3S \perp
 begging \top him \perp not to set out because he \perp was alone.
- iv. *Uj-ata=li tusar-uma-na-gu*
 [husband-3S \perp .ERG] \top listen-want-not-not.ELA \top -3S \perp
 But he \top (*lit.* her \perp husband \top) refused to listen to her \perp and
aavi-rsuaq nalip-pa-a.
 walrus-big \perp harpoon-DEC \top \perp -3S.3S
 \top harpooned the great walrus \perp .
- v. *Nali-mm-a-ni upa-annar-pa-a qaja-a tulur-lu-gu.*
 harpoon-FCT \perp -3S \perp .3S \top turn.on-just-DEC \top \perp -3S.3S kayak-3S \perp gore-ELA \top -3S \perp
 As soon as he \perp hit it \top , it \top turned on him \perp , \top goring his \perp kayak \perp with its tusks

2 MANDARIN IN SIMPLE UPDATE WITH CENTERING (UC $_0$)

• SIMPLE UPDATE WITH CENTERING (UC $_0$)

- **Update semantics** (Veltman 1996):

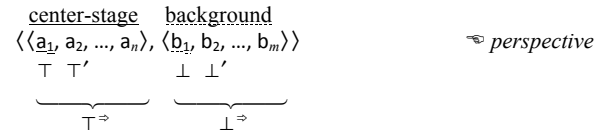
“You know the meaning of a sentence if you know the change it brings about in the information state of anyone who accepts the news conveyed by it.”

- **Centering-based anaphora** (Bittner 2011; cf. Dekker '94, Groenendijk *et al* '95)

(a) update keeps track of current *perspective* = center-stage + background

(b) *persp. concepts* for top four drefs: \top (ctr), \top' (2ry ctr), \perp (bck), \perp' (2ry bck)

(c) otherwise *descriptive* anaphora via $\top \Rightarrow$ (ctr-stage set) & $\perp \Rightarrow$ (background set)



• MANDARIN CHINESE: From discourse (2) to UC $_0$

- (5)i. That car \top is too expensive and it \top 's an ugly color. Lisi \perp doesn't like it \top .
 (input) that-CL car \top , \top price too high
 \top [x] *car*(x), $x \in \perp \Rightarrow$; [x] *price*(x, \top), *too.high*(x);
 $\langle \langle \perp \rangle, \langle \dots, \Rightarrow \rangle \rangle$ $\langle \langle \perp \rangle, \langle \dots, \Rightarrow \rangle \rangle$ $\langle \langle \perp \rangle, \langle \perp, \dots, \Rightarrow \rangle \rangle$
 \top color also NOT good, Lisi \perp NOT like \top
 \top [x] *color*(x, \top), \neg *good*(x); [x] $x = \text{lisi}$, \neg *like*(x, \top);
 $\langle \langle \perp \rangle, \langle \bullet, \$, \dots, \Rightarrow \rangle \rangle$ $\langle \langle \perp \rangle, \langle \bullet, \$, \dots, \Rightarrow \rangle \rangle$
- ii. (Yesterday) he \perp went to take a look at it \top . He \perp even took it out for a spin, ...
 \perp go look \top -PNC, even \perp drive \top -PNC $M_{a.\text{while}}$, ...
 \perp [go.look.at(\perp , \top)] ; \perp [drive.a.while(\perp , \top)] ; ...
 $\langle \langle \perp \rangle, \langle \bullet, \$, \dots, \Rightarrow \rangle \rangle$ $\langle \langle \perp \rangle, \langle \bullet, \$, \dots, \Rightarrow \rangle \rangle$
- (6)i. *Jiajia bing le, zuotian wanshang jiu fa.shao.* [Li:89]
 Jiajia \top sick SFP, yesterday night then \top run.a.fever
 Jiajia \top is sick. She \top ran a fever last night.
- ii. *Lisi zhidao ta-de mama hen mang, mei gan gaosu ta,*
 Lisi \top know 3S \top 's mom \perp very busy, NOT \top dare tell 3S \perp ,
dai ta qu kan-le jizhen, da-le zhen.
 \top take 3S \top , go see-PNC ER \perp , \perp do-PNC injection
 Lisi \top knew her \top , mom \perp was busy, so he \top didn't want to tell her \perp . He \top just
 took her \top , to the ER \perp (*lit.* to see ER \perp) and they \perp gave her \top , an injection.

3 POLISH IN UC₀ WITH(OUT) TEMPORAL CENTERING

• POLISH SUBJECT INFLECTIONS AS NOMINAL CENTERING

- (7) i. Basia^T is young and pretty.
Basia jest młoda i ładna.
 Basia\SF^T be\I.PRS.3SG_T young\SF and pretty\SF
 (start-up) ^T[x| x = basia]; [young⟨T⟩, pretty⟨T⟩]
 ⟨⟨⟩, ⟨⟩⟩ ⟨⟨↑⟩, ⟨⟩⟩
- ii. She_T has a boyfriend⁺ but ...
Ma chłopca ale ...
 have\I.PRS.3SG_T boyfriend.ACC⁺ but ...
 [x| have.as.boyfriend⟨T, x⟩]
 ⟨⟨↑⟩, ⟨⊙⟩⟩
- iii. ... she_T doesn't want to start a family yet.
jeszcze nie=chce zakładać rodziny
 yet not=want\I.PRS.3SG_T form\I-INF family.GEN
 [¬want.start.family⟨T⟩]
 ⟨⟨↑⟩, ⟨⊙⟩⟩
- iii'. ... he_T doesn't want to start a family yet.
on jeszcze nie=chce zakładać rodziny
 he_T yet not=want\I.PRS.3SG_T form\I-INF family.GEN
^T[x| x = ⊥]; [¬want.start.family⟨T⟩]
 ⟨⟨⊙, ↑⟩, ⟨⊙⟩⟩

• UC₀ WITH TEMPORAL CENTERING (UC_T, see Bittner 2011)

- *Discourse referent types*

type *a*: δ (individuals), τ (times), ε (events), σ (states)
 var. *u_a*: x t e s

- *Perspectives & type-relative anaphors*

center-stage background
 e.g. ⟨⟨x₁, t₁, e₀⟩, ⟨s₂, s₁, e₁⟩⟩ perspective
 Tδ Tτ Tε ⊥σ ⊥'σ ⊥ε type-relative anaphors

- *Operations on eventualities* (see also Sec. 4, Fig. 3)

time-of ∂(·), central-individual-of ↑(·), ...

- e₀-*Start-up info-state* (due to speech act e₀)

ste₀ := {⟨e₀⟩, ⟨⟩} cf. 'commonplace effect', Stalnaker 1978

• POLISH TENSE INFLECTIONS AS TEMPORAL CENTERING

- (ste₀) (e₀-start-up)
 ⟨⟨e₀⟩, ⟨⟩⟩
- (8) I am hungry.
Jestem głodny.
 be\I.PRS.1SG hungry\SM
 [s| ∂Tε ⊆ ∂s, ↑s = ↑Tε]; [hungry⟨⊥σ, ↑⊥σ⟩]
 ⟨⟨e₀⟩, ⟨s₁⟩⟩

Model for (8)

	→ real time		
<u>Discourse ref.</u>	<u>Symbol: Description</u>	<u>Temporal condition</u>	<u>Source</u>
•	^T e ₀ : ↑e ₀ speaks up		e ₀
—	s ₁ : ↑e ₀ (= ↑s ₁) is hungry	∂e ₀ ⊆ ∂s ₁	↑ _T .PRS _T

- (9) i. There was once an old king.
Był ...
 be\I-PST.3SM
^T[x t| t < ∂Tε, x ≠ ↑Tε]; [s e| ∂e ⊆ Tτ ⊆ ∂s, ↑s = Tδ];
 ⟨⟨ϕ, t₁, e₀⟩, ⟨⟩⟩ ⟨⟨ϕ, t₁, e₀⟩, ⟨s₁, e₁⟩⟩
- sobie kiedyś stary król.*
 self.DAT once old king\SM
 [alive⟨Tδ, Tτ⟩]; [Tτ <_{long} ∂Tε]; [old.king⟨Tδ, Tτ⟩]

ii. He was very rich.

Był bardzo bogaty.
 be\I-PST.3SM very rich\SM
 [Tτ < ∂Tε, Tδ ≠ ↑Tε]; [s| ∂⊥ε ⊆ Tτ ⊆ ∂s, ↑s = Tδ]; [v.rich⟨⊥σ, ↑⊥σ⟩]
 ⟨⟨ϕ, t₁, e₀⟩, ⟨s₂, s₁, e₁⟩⟩

Model for (9)

	→ real time		
<u>Discourse ref.</u>	<u>Symbol: Description</u>	<u>Temporal condition</u>	<u>Source</u>
•	^T e ₀ : ↑e ₀ speaks up		e ₀
■ ■ ■	^T t ₁ : long before ∂e ₀	t ₁ < _{long} ∂e ₀	PST _T ^T ...adv
•	e ₁ : viewpoint		↑ _T
—	s ₁ : ϕ is an old king	∂e ₁ ⊆ t ₁ ⊆ ∂s ₁	↑ _T
—	s ₂ : ϕ is very rich	∂e ₁ ⊆ t ₁ ⊆ ∂s ₂	↑ _T

4 ENGLISH IN UC₀ WITH TEMPORAL CENTERING (UC_τ)

Figure 1. Moens & Steedman 1988 *aspectual algebra*: $\langle \mathcal{D}_e \cup \mathcal{D}_s, \triangleright, \triangleleft, \dots \rangle$

INPUT	OPERATION	OUTPUT	GRAPHIC
point e			•
point e	$\triangleright_e = s$	consequent state s	_____
point e	$\triangleleft_e = e'$	preparatory process e'	•••••
(10) i.	Al went (PST_{τ}^{τ} go ^e) into a florist shop.		$\vartheta e_1 \subseteq \tau t_1, \tau t_1 < \vartheta^{\tau} e_0$
ii.	He bought ($PST_{\tau \perp}^{\perp}$ buy ^e) some roses.		$\vartheta e_2 \subseteq \tau t_2 \subseteq \vartheta^{\triangleright} e_1, \tau t_2 < \vartheta^{\tau} e_0$
ii'.	He didn't buy ($PST_{\tau \perp}^{\perp}$ buy ^e) anything.		$\neg \exists t_2, e_2: \vartheta e_2 \subseteq t_2 \subseteq \vartheta^{\triangleright} e_1 \ \& \dots$
(11) i.	Al went (PST_{τ}^{τ} go ^e) into a florist shop.		$\vartheta e_1 \subseteq \tau t_1, \tau t_1 < \vartheta^{\tau} e_0$
ii.	He promised ($PST_{\tau \perp}^{\perp}$ promise ^e) his wife to buy some flowers.		$\vartheta e_2 \subseteq t_2 \subseteq \vartheta^{\triangleleft} e_1, t_2 < \vartheta^{\tau} e_0$
iii.	He picked out ($PST_{\tau \perp \tau}$ pick.out ^e) sm roses.		$\vartheta e_3 \subseteq \tau t_1 \subseteq \vartheta^{\triangleright} e_2, \tau t_1 < \vartheta^{\tau} e_0$

Figure 2. Bach 1986 *event algebra*: $\langle \mathcal{D}_e \cup \mathcal{D}_s, \sqsupseteq, \nabla, \blacktriangle, \dots \rangle$

INPUT	OPERATION	OUTPUT	GRAPHIC
process e'	$\nabla e' = s'$	state-equivalent s'	_____
process e'	$\blacktriangle e' = e''$	point-equivalent e''	•••••
(12) a.	Al is ^s {working _⊥ ^e leaving _⊥ ^e }		$\{s \sqsupseteq_{\sigma} \nabla e \mid s \sqsupseteq_{\sigma} \nabla \blacktriangle e\}$
b.	Al put some ^y {nuts ^x oil ^y } in the salad.		$\{y \sqsupseteq_{\delta} \nabla x \mid y \sqsupseteq_{\delta} \nabla y'\}$
(13) a.	Al did a bit ^{e'} of {work- \emptyset _⊥ ^e *leaving _⊥ ^e }.		$e' = \blacktriangle e$
b.	Al ate a portion ^{x'} of {nuts ^x *a nut ^x }.		$x' = \blacktriangle x$

Figure 3. UC_τ *aspectual algebra*: $\langle \mathcal{D}_e \cup \mathcal{D}_s, \sqsupseteq, \triangleright, \triangleleft, \nabla, \blacktriangle, \blacktriangleright, \blacktriangleleft, \dots \rangle$

INPUT	OPERATION	OUTPUT	GRAPHIC
point e			•
point e	$\triangleright_e = s$	consequent state s	_____
point e	$\triangleleft_e = e'$	preparatory process e'	•••••
process e'	$\nabla e' = s'$	state-equivalent s'	_____
process e'	$\blacktriangle e' = e''$	point-equivalent e''	•••••
state s'	$\blacktriangleright s' = e'''$	start-point e'''	•
state s'	$\blacktriangleleft s' = e$	culmination-point e	•
(14) i.	Al played chess (PST_{τ}^{τ} play.chess ^e) today.		$\vartheta e_1 \subseteq \tau t_1, \dots$
ii.	He started ($PST_{\tau \perp}^{\perp}$ start _⊥ ^e) poorly but in ^τ the end _⊥ , he won ($PST_{\tau \tau}$ win _⊥ ^e).		$\vartheta e_2 \subseteq \tau t_2 \subseteq \vartheta^{\nabla} e_1, \dots, e_2 = \blacktriangle \nabla e_1$ $\vartheta e'_2 \subseteq \tau t'_2 \subseteq \vartheta^{\blacktriangleleft} e_1, \dots, e'_2 = \blacktriangle \nabla e_1$

• TOWARD UC_τ WITH MODAL CENTERING (UC)

- (15) i. Al **went** (PST_{τ}^{τ} go^e) into a florist shop.
- ii. He **promised** ($PST_{\tau \perp}^{\perp}$ promise^e) his wife to **buy** (INF_{\perp} buy^e) some flowers.
- iii. He **picked out** ($PST_{\tau \perp \tau}$ pick.out^e) some roses.

Model for (15)

Discourse ref.	Symbol: Description	Temporal condition	Source
$\tau w_0 \in \tau p''_0 \subseteq p_0$ (e_0 -speech modality)			e_0
•	τe_0 : $\uparrow e_0$ speaks up		e_0
■ ■	τt_1 : e_0 -past	$t_1 < \vartheta e_0$	PST_{τ}^{τ}
•	e_1 : Al \odot enters florist shop	$\vartheta e_1 \subseteq t_1$	v^e
■	t_2 : e_0 -past with e_1 -anchor	$t_2 < \vartheta e_0, t_2 \subseteq \vartheta^{\triangleleft} e_1$	$PST_{\tau \perp}^{\perp}$
_____	s_2 : state initiated by e'_2 -promise	$\vartheta^{\blacktriangle} s_2 \subseteq t_2$	promise ^e
•	e'_2 : \odot promises $\blacktriangle s_2$ to wife	$e'_2 = \blacktriangle s_2$	promise ^e
■ ■	τt_1 : e_0 -past with e'_2 anchor	$t_1 < \vartheta e_0, t_1 \subseteq \vartheta^{\triangleright} e'_2$	$PST_{\tau \perp \tau}$
•	e_3 : \odot picks out roses	$\vartheta e_3 \subseteq t_1$	v^e
$w_2 \in \text{Dom } \blacktriangle s_2$ ($\blacktriangle s_2$ -promise kept)			INF_{\perp}
•	e_2 : \odot buys flowers	$e_2 = (\blacktriangle s_2)w_2$	INF_{\perp}

5 CENTERING AS SEMANTIC UNIVERSAL

Figure 4. Centering TAMP-universals [Bittner 2011]

- (T) *Grammatical tense* (TNS) fills, or pushes down, the verb's *ref. time* argument with a dref anchored to a top-ranked time and/or event ($\tau \tau, \perp \tau, \tau \varepsilon, \perp \varepsilon$).
- (A) *Grammatical aspect* (ASP) fills, or pushes down, the verb's *eventuality* arg. with a dref anchored to a top-ranked state and/or event ($\tau \sigma, \perp \sigma, \tau \varepsilon, \perp \varepsilon$).
- (M) *Grammatical mood* (MOOD) fills, or pushes down, the verb's *world* argument with a dref anchored to a top-ranked world and/or event. ($\tau \omega, \perp \omega, \tau \varepsilon, \perp \varepsilon$).
- (P) *Grammatical person* (PRN) fills the verb's *subject or object* argument with a dref anchored to a top-ranked individual and/or event ($\tau \delta, \perp \delta, \tau \varepsilon, \perp \varepsilon$).

Based on a language sample consisting of English (*T*-prominent), Polish (*TAP*-prominent), Mandarin Chinese (*AP*-prominent), and Kalaallisut (*MP*-prominent), I conjecture that every language has at least one prominent *TAMP*-feature, most languages have more than one, and no *TAMP* feature is universally prominent.

REFERENCES

- Bach, E. 1986. The algebra of events. *Linguistics and Philosophy* 9:5–16.
- Bittner, M. 2011. *Temporality: Universals and Variation*. Book in progress.
Ch. 1–7 (*Universals*) available at <http://www.rci.rutgers.edu/mbittner>
- Chu, C. 1998. *A Discourse Grammar of Mandarin Chinese*. P. Lang: New York
- Dekker, P. 1994. Predicate Logic with Anaphora. *SALT IV*.
- Groenendijk, J. et al 1995. Coreference and contextually restricted quantification. *SALT XV*.
- Kamp, H. 1979. Events, instants, and temporal reference. In: *Semantics from Different Points of View* (Bäuerle, R. et al., eds.). Springer: Berlin.
- Kamp, H. 1981. Evènements, représentations discursive et référence temporelle. *Langages* 64:39–64.
- Kamp, H. and U. Reyle. 1993. *From Discourse to Logic*. Kluwer: Dordrecht.
- Kehler, A. 2002. *Coherence, Reference, and the Theory of Grammar*. CSLI.
- Lascarides, A. and N. Asher. 1993. Temporal interpretation, discourse relations, and common sense entailment. *Linguistics and Philosophy* 16:437–93.
- Li, W. 2005. *Topic Chains in Chinese*. Lincom: München.
- [M&S] Moens, M. and M. Steedman. 1988. Temporal ontology and temporal reference. *Computational Linguistics* 14:15–28.
- Partee, B. 1973. Some structural analogies between tenses and pronouns in English. *Journal of Philosophy* 70:601–9.
- Partee, B. 1984. Nominal and temporal anaphora. *Linguistics and Philosophy* 7:243–86.
- Reichenbach, H. 1947. *Elements of Symbolic Logic*. New York: Macmillan.
- Stone, M. 1997. The anaphoric parallel between tenses and modals. *IRCS Report* 97–6.
- Tsao, F. 1979. *A Functional Study of Topic in Chinese*. Student Book: Taiwan
- Veltman, F. 1996. Defaults in update semantics. *Journal of Philosophical Logic* 25:221–61.
- Webber, B. 1988. Tense as discourse anaphor. *Computational Linguistics* 14:61–73.