ENGLISH-BASED THEORY:
Kalaallisut as English minus tense (Shaer 2003)

1 TEMPORAL ANAPHORA IN ENGLISH

S speaking to H in w_0 at t_0 (about Ann and John): $\mathbf{s}_0 = \{\langle e, \langle \ldots, \mathrm{J, A, H, S}\rangle\rangle$, *entity*-drefs
$\langle \omega, \langle \ldots, w_0\rangle\rangle$, *world*-drefs
$\langle \tau, \langle \ldots, t_0\rangle\rangle$, *time*-drefs
$\langle \varepsilon, \langle e_0, \ldots\rangle\rangle\}$ *evt*-drefs

(1) [1] *Ann has gone out.* [2] *John is asleep.*
Ann$_{97}^{\top}$ have-PRS go.out-PRF John$_{96}^{\top}$ be-PRS asleep

[1] Ann$_{97}^{\top}$ ~ Msk 96:151–3 + ctr
$[\mid u_{97} = ann, u_{97} \neq u_0]; [u_0 \mid u_0 = u_{97}]$
$\mathbf{s}_{11} = \{\langle e, \langle \mathrm{A}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$
$\langle \omega, \langle \ldots, w_0\rangle\rangle$,
$\langle \tau, \langle \ldots, t_0\rangle\rangle$,
$\langle \varepsilon, \langle e_0, \ldots\rangle\rangle\}$

have-PRS ~ Msk 95:169, 173 + ctr
$[\mid (\vartheta E_0 = T), (E_0\ in\ W)];$
$[E_2 \mid E_2 = E_0]; [E_0 \mid E_0 < E_2];$
$\mathbf{s}_{12} = \{\langle e, \langle \mathrm{A}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$,
$\langle \omega, \langle \ldots, w_0\rangle\rangle$,
$\langle \tau, \langle \ldots, t_0\rangle\rangle$,
$\langle \varepsilon, \langle e_1, ?, e_0, \ldots\rangle\rangle\}$

go.out-PRF ~ Msk 95:172–3 + ctr
$[\mid E_0{:}\ go.out_{\varepsilon et}\ u_0]; [E_1 \mid E_1 = E_0]; [E_0 \mid E_1 \bullet\!< E_0];$
$[E_0 \mid E_0 = E_2]$
$\mathbf{s}_{13} = \{\langle e, \langle \mathrm{A}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$,
$\langle \omega, \langle \ldots, w_0\rangle\rangle$,
$\langle \tau, \langle \ldots, t_0\rangle\rangle$,
$\langle \varepsilon, \langle e_0, e_1, e_0, \ldots\rangle\rangle\}$

[2] John$_{96}^{\top}$ ~ Msk 96:151–3 + ctr
$[\mid u_{96} = john, u_{96} \neq u_0]; [u_0 \mid u_0 = u_{96}]$
$\mathbf{s}_{21} = \{\langle e, \langle \mathrm{J}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$
$\langle \omega, \langle \ldots, w_0\rangle\rangle$,
$\langle \tau, \langle \ldots, t_0\rangle\rangle$,
$\langle \varepsilon, \langle e_0, e_1, e_0, \ldots\rangle\rangle\}$

be-PRS ~ Msk 95:172–3 + ctr
$[\mid (\vartheta E_0 = T), (E_0\ in\ W)];$
$[E_1 \mid E_0 \subseteq E_1];$
$\mathbf{s}_{22} = \{\langle e, \langle \mathrm{J}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$,
$\langle \omega, \langle \ldots, w_0\rangle\rangle$,
$\langle \tau, \langle \ldots, t_0\rangle\rangle$,
$\langle \varepsilon, \langle e_0, e_3, e_0, \ldots\rangle\rangle\}$

asleep
$[\mid E_1{:}\ asleep_{\varepsilon et}\ u_0];$

speech world w_0 | ***t_0: speech time***
e_0: $\vartheta e_0 = t_0$
${}^{w0?}(e_1$: $\vartheta e_1 < \vartheta e_0 = t_0$, Ann goes out)
${}^{w0?}(e_2$: $\vartheta e_1 \bullet\!< \vartheta e_2)$
${}^{w0?}(e_3$: $t_0 = \vartheta e_0 \subseteq \vartheta e_2$, John is asleep)

(2)

[1]*When*	*I*	*came home,*	[2]*Ann*	*went out.*	[3]*John*	*was*	*asleep.*
when	1s$_{\top}$	come.home-PST	Ann$_{97}^{\top}$	go.out-PST	John$_{96}^{\top}$	be-PST	asleep

[1]*when* ~ Msk 95:178 + ctr

$[E_1 |\, E_1 = E_0];\ [E_0 |\, E_1 < E_0]$

$\mathbf{s}_{11} = \{\langle e, \langle \ldots, \mathrm{J, A, H, S}\rangle\rangle$
$\langle \omega, \langle \ldots, w_0\rangle\rangle,$
$\langle \tau, \langle \ldots, t_0\rangle\rangle,$
$\langle \varepsilon, \langle e_1, e_0, \ldots\rangle\rangle\}$

1s$_{\top}$ ~ Msk 95:166 + ctr

$[u_0 |\, u_0 = u]$

$\mathbf{s}_{12} = \{\langle e, \langle \mathrm{R}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$
$\langle \omega, \langle \ldots, w_0\rangle\rangle,$
$\langle \tau, \langle \ldots, t_0\rangle\rangle,$
$\langle \varepsilon, \langle e_1, e_0, \ldots\rangle\rangle\}$

come.home-PST ~ Msk 95:172-3 + ctr

$[|\, (\vartheta E_0 < T), (E_0\ in\ W)];$
$[|\, E_0{:}\ cmh_{\varepsilon et}\, u_0];\ [E_1 |\, E_0 = E_1];\ [E_0 |\, E_1 \bullet\!\!< E_0]$

$\mathbf{s}_{13} = \{\langle e, \langle \mathrm{R}, \ldots, \mathrm{J, A, H, S}\rangle\rangle,$
$\langle \omega, \langle \ldots, w_0\rangle\rangle,$
$\langle \tau, \langle \ldots, t_0\rangle\rangle,$
$\langle \varepsilon, \langle e_2, e_1, \ldots\rangle\rangle\}$

Ann$_{97}^{\top}$ ~ Msk 96:151–3 + ctr

$[|\, u_{97} = ann, u_{97} \neq u_0];\ [u_0 |\, u_0 = u_{97}]$

$\mathbf{s}_{21} = \{\langle e, \langle \mathrm{A}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$
$\langle \omega, \langle \ldots, w_0\rangle\rangle,$
$\langle \tau, \langle \ldots, t_0\rangle\rangle,$
$\langle \varepsilon, \langle e_2, e_1, \ldots\rangle\rangle\}$

go.out-PST ~ Msk 95:172-3 + ctr

$[|\, (\vartheta E_0 < T), (E_0\ in\ W)];$
$[|\, E_0{:}\ go.out_{\varepsilon et}\, u_0];\ [E_1 |\, E_0 = E_1];\ [E_0 |\, E_1 \bullet\!\!< E_0]$

$\mathbf{s}_{22} = \{\langle e, \langle \mathrm{A}, \ldots, \mathrm{J, A, H, S}\rangle\rangle,$
$\langle \omega, \langle \ldots, w_0\rangle\rangle,$
$\langle \tau, \langle \ldots, t_0\rangle\rangle,$
$\langle \varepsilon, \langle e_3, e_2, \ldots\rangle\rangle\}$

[3]John$_{96}^{\top}$ ~ Msk 96:151–3 + ctr

$[|\, u_{96} = john, u_{96} \neq u_0];\ [u_0 |\, u_0 = u_{96}]$

$\mathbf{s}_{31} = \{\langle e, \langle \mathrm{J}, \ldots, \mathrm{J, A, H, S}\rangle\rangle$
$\langle \omega, \langle \ldots, w_0\rangle\rangle,$
$\langle \tau, \langle \ldots, t_0\rangle\rangle,$
$\langle \varepsilon, \langle e_3, e_2, \ldots\rangle\rangle\}$

be-PST ~ Msk 95:172-3 + ctr

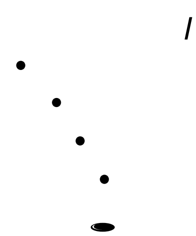
$[|\, (\vartheta E_0 < T), (E_0\ in\ W)];$
$[E_1 |\, E_0 \subseteq E_1];$

asleep

$[|\, E_1{:}\ asleep_{\varepsilon et}\, u_0]$

$\mathbf{s}_{33} = \{\langle e, \langle \mathrm{J}, \ldots, \mathrm{J, A, H, S}\rangle\rangle,$
$\langle \omega, \langle \ldots, w_0\rangle\rangle,$
$\langle \tau, \langle \ldots, t_0\rangle\rangle,$
$\langle \varepsilon, \langle e_3, e_4, \ldots\rangle\rangle\}$

speech world $\boldsymbol{w_0}$



$\boldsymbol{t_0}$***: speech time***

e_0:
e_1: $\vartheta e_0 < \vartheta e_1 < t_0$, $\mathbf{s}_0$-speaker S comes home
e_2: $\vartheta e_1 \bullet\!\!< \vartheta e_2 < t_0$, Ann goes out
e_3: $\vartheta e_2 \bullet\!\!< \vartheta e_3 < t_0$
$^{w0?}(e_4$: $\vartheta e_3 \subseteq \vartheta e_4$, John is asleep)

2 SORTED LOGIC OF CHANGE (LCh_5): MODELS INSTEAD OF AXIOMS

D1.1 (LCh_5-types)
- $t, e, \varepsilon, \omega, \tau, s \in \mathbf{Typ}$
- $(ab) \in \mathbf{Typ}$ if $a, b \in \mathbf{Typ}$

D1.2 (Basic LCh_5-terms)
- $\mathbf{Con}_e = \{john_e, mary_e, \ldots\}$
  $\mathbf{Con}_{sa} = \{u_{0,a}, \ldots, u_{99,a}\}$, for all $a \in \{e, \varepsilon, \tau, \omega\}$
  $\mathbf{Con}_{\varepsilon\tau} = \{\vartheta, \ldots\}$
  $\mathbf{Con}_{\tau\tau t} = \{<, \ldots\}$
  $\mathbf{Con}_{\omega\varepsilon t} = \{in, \ldots\}$
  $\mathbf{Con}_{\varepsilon e t} = \{ agt_{\varepsilon e t}, exp_{\varepsilon e t}, enter_{\varepsilon e t}, \ldots, man_{\varepsilon e t}, \ldots\}$
  $\mathbf{Con}_{\varepsilon e e t} = \{hit_{\varepsilon e e t}, \ldots, frn.of_{\varepsilon e e t}, \ldots\}$
  ⋮
- $\mathbf{Var}_e = \{x, y, z, x', y', z', \ldots\}$ $\quad$ $\mathbf{Var}_{(se)} = \{\underline{x}, \underline{y}, \underline{z}. \ldots\}$
  $\mathbf{Var}_\varepsilon = \{e, e', e'', \ldots\}$ $\quad$ $\mathbf{Var}_{(sa)} = \{r_a, r_a', \ldots\}$, for all $a \in \{e, \varepsilon, \omega, \tau\}$
  $\mathbf{Var}_\omega = \{w, w', w'', \ldots\}$ $\quad$ $\mathbf{Var}_{sst} = \{p, q, \ldots\}$
  $\mathbf{Var}_\tau = \{t, t', t'', \ldots\}$ $\quad$ $\mathbf{Var}_{(se)(sst)} = \{P, P', \ldots\}$
  $\mathbf{Var}_s = \{i, j, k, i', j', k', \ldots\}$ $\quad$ $\mathbf{Var}_{(se)\,(se)(sst)} = \{R, R', \ldots\}$

D1.3 (LCh_5-syntax)
- $\alpha \in \mathbf{Term}_a$ if $\alpha \in \mathbf{Con}_a$ or $\alpha \in \mathbf{Var}_a$
- $\alpha\beta \in \mathbf{Term}_a$ if $\alpha \in \mathbf{Term}_{(ba)}$ and $\beta \in \mathbf{Term}_b$
- $(\lambda v\alpha) \in \mathbf{Term}_{(ba)}$ if $v \in \mathbf{Var}_b$ and $\alpha \in \mathbf{Term}_a$
- $(\alpha = \beta) \in \mathbf{Term}_t$ if $\alpha \in \mathbf{Term}_a$ and $\beta \in \mathbf{Term}_a$
- $(\alpha \wedge \beta) \in \mathbf{Term}_t$ if $\alpha \in \mathbf{Term}_t$ and $\beta \in \mathbf{Term}_t$
- $\neg\alpha \in \mathbf{Term}_t$ if $\alpha \in \mathbf{Term}_t$

D2.1 (LCh_5-frames)
- $D_t = \{\mathrm{T}, \mathrm{F}\}$
  D_e, D_ε and D_ω are non-empty sets pairwise disjoint from each other and from D_t and D_τ
  $D_\tau = \{\mathbf{t} | \varnothing \subset \mathbf{t} \subseteq \{\ldots, -1, 0, 1, \ldots\}$
  $\quad \& \; \forall \mathbf{i}, \mathbf{i}', \mathbf{i}'' \in \{\ldots, -1, 0, 1, \ldots\}: \mathbf{i} \in \mathbf{t} \;\&\; \mathbf{i}'' \in \mathbf{t} \;\&\; \mathbf{i} < \mathbf{i}' < \mathbf{i}'' \rightarrow \mathbf{i}' \in \mathbf{t}\}$
  $D_s = \{\mathbf{s} | \mathrm{Dom}\ \mathbf{s} = \{e, \varepsilon, \tau, \omega\} \;\&\; \forall a \in \mathrm{Dom}\ \mathbf{s}: \mathbf{s}_a \in (D_a)^{100}\}$
- $D_{(ab)} = \{f | \mathrm{Dom}\ f = D_a \;\&\; \mathrm{Ran}\ f \subseteq D_b\}$

D2.2 (LCh_5-models and assignments)
- An LCh_5-*model* is a structure $M = \langle D^M, [\![\cdot]\!]^M\rangle$ such that:
  (i) $D^M = \{D_a^M: a \in \mathbf{Typ}\}$ is an LCh_5-frame.
  (ii) $[\![\cdot]\!]^M$ is a function that assigns to any $\alpha \in \mathbf{Con}_a$ a denotation $[\![\alpha]\!]^M \in D_a^M$.
  (iii) $\forall \mathbf{s} \in D_s: [\![u_{n,a}]\!]^M(\mathbf{s}) = {}^{n+1}(\mathbf{s}_a)$
  (iv) $\forall \mathbf{t}, \mathbf{t}' \in D_\tau$:
    - $\mathbf{t} <_\tau \mathbf{t}'$ iff $\forall \mathbf{i} \in \mathbf{t} \forall \mathbf{i}' \in \mathbf{t}': \mathbf{i} < \mathbf{i}'$
    - $[\![<]\!]^M(\mathbf{t}')(\mathbf{t}) = \mathrm{T}$ iff $\mathbf{t} <_\tau \mathbf{t}'$
- An *M-assignment* θ assigns to any variable $v \in \mathbf{Var}_a$ a *value* $\theta(v) \in D_a^M$. If $d \in D_a^M$, then $\theta[v/d]$ is the M-assignment s.t. (i) $\theta[v/d](v) = d$, and (ii) $\theta[v/d](v') = \theta(v')$ if $v' \neq v$.

D2.3 (LCh_5-semantics).

- $[\![\alpha]\!]^{M,\theta} \quad = \quad [\![\alpha]\!]^{M}$ if $\alpha \in \mathbf{Con}_a$
  $\quad = \quad \theta(\alpha)$ if $\alpha \in \mathbf{Var}_a$
- $[\![\alpha\beta]\!]^{M,\theta} \quad = \quad [\![\alpha]\!]^{M,\theta}([\![\beta]\!]^{M,\theta})$
- $[\![(\lambda v\alpha)]\!]^{M,\theta} \quad = \quad \langle [\![\alpha]\!]^{M,\theta[v/d]}: d \in D_b{}^M \rangle$
- $[\![(\alpha = \beta)]\!]^{M,\theta} \quad = \quad$ T, iff $[\![\alpha]\!]^{M,\theta} = [\![\beta]\!]^{M,\theta}$
- $[\![(\alpha \wedge \beta)]\!]^{M,\theta} \quad = \quad$ T, iff $[\![\alpha]\!]^{M,\theta} = [\![\beta]\!]^{M,\theta} = 1$
- $[\![\neg\alpha]\!]^{M,\theta} \quad = \quad$ T, iff $[\![\alpha]\!]^{M,\theta} = \mathrm{F}$
- $[\![\alpha]\!]^{M,\theta} \quad \in \quad D_a{}^M$ if $\alpha \in \mathbf{Term}_a$

A1 (mostly standard abbreviations). We write:

- $(\phi \rightarrow \psi)$ for $\neg(\phi \wedge \neg\psi)$
  $(\phi \vee \psi)$ for $\neg(\neg\phi \wedge \neg\psi)$
- $\forall v\phi$ for $(\lambda v[\phi] = \lambda v[v = v])$
  $\exists v\phi$ for $\neg\forall v\neg\phi$
- $\forall v_1 \ldots v_n\phi$ for $\forall v_1 \ldots \forall v_n\phi$
  $\exists v_1 \ldots v_n\phi$ for $\exists v_1 \ldots \exists v_n\phi$
  $\lambda v_1 \ldots v_n\, \alpha$ for $(\lambda v_1 \ldots (\lambda v_n\, \alpha)\ldots)$
- ${}^n\langle a_1, \ldots a_{n'}\rangle$ for a_n, for any $1 \le n \le n'$ [nth coordinate]
- $(\alpha\ \beta\ \alpha')$ for $\beta\alpha'\alpha$
  $(t < t' < t'')$ for $(t < t' \wedge t' < t'')$ Msk 95:167
  $(t \bullet\!\!< t')$ for $(t < t' \wedge \neg\exists t''(t < t'' < t'))$
  $(t \subseteq t')$ for $\forall t''((t'' < t' \rightarrow t'' < t) \wedge (t' < t'' \rightarrow t < t''))$

A2 (DRT notation). We write

- $\mathbf{DR}_a$ for $\lambda r_a(r_a = u_{0,a} \vee \ldots\ r_a = u_{99,a})$
  $i[\delta_a]j$ for $\forall r_a(\mathbf{DR}_a\, r_a \wedge r_a \neq \delta_a \rightarrow r_a j = r_a i)$
  $i[\delta_{1,a1} \ldots \delta_{n,an}]j$ for $\exists k(i[\delta_{1,a1}]k \wedge k[\delta_{2,a2} \ldots \delta_{n,an}]j)$
- u_n, u, u' for $u_{n,e}, u_{99,e}, u_{98,e}$
  T_n, T for $u_{n,\tau}, u_{99,\tau}$
  W_n, W for $u_{n,\omega}, u_{99,\omega}$
  E_n for $u_{n,\varepsilon}$
- $(\delta_{sa} = \delta'_{sa})$ for $\lambda i(\delta i = \delta' i)$ $a \in \{e, \varepsilon, \omega, \tau\}$
  $(\delta_{sa} \neq \delta'_{sa})$ for $\lambda i\, \neg(\delta i = \delta' i)$
- $(E_n\!: \alpha_{\varepsilon et}\, \delta_{se})$ for $\lambda i\, \alpha E_n i\, \delta i$ [e.g., $(E_0\!: cmh_{\varepsilon et}\, u_0)$]
  $(E_n\!: \delta_{se}\, \alpha_{\varepsilon eet}\, \delta'_{se})$ for $\lambda i\, \alpha\, E_n i\, \delta' i\, \delta i$ [e.g., $(E_0\!: u_0\, see_{eet}\, u_1)$]
  $(E_n\!: \delta_{se}\, \alpha_{\varepsilon eeet}\, \delta'_{se}\, \delta''_{se})$ for $\lambda i\, \alpha E_n i\, \delta'' i\, \delta' i\, \delta i$ [e.g. $(E_0\!: u_0\, give_{eet}\, u_1\, u_2)$
- $(\vartheta\delta_{s\varepsilon} < T)$ for $\lambda i\, (\vartheta\delta i < Ti)$
  $(\delta_{s\varepsilon} \bullet\!\!< \delta_{s\varepsilon}')$ for $\lambda i\, (\vartheta\delta i \bullet\!\!< \vartheta\delta' i \wedge \exists w(\delta i\ in\ w \wedge \delta' i\ in\ w))$
  $(\delta_{s\varepsilon} \subseteq \delta_{s\varepsilon}')$ for $\lambda i\, (\vartheta\delta i \subseteq \vartheta\delta' i \wedge \exists w(\delta i\ in\ w \wedge \delta' i\ in\ w))$
- $(J_{sst} \Rightarrow K_{sst})$ for $\lambda i\, \forall j(Jij \rightarrow \exists k\, Kjk)$
  $(\mathbf{not}\ J_{sst})$ for $\lambda i\, \neg\exists j\, Jij$
- $[\delta_1 \ldots \delta_n |\, \chi_1, \ldots \chi_m]$ for $\lambda ij(i[\delta_1 \ldots \delta_n]j \wedge \chi_1 j \wedge \ldots \wedge \chi_m j)$
  $[\,|\, \chi_1, \ldots \chi_m]$ for $\lambda ij(i = j \wedge \chi_1 j \wedge \ldots \wedge \chi_m j)$
  $(J_{sst}\, ;\, K_{sst})$ for $\lambda ij \exists k(J_{sst} ik \wedge K_{sst} kj)$

D3 (Truth and equivalence).

- A *t*-term ϕ is *true* in M under θ, written $\models_{M,\theta} \phi$, iff $[\![\phi]\!]^{M,\theta} = 1$
- A *t*-term ϕ is *true* in M, written $\models_M \phi$, iff $\forall\theta$: $\models_{M,\theta} \phi$
- An *sst*-term K is *true* in M, written $\models_M K$, iff $\models_M \exists ij\ Kij$ [Kamp 1981 def. of truth]
- α is *equivalent* to β, written $\alpha \equiv \beta$, iff $\forall M, \theta$: $[\![\alpha]\!]^{M,\theta} = [\![\beta]\!]^{M,\theta}$

3 TRANSLATION RULES FOR ENGLISH (a la Muskens 1995, 1996)

- $\mathbf{B}_{Eng}$. Base rule for *English*

					Type	*'Category'*
1	John$_n$	$\rightsquigarrow$	$[\mid u_n = john_e{}^\circ, u_n \neq u_0]$	$n > 2$	[]	n
	$_n{}^\top$	$\rightsquigarrow$	$[u_0 \mid u_n = u_0]$	$n > 2$	[]	n\N (subject)
	$_n{}^\perp$	$\rightsquigarrow$	$[\mid u_n = u_1]$	$n > 2$	[]	(object)
1′	I	$\rightsquigarrow$	$[u_0 \mid u_0 = u]$		[]	N
	me	$\rightsquigarrow$	$[\mid u \neq u_0]; [\mid u = u_1]$		[]	
	he$_n$	$\rightsquigarrow$	$[\mid male_{et}\ u_n]; [u_0 \mid u_n = u_0]$		[]	
	him$_n$	$\rightsquigarrow$	$[\mid male_{et}\ u_n, u_n \neq u_0]; [\mid u_n = u_1]$	$n > 2$	[]	
2	go#out-	$\rightsquigarrow$	$[\mid E_0\text{: } go.out_{\varepsilon et}\ u_0]; [E_1 \mid E_0 = E_1]; [E_0 \mid E_1 \bullet\!< E_0]$		[]	**event**-v
2′	be- (A)	$\rightsquigarrow$	$[E_1 \mid E_0 \subseteq E_1]$		[]	A/**state**-v
2′	be- (PRG)	$\rightsquigarrow$	$[E_2 \mid E_2 = E_0]; [E_0 \mid E_2 \subseteq E_0]$		[]	V/state-v (**asp**)
	have- (PRF)	$\rightsquigarrow$	$[E_2 \mid E_2 = E_0]; [E_0 \mid E_0 < E_2]$		[]	V/state-v (**asp**)
2″	asleep	$\rightsquigarrow$	$[\mid E_1\text{: } asleep_{\varepsilon et}\ u_0]$		[]	A
	-PRG, -PRF	$\rightsquigarrow$	$[E_0 \mid E_0 = E_2]$		[]	v\V (**asp**)
3	-PRS	$\rightsquigarrow$	$\lambda p\ ([\mid (\vartheta E_0 = T), (E_0\ in\ W)]; p)$		[][]	v\V (**tns**)
	-PST	$\rightsquigarrow$	$\lambda p\ ([\mid (\vartheta E_0 < T), (E_0\ in\ W)]; p)$		[][]	
4	when	$\rightsquigarrow$	$[E_1 \mid E_1 = E_0]; [E_0 \mid E_1 < E_0]$		[]	C

- *Application rule* (**A**)
  If A and B are sisters, $A \rightsquigarrow \alpha$, and $B \rightsquigarrow \beta$,
  then $[A, B] \rightsquigarrow \alpha\beta$, provided that this is an LCh_5-term.

- *Sequencing rule* (**;**)
  If A and B are sisters, $A \rightsquigarrow \alpha$, $B \rightsquigarrow \beta$,
  then $[A\ B] \rightsquigarrow (\alpha; \beta)$, provided that this is an LCh_5-term.

- *Property sequencing rule* (**;**^{r})
  If A and B are sisters, $A \rightsquigarrow \alpha$, $B \rightsquigarrow \beta$,
  then $[A\ B] \rightsquigarrow \lambda r(\alpha r\ ;\ \beta r)$, provided that this is an LCh_5-term.

- *Reduction rule* (**R**)
  If $A \rightsquigarrow \alpha$, and $\alpha \equiv \beta$, then $A \rightsquigarrow \beta$.

4 FROM ENGLISH TO KALAALLISUT (Shaer 2003)

Shaer 2003 ('Toward a tenseless analysis of a tenseless language', *SULA* 3) proposes to extend Muskens 1995 analysis to tenseless Kalaallisut as follows: Kalaallisut is just like English minus the temporal tests of the English tenses. The following base rule $\mathbf{B}_{Ksl}$ implements this idea:

Abbreviations: $(t = t' \cup t'')$ for $t' \subseteq t \wedge t'' \subseteq t \wedge \forall t'''(t' \subseteq t''' \wedge t'' \subseteq t''' \rightarrow t \subseteq t''')$

$(\vartheta\delta_{s\varepsilon} = \vartheta\delta_{s\varepsilon}' \cup \vartheta\delta_{s\varepsilon}'')$ for $\lambda i(\vartheta\delta i = \vartheta\delta' i \cup \vartheta\delta'' i)$

	• $\mathbf{B}_{Kal}$. Base rule for *Kalaallisut*			*Type*	*'Category'*
1	John-	$\rightsquigarrow$	$\lambda r[\mid r = john_e{}^{\circ}, r \neq u_0]$	$[se]$	cn (name)
	-sg$_n$	$\rightsquigarrow$	$\lambda P(Pu_n; [u_0 \mid u_0 = u_n])$	$[se][]$	cn\CN (subj.)
	-sg$_n{}^{\perp}$	$\rightsquigarrow$	$\lambda P(Pu_n; [u_1 \mid u_1 = u_n])$	$[se][]$	cn\CN (obj.)
2	go.out-	$\rightsquigarrow$	$[\mid E_0\!: go.out_{\varepsilon et}\, u_0]; [E_1 \mid E_0 = E_1]; [E_0 \mid E_1 \bullet\!< E_0]$	$[]$	**event**-iv
		$\rightsquigarrow$	$[u_0 \mid E_0\!: go.out_{\varepsilon et}\, u_0]; [E_1 \mid E_0 = E_1]; [E_0 \mid E_1 \bullet\!< E_0]$	$[]$	
	be.asleep-	$\rightsquigarrow$	$[E_1 \mid (E_1\!: asleep_{\varepsilon et}\, u_0), (E_0 \subseteq E_1)]$	$[]$	**state**-iv
		$\rightsquigarrow$	$[u_0\, E_1 \mid (E_1\!: asleep_{\varepsilon et}\, u_0), (E_0 \subseteq E_1)]$	$[]$	
2′	-prf	$\rightsquigarrow$	$\lambda p([E_2 \mid E_2 = E_0]; [E_0 \mid E_0 < E_2]; p; [E_0 \mid E_0 = E_2])$	$[][]$	iv\iv (**asp**)
	-begin	$\rightsquigarrow$	$([E_2 \mid (E_0 \bullet\!< E_2), (\vartheta E_1 = \vartheta E_0 \cup \vartheta E_2)];$ $[E_1 \mid E_1 = E_0]; [E_0 \mid E_1 \bullet\!< E_0])$	$[]$	
3	-IND.IV	$\rightsquigarrow$	$[\mid E_0\ in\ W]$	$[]$	iv\IV′ (**mood**)
	-FCT$_{\top}$	$\rightsquigarrow$	$[E_1 \mid E_1 = E_0]; [E_0 \mid (E_1 < E_0), (E_0\ in\ W)];$	$[]$	
	-FCT$_{\perp}$	$\rightsquigarrow$	$[E_1 \mid E_1 = E_0]; [E_0 \mid (E_1 < E_0), (E_0\ in\ W)]; [u_1 \mid u_1 = u_0]$	$[]$	
3′	-1s	$\rightsquigarrow$	$[\mid u_0 = u]$	$[]$	IV′/IV (1s agr)
	-3s$_{(\top)}$	$\rightsquigarrow$	$[\mid u_0 \neq u, u_0 \neq u']$	$[]$	(3s$_{\top}$ agr)
	-3s$_{\perp}$	$\rightsquigarrow$	$[\mid u_1 \neq u, u_1 \neq u']$	$[]$	(3s$_{\perp}$ agr)

5 Temporal Anaphora in Kalaallisut

S speaking to H in w_0 at t_0 (about Ann and John)	$\mathbf{s}_0 = \{\langle e, \langle \ldots, \mathrm{J, A, H, S}\rangle\rangle,$	*entity*-drefs
Locate initial reference point, e_0, in w_0 at t_0	$\langle \omega, \langle \ldots, w_0\rangle\rangle,$	*world*-drefs
(null assumption)	$\langle \tau, \langle \ldots, t_0\rangle\rangle,$	*time*-drefs
	$\langle \varepsilon, \langle e_0, \ldots\rangle\rangle\}$	*evt*-drefs

speech world $\boldsymbol{w_0}$	|	$\boldsymbol{t_0}$: ***speech time***
	•	e_0: $\vartheta e_0 = t_0$

Kalaallisut (1K) and (2K) are *translation equivalents* of English (1) and (2), while (3K) and (4K) illustrate some (simple or recursive) *aspectual shifts*:

(1K) [1]*Aani* *ani-vu-q.* [2]*Juuna* *sinip-pu-q.*
Ann-sg$_{97}$ go.out-IND.IV-3s John-sg$_{96}$ be.asleep-IND.IV-3s

(2K) [1]*Angirlar-a-ma* [2]*Aani* *ani-vu-q.* [3]*Juuna* *sinip-pu-q.*
come.home-FCT$_{\top}$-1s Ann-sg$_{97}$ go.out-IND.IV-3s John-sg$_{96}$ be.asleep-IND.IV-3s

(3K) [1]*Aani* *ani-sima-vu-q.* [2]*Juuna* *sini-lir-pu-q.*
Ann-sg$_{95}$ go.out-prf-IND.IV-3s Juuna-sg$_{97}$ be.asleep-IND.IV-3s

(4K) [1]*Juuna* *sini-lir-sima-lir-(m)m-at* [2]*Aani* *ani-vu-q.*
John-sg$_{95}$ be.asleep-begin-prf-begin-FCT$_{\perp}$-3s$_{\perp}$ Ann-sg$_{97}$ go.out-IND.IV-3s

Kalaallisut (1K)

- Predicted interpretation

(1K) [1]Ann.sg$_{97}$

$[\mid u_{97} = ann, u_{97} \neq u_0]; [u_0\mid u_0 = u_{97}]$

$\mathbf{s}_{11} = \{\langle e, \langle \text{A}, \ldots\text{J}, \text{A}, \text{H}, \text{S}\rangle\rangle, \langle \omega, \langle \ldots, w_0\rangle\rangle, \langle \tau, \langle \ldots, t_0\rangle\rangle, \langle \varepsilon, \langle e_0, \ldots\rangle\rangle\}$

go.out-IND.IV-3s

$[\mid E_0\text{: } go.out_{\varepsilon et}\ u_0]; [E_1\mid E_0 = E_1]; [E_0\mid E_1 \bullet\!< E_0]; [\mid E_0\ in\ W]; [\mid u_0 \neq u, u_0 \neq u']$

$\mathbf{s}_{12} = \{\langle e, \langle \text{A}, \ldots\text{J}, \text{A}, \text{H}, \text{S}\rangle\rangle, \langle \omega, \langle \ldots, w_0\rangle\rangle, \langle \tau, \langle \ldots, t_0\rangle\rangle, \langle \varepsilon, \langle e_1, e_0, \ldots\rangle\rangle\}$

[2]John.sg$_{96}$

$[\mid u_{96} = john_e, u_{96} \neq u_0]; [u_0\mid u_0 = u_{96}]$

$\mathbf{s}_{21} = \{\langle e, \langle \text{J}, \ldots\text{J}, \text{A}, \text{H}, \text{S}\rangle\rangle \langle \omega, \langle \ldots, w_0\rangle\rangle, \langle \tau, \langle \ldots, t_0\rangle\rangle, \langle \varepsilon, \langle e_1, e_0, \ldots\rangle\rangle\}$

be.asleep-IND.IV-3s

$[E_1\mid (E_1\text{: } asleep_{\varepsilon et}\ u_0), (E_0 \subseteq E_1)]; [\mid E_0\ in\ W]; [\mid u_0 \neq u, u_0 \neq u']$

$\mathbf{s}_{22} = \{\langle e, \langle \text{J}, \ldots\text{J}, \text{A}, \text{H}, \text{S}\rangle\rangle, \langle \omega, \langle \ldots, w_0\rangle\rangle, \langle \tau, \langle \ldots, t_0\rangle\rangle, \langle \varepsilon, \langle e_1, e_2, \ldots\rangle\rangle\}$

speech world w_0 | ***t_0: speech time***

• e_0: $\vartheta e_0 = t_0$, Ann goes out

• e_1: $\vartheta e_0 \bullet\!< \vartheta e_1$

$^{w0?}$(e_2: $\vartheta e_1 \subseteq \vartheta e_2$, John is asleep)

- Actual interpretation

(1K)	[1]*Aani*	*ani-vu-q.*	[2]*Juuna*	*sinip-pu-q.* $\approx$ *Eng*. (1)
	Ann-sg$_{97}$	go.out-IND.IV-3s	John-sg$_{96}$	be.asleep-IND.IV-3s

Ann has gone out. John is asleep.

Kalaallisut (2K)

- Predicted interpretation

(2K) come.home-FCT$_{\top}$-1s	
$[u_0 \vert\ E_0\text{: } cmh_{\varepsilon et}\ u_0]; [E_1 \vert\ E_0 = E_1]; [E_0 \vert\ E_1 \bullet\!< E_0];$ $[E_1 \vert\ E_1 = E_0]; [E_0 \vert\ (E_1 < E_0), (E_0\ in\ W)];$ $[\vert\ u_0 = u]$	$\mathbf{s}_{12} = \{\langle e, \langle S,\ldots J, A, H, S\rangle\rangle,$ $\langle \omega, \langle \ldots, w_0\rangle\rangle,$ $\langle \tau, \langle \ldots, t_0\rangle\rangle,$ $\langle \varepsilon, \langle e_2, e_1,\ldots\rangle\rangle\}$
[2]Ann.sg$_{97}$	
$[\vert\ u_{97} = ann, u_{97} \neq u_0]; [u_0 \vert\ u_0 = u_{97}]$	$\mathbf{s}_{21} = \{\langle e, \langle A,\ldots J, A, H, S\rangle\rangle,$ $\langle \omega, \langle \ldots, w_0\rangle\rangle,$ $\langle \tau, \langle \ldots, t_0\rangle\rangle,$ $\langle \varepsilon, \langle e_2, e_1,\ldots\rangle\rangle\}$
go.out-IND.IV-3s	
$[\vert\ E_0\text{: } go.out\ u_0]; [E_1 \vert\ E_0 = E_1]; [E_0 \vert\ E_1 \bullet\!< E_0];$ $[\vert\ E_0\ in\ W]; [\vert\ u_0 \neq u, u_0 \neq u']$	$\mathbf{s}_{22} = \{\langle e, \langle A,\ldots J, A, H, S\rangle\rangle,$ $\langle \omega, \langle \ldots, w_0\rangle\rangle,$ $\langle \tau, \langle \ldots, t_0\rangle\rangle,$ $\langle \varepsilon, \langle e_3, e_2, \ldots\rangle\rangle\}$
[3]John.sg$_{96}$	
$[\vert\ u_{96} = john_e, u_{96} \neq u_0]; [u_0 \vert\ u_0 = u_{96}]$	$\mathbf{s}_{31} = \{\langle e, \langle J,\ldots J, A, H, S\rangle\rangle$ $\langle \omega, \langle \ldots, w_0\rangle\rangle,$ $\langle \tau, \langle \ldots, t_0\rangle\rangle,$ $\langle \varepsilon, \langle e_3, e_2, \ldots\rangle\rangle\}$
be.asleep-IND.IV-3s$_{\top}$	
$[E_1 \vert\ (E_1\text{: } asleep\ u_0), (E_0 \subseteq E_1)];$ $[\vert\ E_0\ in\ W]; [\vert\ u_0 \neq u, u_0 \neq u']$	$\mathbf{s}_{32} = \{\langle e, \langle J,\ldots J, A, H, S\rangle\rangle,$ $\langle \omega, \langle \ldots, w_0\rangle\rangle,$ $\langle \tau, \langle \ldots, t_0\rangle\rangle,$ $\langle \varepsilon, \langle e_3, e_4, \ldots\rangle\rangle\}$

speech world w_0	***t_0: speech time***	
	e_0: $\vartheta e_0 = t_0$,	speaker comes home
	$^{w0?}(e_1$: $\vartheta e_0 \bullet\!< \vartheta e_1)$	
	e_2: $\vartheta e_1 < \vartheta e_2$,	Ann goes out
	e_3: $\vartheta e_2 \bullet\!< \vartheta e_3$	
	$^{w0?}(e_4$: $\vartheta e_3 \subseteq \vartheta e_3$,	John is asleep)

- Actual interpretation

(2K) [1]*Angirlar-a-ma*	[2]*Aani*	*ani-vu-q.*	[3]*Juuna*	*sinip-pu-q.*	≈ *Eng* (2)
come.home-FCT$_{\top}$-1s	Ann-sg$_{97}$	go.out-IND.IV-3s	John-sg$_{95}$	be.asleep-IND.IV-3s	

When I came home, Ann went out. John was asleep.

Kalaallisut (3K) & (4K)
See analysis at http://www.rci.rutgers.edu/~mbittner/lct.html, Semantics 2, top 6b, pp.15–16.

6 CONCLUSION

Wrong approach. A tenseless language cannot be analyzed like a tensed language minus tense.