Bittner, M. *to appear*

Online Update (Sec. 1–3)

1 REDUCED ARGUMENTS IN KALAALLISUT YET AGAIN

(1) Ataata-ga skakkir-tar-pu-q.
dad-1s.sg play.chess-habit-IND.IV-3s
My dad$_\top$ plays chess.

(2) Siurna arna-mi uqalu-qatigii-mm-a.ni
last.year mother-3s$_\top$.sg.ERG talk-with-FCT$_\perp$-3s$_\perp$.3s$_\top$
Last year when his$_\top$ mother talked with him$_\top$, …

a. uqar-p.u-q: “Amirlanir-tigut ajugaa-sar-pu-nga.”
say-IND.IV-3s most-VIA win-habit-IND.IV-1s
… he$_\top$ said: “I mostly win.”

b. amirlanir-tigut ajugaa-sar-nirar-pu-q.
most-VIA win-habit-say-IND.IV-3s
… he$_\top$ said that he (= *se*) mostly won.

(3) Ilaanni skakkir-a-mi,
once play.chess-FCT$_\top$-3s$_\top$
Once when he$_\top$ played chess, …

a. isuma-qa-lir-pu-q: “Immaqa ajugaa-ssa-u-nga.”
idea-have-begin-IND.IV-3s maybe win-prospect-IND.IV-1s
…he$_\top$ began to think: “Maybe I’ll win.”

b. immaqa ajugaa-ssa-suri-lir-pu-q.
maybe win-prospect-believe-begin-IND.IV-3s
…he$_\top$ began to think that maybe he (= *se*) would win.

(4) Aqagu-a-ni
next.day-3s$_\perp$.sg-LOC
The next day…

a. uqar-ajut-tar-p.u-q: “Ajugaa-sima-vu-nga.”
say-often-habit-IND.IV-3s: win-prf-IND.IV-1s
…he$_\top$ often says: “I won.”

b. ajuagaa-sima-nirar-ajut-tar-pu-q.
win-prf-say-often-habit-IND.IV-3s
…he$_\top$ often says that he (= *se*) won.

2 FRAMEWORK FOR ONLINE UPDATE: LOGIC OF CENTERING (LC)

TABLE 1. LC ontology and two sets of variables

Type	Abr.	Name of objects	$^{\top}\mathit{Var}$	$^{\bot}\mathit{Var}$
ω		worlds	$\mathbf{w}$	w
τ		times	$\mathbf{t}$	t
π		places	$\mathbf{l}$	l
α		animate entities	$\mathbf{a}$	a
β		inanimate entities	$\mathbf{b}$	b
ε		events	$\mathbf{e}$	e
σ		states of entities	$\mathbf{s}$	s
$\varepsilon\vee\sigma$	$\varepsilon^{\bullet}$	atomic episodes	$\mathbf{e}^{\bullet}$	$e^{\bullet}$
$\varepsilon\varepsilon$		ε-chains (incl. *processes*)	$\mathbf{ee}$	ee
$\omega\tau\mathrm{V}$	η^{V}	V-habits ($\mathrm{V} \in \{\varepsilon, \sigma, \varepsilon\varepsilon\}$)	$\mathbf{h}^{\mathrm{V}}$	h^{V}
$\omega\varepsilon^{\bullet}\mathrm{N}$	κ^{N}	N-kinds ($\mathrm{N} \in \{\alpha, \beta, \tau, \pi, \omega t\}$)	$\mathbf{k}^{\mathrm{N}}$	k^{N}
ωt	Ω	ω-domains	$\mathbf{p}$	p
$\omega\omega$	$\underline{\omega}$	ω-concepts	$\underline{\mathbf{w}}$	$\underline{w}$
$\omega\sigma$	$\underline{\sigma}$	σ-concepts	$\underline{\mathbf{s}}$	$\underline{s}$
$\omega\varepsilon$	$\underline{\varepsilon}$	ε-concepts	$\underline{\mathbf{e}}$	$\underline{e}$
$\underline{\varepsilon}(\underline{\varepsilon})$	$\underline{\varepsilon\varepsilon}$	ε-concept chains	$\underline{\mathbf{ee}}$	$\underline{ee}$
$\varepsilon\underline{\sigma}$		ε-dependent σ-concepts	$\underline{\mathbf{s}}_{\varepsilon}$	$\underline{s}_{\varepsilon}$
$\varepsilon\underline{\varepsilon}$		ε-dependent ε-concepts	$\underline{\mathbf{e}}_{\varepsilon}$	$\underline{e}_{\varepsilon}$
$\alpha\kappa^{\alpha}$	$\alpha\kappa$	α-dependent α-kinds	$\mathbf{k}_{\alpha}$	k_{α}
ζ		stacks (of dref objects)		z
$\omega\times\zeta\times\zeta$	s	information-and-attention states		i, j
sst		update		D

TABLE 2. LC constants

Type	Name of objects	Con
$\omega\alpha\sigma t$	stative α-property	*sleep*, *busy*, …
$\omega\alpha\varepsilon t$	eventive α-property	*wake.up*, *play.chess*, …
$\omega\Omega\alpha\sigma t$	stative (α, Ω)-relation	*believe*, *doubt*, …
$\omega\Omega\alpha\varepsilon t$	eventive (α, Ω)-relation	*say*, *think*, …
⋮	⋮	⋮
$\omega\sigma\varepsilon$	state onset (beginning)	BEG
$\omega\varepsilon\sigma$	result state	RES
$\omega\varepsilon\alpha$	agent	AGT
$\omega\varepsilon^{\bullet}\alpha$	experiencer	EXP
$\omega\varepsilon^{\bullet}\tau$	time	ϑ
$\omega\varepsilon^{\bullet}\pi$	place	Π

For type uniformity, stacks are formalized as primitive semantic objects (of type ζ). But they are constrained by a set of axioms, Ax1–5, to behave as sequences of semantic dref objects of types $\textsc{r} \in \Theta$, where Θ are the types based on $\{t, \omega, \tau, \pi, \alpha, \beta, \varepsilon, \sigma\}$, and this intuition informs the definition A1:

Ax1 $\exists z_\zeta: \forall n({}^{n}(z) = \dagger) \wedge \forall \textsc{r}({}^{\textsc{r}}(z) = z)$
[There is an empty stack—i.e., the n'th coordinate is Kaplan's † (the *non-existent object*) for all n; and the sub-sequence of type R coordinates is likewise empty, for any dref type R]

Ax2 $\forall z_\zeta \forall \textsc{r} \forall x_{\textsc{r}}: {}^{1}(x \cdot z) = x \wedge \forall n(n > 1 \rightarrow {}^{n}(x \cdot z) = {}^{n-1}(z))$
[Adding a R-object x to a stack z yields a recentered stack $(x \cdot z)$: x is now the 1st object and all old objects are demoted one notch]

Ax3 $\forall z_\zeta \forall \textsc{r} \forall x_{\textsc{r}}: {}^{\textsc{r}}(x \cdot z) = (x \cdot {}^{\textsc{r}}(z)) \wedge \forall \textsc{r}'(\textsc{r}' \neq \textsc{r} \rightarrow {}^{\textsc{r}'}(x \cdot z) = {}^{\textsc{r}'}(z))$
[In $(x \cdot z)$, x is the top R-object, old R-objects are demoted one notch, old objects of other types are not affected.

Ax4 $\forall z_\zeta \forall \textsc{r} \forall x_{\textsc{r}} \exists z'_\zeta: (x \cdot z) = z'$
[Any object $v_{\textsc{r}}$ of any dref type R can be added to any stack z]

Ax5 $\forall z_\zeta \forall z'_\zeta: \forall n({}^{n}(z) = {}^{n}(z')) \rightarrow z = z'$
[A stack is completely determined by its coordinates]

A1 Core abbreviations of LC

For any information-and-attention state $i_s = \langle w_i, \top_i, \bot_i \rangle$, we write:

i.	$\mathbf{v}_{\textsc{r}} \cdot i_s$	for $\langle w_i, (\mathbf{v} \cdot \top_i), \bot_i \rangle$	if $\mathbf{v} \in {}^{\top}\mathrm{Var}$
	$v_{\textsc{r}} \cdot i_s$	for $\langle w_i, \top_i, (v \cdot \bot_i) \rangle$	if $v \in {}^{\bot}\mathrm{Var}$
ii.	$(\mathbf{d}\textsc{r}_n)_i$	for ${}^{n+1}({}^{\textsc{r}}(\top_i))$	
	$(d\textsc{r}_n)_i$	for ${}^{n+1}({}^{\textsc{r}}(\bot_i))$	
	$\mathbf{d}\textsc{r}_i$	for $(\mathbf{d}\textsc{r}_0)_i$	
	$d\textsc{r}_i$	for $(d\textsc{r}_0)_i$	

Information-and-attention update:

iii.	$[\mathrm{v}_1 \ldots \mathrm{v}_n \mid C]$	for $\lambda ij\, \exists \mathrm{v}_1 \ldots \mathrm{v}_n (j = (\mathrm{v}_1 \cdot \ldots (\mathrm{v}_n \cdot i)) \wedge Ci)$
	$[\mid C]$	for $\lambda ij\, (j = i \wedge Ci)$
	$(D_1; D_2)$	for $\lambda ij\, \exists i'(D_1 ii' \wedge D_2 i'j)$

- Stalnaker 1978:323 on assertion:

  "When I speak I presuppose that others know I am speaking…This fact, too, can be exploited in the conversation, as when Daniels says *I am bald*, taking it for granted that his audience can figure out who is being said to be bald. I mention this COMMONPLACE way [MB emphasis] that assertions change the context in order to make it clear that the context on which assertion has its ESSENTIAL effect is not defined by what is presupposed before the speaker begins to speak, but will include any information which the speaker assumes his audience can infer from the performance of the speech act."

A2. Speech start-up conditions:

- $\mathbf{w} = r$ for $\lambda i.\ \mathbf{w} = w_i$
- ($\mathbf{e}$: AGT $speak.up_{\mathbf{d}\omega}$) for $\lambda i.\ speak.up_{\mathbf{d}\omega i}(\mathbf{e}, \text{AGT}_{\mathbf{d}\omega i}\,\mathbf{e})$
- $\mathbf{t} =_{\mathbf{d}\omega} \vartheta\mathbf{d}\varepsilon$ for $\lambda i.\ \mathbf{t} = \vartheta_{\mathbf{d}\omega i}\,\mathbf{d}\varepsilon_i$

A3. Indexical persons:

- $1s_{\mathbf{d}\omega}\,\mathbf{d}\alpha$ for (AGT $\mathbf{d}\varepsilon =_{\mathbf{d}\omega} \mathbf{d}\alpha$) for $\lambda i(\text{AGT}_{\mathbf{d}\omega i}\,\mathbf{d}\varepsilon_i = \mathbf{d}\alpha_i)$
  $1p_{\mathbf{d}\omega}\,\mathbf{d}\alpha$ for (AGT $\mathbf{d}\varepsilon \in_{\mathbf{d}\omega} \mathbf{d}\alpha$) for $\lambda i(\text{AGT}_{\mathbf{d}\omega i}\,\mathbf{d}\varepsilon_i \in \mathbf{d}\alpha_i)$
- $2s_{\mathbf{d}\omega}\,\mathbf{d}\alpha$ for (EXP $\mathbf{d}\varepsilon =_{\mathbf{d}\omega} \mathbf{d}\alpha$) for $\lambda i(\text{EXP}_{\mathbf{d}\omega i}\,\mathbf{d}\varepsilon_i = \mathbf{d}\alpha_i)$

(5) I am busy.

(6) $i_0 = \langle w_0, \langle\,\rangle, \langle\,\rangle\rangle$ where w_0 is a candidate reality[1]

(7) **MB:** speech start-up **RS**: commonplace effect
$[\mathbf{w}|\ \mathbf{w} = r]$; $[\mathbf{e}|\ \mathbf{e}$: AGT $speak.up_{\mathbf{d}\omega}]$; $[\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\mathbf{d}\varepsilon]$

(7a) $i_0[\mathbf{w}|\ \mathbf{w} = r]i_1$
$\equiv\ \exists\mathbf{w}(i_1 = \langle w_{i0}, \mathbf{w}\cdot\top_{i0}, \bot_{i0}\rangle \wedge \mathbf{w} = w_{i0})$ A1iii, i, A2
$\equiv\ (i_1 = \langle w_0, (w_0\cdot\langle\,\rangle), \langle\,\rangle\rangle)$ (6)
$\equiv\ (i_1 = \langle w_0, \langle w_0\rangle, \langle\,\rangle\rangle)$ ftn. 4, [App. (7a)]

(7b) $i_1[\mathbf{e}|\ \mathbf{e}$: AGT $speak.up_{\mathbf{d}\omega}]i_2$
$\equiv\ \exists\mathbf{e}(i_2 = \langle w_{i1}, \mathbf{e}\cdot\top_{i1}, \bot_{i1}\rangle$ A1iii, i, A2
$\wedge\ speak.up_{\mathbf{d}\omega i1}(\mathbf{e}, \text{AGT}_{\mathbf{d}\omega i1}\,\mathbf{e}))$
$\equiv\ \exists\mathbf{e}(i_2 = \langle w_0, \langle\mathbf{e}, w_0\rangle, \langle\,\rangle\rangle$ (7a), ftn. 4, A1ii,
$\wedge\ speak.up_{w0}(\mathbf{e}, \text{AGT}_{w0}\,\mathbf{e}))$ Ax1–3 [App. (7b)]

(7c) $i_1([\mathbf{e}|\ \mathbf{e}$: AGT $speak.up_{\mathbf{d}\omega}]$; $[\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\mathbf{d}\varepsilon])i_3$
$\equiv\ \exists j(\exists\mathbf{e}(j = \langle w_{i1}, \mathbf{e}\cdot\top_{i1}, \bot_{i1}\rangle$ A1iii, i, A2
$\wedge\ speak.up_{\mathbf{d}\omega i1}(\mathbf{e}, \text{AGT}_{\mathbf{d}\omega i1}\,\mathbf{e}))$
$\wedge\ \exists\mathbf{t}(i_3 = \langle w_j, \mathbf{t}\cdot\top_j, \bot_j\rangle$
$\wedge\ \mathbf{t} = \vartheta_{\mathbf{d}\omega j}\,\mathbf{d}\varepsilon_j))$
$\equiv\ \exists\mathbf{e}\exists\mathbf{t}(i_3 = \langle w_0, \langle\mathbf{t}, \mathbf{e}, w_0\rangle, \langle\,\rangle\rangle$ (7a), ftn. 4, A1ii,
$\wedge\ speak.up_{w0}(\mathbf{e}, \text{AGT}_{w0}\,\mathbf{e})$ Ax1–5 [App. (7c)]
$\wedge\ \mathbf{t} = \vartheta_{w0}\,\mathbf{e})$

Model for i_3:
i_3-reality: ${}^{\top}w_0$ • ${}^{\top}e_0$: e_0-agent speaks up
| ${}^{\top}t_0 = \vartheta_{w0}\,e_0$: e_0-time

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[1] $\langle\,\rangle$ abbreviates $\iota z_\zeta\,\forall n({}^{n}(z) = \dagger)$ the empty stack
$\langle x_1, \ldots, x_n\rangle$ abbreviates $(x_1\cdot\ldots(x_n\cdot\langle\,\rangle)\ldots)$ stack of $x_1, \ldots x_n$

MB: online update **RS**: essential effect

(8) I App. (8)

$[\mathbf{a}|\ 1s_{\mathbf{d}\omega}\ \mathbf{a}];$

$\equiv\ \ \lambda ij\ \exists\mathbf{a}(j = \langle w_i, (\mathbf{a} \cdot \top_i), \bot_i\rangle \wedge \mathrm{AGT}_{\mathbf{d}\omega i}\ \mathbf{d}\varepsilon_i = \mathbf{a})$

be-

$[s\ k^{\alpha}|\ \mathbf{d}\alpha =_{\mathbf{d}\omega} k^{\alpha}\{s\}];$

$\equiv\ \ \lambda ij\ \exists s\ k^{\alpha}(j = \langle w_i, \top_i, (s \cdot k^{\alpha} \cdot \bot_i)\rangle \wedge \mathbf{d}\alpha_i = k^{\alpha}\mathbf{d}\omega_i s)$

-PRS

$^{\mathrm{P}}[|\ \mathbf{d}\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau];\ [|\ \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma];$

$\equiv\ \ \lambda ij(j = i \wedge \vartheta_{\mathbf{d}\omega i}\ \mathbf{d}\varepsilon_i \subseteq \mathbf{d}\tau_i)\ ;\ \lambda ij(j = i \wedge \mathbf{d}\tau_i \subseteq \vartheta_{\mathbf{d}\omega i}\ d\sigma_i)$

busy

$[|\ busy\ d\kappa^{\alpha}]$

$\equiv\ \ \lambda ij(j = i \wedge \forall w \in \mathrm{Dom}\ d\kappa^{\alpha}{}_i \forall e^{\bullet} \in \mathrm{Dom}\ d\kappa^{\alpha}{}_i w \exists s:$

$s = e^{\bullet} \wedge busy_w(s, d\kappa^{\alpha}{}_i ws))$

(8a) $i_4 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, \langle s_1, k^{\alpha}{}_1\rangle\rangle$

s.t. $speak.up_{w0}(e_0, \mathrm{AGT}_{w0}\ e_0)$

$t_0 = \vartheta_{w0}\ e_0 \wedge t_0 \subseteq \vartheta_{w0}\ s_1$

$a_1 = \mathrm{AGT}_{w0}\ e_0 \wedge a_1 = k^{\alpha}{}_1 w_0 s_1$

$\forall w \in \mathrm{Dom}\ k^{\alpha}{}_1 \forall e^{\bullet} \in \mathrm{Dom}\ k^{\alpha}{}_1 w \exists s\!: e^{\bullet} = s \wedge busy_w(s, k^{\alpha}{}_1 ws)$

Model for i_4:

i_4-reality: $^{\top}w_0$	•	$^{\top}e_0$: e_0-agent speaks up
	|	$^{\top}t_0 = \vartheta_{w0}\ e_0$: e_0-time
	——	s_1: $^{\top}a_1 = e_0$-agent is $k^{\alpha}{}_1$-busy

• General guidelines for analysis by *Online Update* (OU)

i. *Input*: surface string, interpreted L-to-R morpheme-by-morpheme.

ii. *Form* of basic meaning:

	presupposition; (input test)	*assertion*; (main update)	*implicature* (default extra)
e.g. be- ⇝		$[s\ k^{\alpha}|\ \mathbf{d}\alpha =_{\mathbf{d}\omega} k^{\alpha}\{s\}]$	
-PRS ⇝	$^{\mathrm{P}}[|\ \mathbf{d}\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau]$;	$[|\ \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma]$	

iii. *Constraints* on basic meanings:

- *number*: *A ⇝ $[\mathrm{v}_1\ \mathrm{v}_2\ \mathrm{v}_3|\ldots]$
  - *A ⇝ $[\mathbf{v}_1\ \mathbf{v}_2|\ldots]$
- *centering*: $*[\mathrm{A}]_{\mathrm{X}}$ ⇝ $[(v)\ \mathbf{v}\ (v)|\ldots]$, if X is an open category
- *cat-to-type*: $[\mathrm{A}]_{\mathrm{N}}$ ⇝ $[\mathrm{v}_{\mathrm{R}}\ (v')|\ldots]$, where R is N-*type* (Bittner 2003)
  - $[\mathrm{A}]_{\mathrm{V}}$ ⇝ $[\mathrm{v}_{\mathrm{R}}\ (v')|\ldots]$, where R is V-*type* (Bittner 2003)

iv. *Adaptations* of basic meanings:

• *concrete > abstract*:

$[\text{sleep-}]_V$	⇝	$[s \mid s\text{: EXP } sleep_{\mathbf{d}\omega}]$	default: *real* state
	⇝	$[\mathcal{S} \mid \mathcal{S}\text{: EXP } sleep]$	**adapted**: /_ *modal* suffix
	⇝	$[h^{\sigma} \mid h^{\sigma}\text{: EXP } sleep]$	**adapted**: /_ *habitual* suffix
	⋮	⋮	

• *anaphoric > new*:

$[\text{sleep-}]_V$	⇝	$[\mid d\sigma\text{: EXP } sleep_{\mathbf{d}\omega}]$	default: *that* state
	⇝	$[s \mid s\text{: EXP } sleep_{\mathbf{d}\omega}]$	**adapted**: /_no antec. for $d\sigma$

vi. Composition by *presuppositional sequencing*:

($^{\perp}$;) BACKGROUND-ELABORATION LINK
If A ⇝ α and B ⇝ β, then [A B] ⇝ (α; β), provided that a demonstrative dR (:= $d\text{R}_0$) in β is anaphoric to an R-dref in α.

($^{\top}$;) TOPIC-COMMENT LINK
If A ⇝ α and B ⇝ β, then [A B] ⇝ (α; β), provided that a demonstrative **d**R (:= $\mathbf{d}\text{R}_0$) in β is anaphoric to an R-dref in α.

e.g. composition of (8):

(9) I be- -PRS

$([\mathbf{a} \mid 1s_{\mathbf{d}\omega}\ \mathbf{a}]\ ^{\top};\ ([s\ k^{\alpha} \mid \mathbf{d}\alpha =_{\mathbf{d}\omega} k^{\alpha}\{s\}]\ ^{\perp};\ (\ldots;\ [\mid \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma])))$

busy

$^{\perp};\ [\mid busy\ d\kappa^{\alpha}]$

3 KALAALLISUT EPISODICS ONLINE

(11) Ullu-mi ataata-ga isir-m-at…
day-sg.LOC dad-1s.sg enter-$\text{FCT}_{\perp}$-$3\text{s}_{\perp}$
Today when my dad came by,…

a. …*sinip*-pu-tit. *state*
…asleep-IND.IV-2s
…you were asleep.

b. …*itir*-pu-nga. *event*
…wake.up-IND.IV-1s
…I woke up.

c. …*skakkir*-pu-gut. *process*
…play.chess-IND.IV-1p
…we played chess.

A4. Processes and stages.

- $process_w\; ee$ for $\forall e \in \text{Dom}\; ee: \vartheta_w\, ee(e) \subseteq \vartheta_w \text{RES}_w\, e$
- $e \in ee$ for $e \in (\text{Dom}\; ee \cup \text{Ran}\; ee)$

  ${}^{1}ee$ for $\iota e.\; e \in (\text{Dom}\; ee - \text{Ran}\; ee)$

  ${}^{n+1}ee$ for $ee({}^{n}ee)$

  ${}^{f}ee$ for $\iota e.\; e \in (\text{Ran}\; ee - \text{Dom}\; ee)$

A5. Episodic predicates (of states, events, or distributive processes).

- s: EXP $sleep_{\mathbf{d}\omega}$ for $\lambda i.\; sleep_{\mathbf{d}\omega i}(s, \text{EXP}_{\mathbf{d}\omega i}\, s)$
- e: EXP $wake.up_{\mathbf{d}\omega}$ for $\lambda i.\; wake.up_{\mathbf{d}\omega i}(e, \text{EXP}_{\mathbf{d}\omega i}\, e)$
- ee: AGT $play.chess_{\mathbf{d}\omega}$ for $\lambda i.\; process_{\mathbf{d}\omega i}\, ee$

  $\wedge\; \forall e \in ee: play.chess_{\mathbf{d}\omega i}(e, \text{AGT}_{\mathbf{d}\omega i}\, e)$

  $\wedge\; \text{AGT}_{\mathbf{d}\omega i}\, ee = \bigcup\{\text{AGT}_{\mathbf{d}\omega i}\, e: e \in ee\}$

A6. Real episodes, ωτ-location, and new topic times.

- BEG $d\sigma <_{\mathbf{d}\omega} \mathbf{d}\varepsilon$ for $\lambda i.\; \vartheta_{\mathbf{d}\omega i}\, \text{BEG}_{\mathbf{d}\omega i}\, d\sigma_i < \vartheta_{\mathbf{d}\omega i}\, \mathbf{d}\varepsilon_i$

  $d\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon$ for $\lambda i.\; \vartheta_{\mathbf{d}\omega i}\, d\varepsilon_i < \vartheta_{\mathbf{d}\omega i}\, \mathbf{d}\varepsilon$

  ${}^{1}d\varepsilon\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon$ for $\lambda i.\; \vartheta_{\mathbf{d}\omega i}\, {}^{1}d\varepsilon\varepsilon_i < \vartheta_{\mathbf{d}\omega i}\, \mathbf{d}\varepsilon$
- $\mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma$ for $\lambda i.\; \mathbf{d}\tau_i \subseteq \vartheta_{\mathbf{d}\omega i}\, d\sigma_i$

  $d\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau$ for $\lambda i.\; \vartheta_{\mathbf{d}\omega i}\, d\varepsilon_i \subseteq \mathbf{d}\tau_i$

  ${}^{1}d\varepsilon\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau$ for $\lambda i.\; \vartheta_{\mathbf{d}\omega i}\, {}^{1}d\varepsilon\varepsilon_i \subseteq \mathbf{d}\tau_i$
- $\mathbf{t} =_{\mathbf{d}\omega} \vartheta\, d\sigma$ for $\lambda i.\; \mathbf{t} = \vartheta_{\mathbf{d}\omega i}\, d\sigma_i$

  $\mathbf{t} =_{\mathbf{d}\omega} \vartheta\text{RES}\; d\varepsilon$ for $\lambda i.\; \mathbf{t} = \vartheta_{\mathbf{d}\omega i}\, \text{RES}_{\mathbf{d}\omega i}\, d\varepsilon_i$

  $\mathbf{t} =_{\mathbf{d}\omega} \vartheta\text{RES}\; {}^{1}d\varepsilon\varepsilon$ for $\lambda i.\; \mathbf{t} = \vartheta_{\mathbf{d}\omega i}\, \text{RES}_{\mathbf{d}\omega i}\, {}^{1}d\varepsilon\varepsilon_i$

(11′) Today when my dad came by…[2] App. (11′)

day -sg.LOC

$[k^\tau |\; k^\tau\; day.of\; \varepsilon^\bullet];\; [\mathbf{t}|\; \mathbf{t} \subseteq_{\mathbf{d}\omega} d\kappa^\tau\{\mathbf{d}\varepsilon\}];$

dad- -1s.sg (⊥-subject)

$[k_\alpha |\; k_\alpha\; dad.of\, \alpha];\; {}^{\text{P}}[|\; 1s_{\mathbf{d}\omega}\; \text{AGT}\; \mathbf{d}\varepsilon];\; [a|\; a =_{\mathbf{d}\omega} d\alpha\kappa\{\text{AGT}, \mathbf{d}\varepsilon\}];$

enter-

$[l|\; d\varepsilon: \text{AGT}\; enter_{\mathbf{d}\omega}\; l];\; {}^{\text{I}}[|\; \mathbf{d}\varepsilon \subseteq_{\mathbf{d}\omega} d\pi];$

-FCT$_\perp$

${}^{\text{P}}[|\; \text{AGT}\; d\varepsilon =_{\mathbf{d}\omega} d\alpha];\; [|\; d\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau];\; [\mathbf{t}|\; \mathbf{t} =_{\mathbf{d}\omega} \vartheta\text{RES}\; d\varepsilon];$ **(set** $^\top\tau$**)**

-3s$_\perp$

${}^{\text{P}}[|\; 3s_{\mathbf{d}\omega}\; d\alpha];\; [\mathbf{a}|\; \mathbf{a} \neq d\alpha]$ **(set** $^\top\alpha$**)**

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2 • Any k^τ-time is the day of the instantiating episode:

$k^\tau\; day.of\, \varepsilon^\bullet$ for $\lambda i.\; \forall w \in \text{Dom}\; k^\tau \forall e^\bullet \in \text{Dom}\; k^\tau w: day_w\; k^\tau w e^\bullet \wedge \vartheta_w\, e^\bullet \subseteq k^\tau w e^\bullet$

• For any animate $a \in \text{Dom}\; k_\alpha$, $k_\alpha a w e^\bullet$ is a's dad (in w at the time of $e^\bullet$):

$k_\alpha\; dad.of\, \alpha$ for $\lambda i.\; \forall a \in \text{Dom}\; k_\alpha \forall w \in \text{Dom}\; k_\alpha a \forall e^\bullet \in \text{Dom}\; k_\alpha a w \exists a', t:$

$a' = k_\alpha a w e^\bullet \wedge t = \vartheta_w\, e^\bullet \wedge dad.of_{w,\, t}(a', a)$

Comment on $^{\top}\alpha$ at $^{\top}\tau$ in $^{\top}\omega$:

(11′a) … you were asleep. App. (11′a)
sleep-
$[s|\ s$: EXP $sleep_{\mathbf{d}\omega}]$;

-IND. .IV -2s
$^{P}[|\ \text{BEG}\ d\sigma <_{\mathbf{d}\omega} \mathbf{d}\varepsilon];\ [|\ \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma];\ ^{P}[|\ \text{EXP}\ d\sigma =_{\mathbf{d}\omega} \mathbf{d}\alpha];\ ^{P}[|\ 2s_{\mathbf{d}\omega}\ \mathbf{d}\alpha]$

(11′b) … I woke up. App (11′b)
wake.up-
$[e|\ e$: EXP $wake.up_{\mathbf{d}\omega}]$;

-IND. .IV -1s
$^{P}[|\ d\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon];\ [|\ d\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau];\ ^{P}[|\ \text{EXP}\ d\varepsilon =_{\mathbf{d}\omega} \mathbf{d}\alpha];\ ^{P}[|\ 1s_{\mathbf{d}\omega}\ \mathbf{d}\alpha]$

(11′c) …we played chess. App (11′c)
play.chess-
$[ee|\ ee$: AGT $play.chess_{\mathbf{d}\omega}]$;

-IND. .IV -1p
$^{P}[|\ ^{1}d\varepsilon\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon];\ [|\ ^{1}d\varepsilon\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau];\ ^{P}[|\ \text{AGT}\ d\varepsilon\varepsilon =_{\mathbf{d}\omega} \mathbf{d}\alpha];\ ^{P}[|\ 1p_{\mathbf{d}\omega}\ \mathbf{d}\alpha]$

Models for (11′a, b, c)

i_0-reality: $^{\top}w_0$	•	$^{\top}e_0$: e_0-agent speaks up
	|	$t_0 = \vartheta_{w0}\ e_0$: e_0-time
	||||||||||||||||||||||||||	$k^{\tau}{}_{1}w_0e_0$: e_0-day
	||	$^{(\top)}t_{1.1} \subseteq k^{\tau}{}_{1}w_0e_0$
	•	e_1: e_0-speaker's dad enters e_0-here
	||	$^{\top}t_{1.2} = \vartheta_{w0}\ \text{RES}_{w0}\ e_1$
a.	___	s_2: e_0-addressee is asleep
b.	•	e_2: e_0-speaker wakes up
c.	•••	ee_2: (e_0-speaker + ?) play chess

TABLE 3. Real episodes (**d**τ period)

Base	IND: ωε-*reality*	IND/FCT: ωτ-*loc*.	FCT: *New* τ-*topic*
$[s|\ldots]$;	$^{P}[|\ \text{BEG}\ d\sigma <_{\mathbf{d}\omega} \mathbf{d}\varepsilon]$;	$[|\ \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma]$;	$[\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta d\sigma]$
$[e|\ldots]$;	$^{P}[|\ d\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon]$;	$[|\ d\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau]$;	$[\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\text{RES}\ d\varepsilon]$
$[ee|\ldots]$;	$^{P}[|\ ^{1}d\varepsilon\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon]$;	$[|\ ^{1}d\varepsilon\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau]$;	$[\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\text{RES}\ ^{1}d\varepsilon\varepsilon]$

4 ENGLISH EXISTENTIALS: DRT vs. OU

(E) today I came home, and *there was a mountain lion on the roof*!

- *DRT story*: a la Bende-Farkas & Kamp 2001, Ch. 5

  $\langle\{\langle\tau, \mathit{roof}\,\tau, BC_{pron}\rangle, \langle t, , BC_{t.loc}\rangle\}, \quad [t\ s\ x|\ t < n, t \subseteq s, \tau = \mathscr{L}(s), s\text{: } mt.lion(AT_f(s))]\rangle$

  MB: Model-theoretic interpretation: ??…

- *OU story*: 1st guess

$i_0 = \langle w_0, \langle\,\rangle, \langle\,\rangle\rangle$

Speech start-up:

$i_0([\mathbf{w}|\ \mathbf{w} = r]; [\mathbf{e}|\ \mathbf{e}\text{: AGT } speak.up_{\mathbf{d}\omega}]; [\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\mathbf{d}\varepsilon])i_1$

$i_1 = \langle w_0, (t_0 \cdot (e_0 \cdot (w_0 \cdot \langle\,\rangle))), \langle\,\rangle\rangle$

s.t. 1 $speak.up_{w0}(e_0, \text{AGT}_{w0}\ e_0)$

2 $t_0 = \vartheta_{w0}\ e_0$

Model for i_1:

i_1-reality: ${}^{\top}w_0$ • ${}^{\top}e_0$: e_0-agent speaks up

| ${}^{\top}t_0 = \vartheta_{w0}\ e_0$: e_0-time

S_1 of (E) online:

today

$i_1([k^\tau|\ k^\tau\ day.of\ \varepsilon^\bullet]; [\mathbf{t}|\ \mathbf{t} \subseteq_{\mathbf{d}\omega} d\kappa^\tau\{\mathbf{d}\varepsilon\}]$

I come-

${}^{\top}; ([\mathbf{a}|\ 1s_{\mathbf{d}\omega}\ \mathbf{a}]\ {}^{\top}; ((([e\ l|\ \mathbf{d}\alpha =_{\mathbf{d}\omega} \text{EXP } e = \text{EXP}\{\text{RES } e\}, \text{RES } e \subseteq_{\mathbf{d}\omega} l]$

-PST

${}^{\perp}; ({}^{P}[|\ \mathbf{d}\tau <_{\mathbf{d}\omega} \mathbf{d}\varepsilon]; [|\ d\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau]; [\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\text{RES } d\varepsilon]))$

home

${}^{\perp}; [k^\pi|\ k^\pi\ home.of\ \text{EXP}, d\pi =_{\mathbf{d}\omega} k^\pi\{d\varepsilon\}])))i_2$

$i_2 = \langle w_0, (t_{1.2} \cdot (a_1 \cdot (t_{1.1} \cdot \langle t_0, e_0, w_0\rangle))), (k^\pi{}_1 \cdot (e_1 \cdot (l_1 \cdot (k^\tau{}_1 \cdot \langle\,\rangle))))\rangle$

s.t. 1.1 $\forall w \in \text{Dom } k^\tau{}_1 \forall e^\bullet \in \text{Dom } k^\tau{}_1 w \exists t$:

$t = k^\tau{}_1 w e^\bullet \wedge day_w\ t \wedge \vartheta_w e^\bullet \subseteq t$

$t_{1.1} \subseteq k^\tau{}_1 w_0 e_0$

1.2 $a_1 = \text{AGT}_{w0}\ e_0$

1.3 $a_1 = \text{EXP}_{w0}\ e_1 = \text{EXP}_{w0}(\text{RES}_{w0}\ e_1) \wedge \Pi_{w0}\ \text{RES}_{w0}\ e_1 \subseteq l_1$

1.4 test: $t_{1.1} < \vartheta_{w0}\ e_0$.

new: $\vartheta_{w0}\ e_1 \subseteq t_{1.1} \wedge t_{1.2} = \vartheta_{w0}(\text{RES}_{w0}\ e_1)$

1.5. $\forall w \in \text{Dom } k^\pi{}_1 \forall e^\bullet \in \text{Dom } k^\pi{}_1 w \exists l, t$:

$l = k^\pi{}_1 w e^\bullet \wedge t = \vartheta_w\ e^\bullet \wedge home.of_{w,t}(l, \text{EXP}_w\ e^\bullet)$

$l_1 = k^\pi{}_1 w_0 e_1$

<table>
<tr><td>i_2-reality: $^{\top}w_0$</td><td>•</td><td>$^{\top}e_0$: e_0-agent speaks up</td></tr>
<tr><td></td><td>|</td><td>$t_0 = \vartheta_{w0}\, e_0$</td></tr>
<tr><td></td><td>||||||||||||||||||||||||||</td><td>$k^{\tau}{}_1 w_0 e_0$: e_0-day</td></tr>
<tr><td></td><td>||</td><td>$^{(\top)}t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$</td></tr>
<tr><td></td><td>•</td><td>e_1: e_0-spkr $^{\top}a_1$ comes home to l_1</td></tr>
<tr><td></td><td>==</td><td>$\text{RES}_{w0}\, e_1$: e_0-spkr $^{\top}a_1$ is home at l_1</td></tr>
<tr><td></td><td>|||||</td><td>$^{\top}t_{1.2} = \vartheta_{w0}\, \text{RES}_{w0}\, e_1$</td></tr>
</table>

<u>S_2 of (E) online</u>:

and there

$i_2([e|\ e =_{\mathbf{d}\omega} \text{BEG}\{\text{RES}\ d\varepsilon\}];\ [\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta d\varepsilon]\ ^{\perp};\ ^{\mathrm{P}}[|\ d\varepsilon \subseteq_{\mathbf{d}\omega} d\pi];\ [\mathbf{l}|\ \mathbf{l} \subseteq d\pi])$

be- -PST

$^{\top}; ((([s\, k^{\alpha}|\ \mathbf{d}\pi =_{\mathbf{d}\omega} \Pi s,\ s \in_{\mathbf{d}\omega} \text{Dom}\ k^{\alpha}]\ ^{\perp}; (^{\mathrm{P}}[|\ \mathbf{d}\tau <_{\mathbf{d}\omega} \mathbf{d}\varepsilon];\ [|\ \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma]))$

a mountain lion

$^{\perp}; ([a|\ a =_{\mathbf{d}\omega} d\kappa^{\alpha}\{d\sigma\}]\ ^{\perp}; [|\ mt.lion\ d\kappa^{\alpha}]))$

on the roof

$^{\perp}; ([b|\ d\sigma \subseteq_{\mathbf{d}\omega} on\ b]\ ^{\perp}; ([b_{\pi}|\ d\beta = b_{\pi}\ d\pi]\ ^{\perp}; [|\ d\pi\beta =_{\mathbf{d}\omega,\, \mathbf{d}\tau} roof.of]))i_3$

$i_3 = \langle w_0, (l_2 \cdot (t_2 \cdot \langle t_{1.2}, a_1, t_{1.1}, t_0, e_0, w_0\rangle)),$
$\quad (b_{\pi,2} \cdot (b_2 \cdot (a_2 \cdot (s_2 \cdot (k^{\alpha}{}_2 \cdot (e_2 \cdot \langle k^{\pi}{}_1, e_1, l_1, k^{\tau}{}_1\rangle))))))\rangle$

s.t. 2.1 $e_2 = \text{BEG}_{w0}\,(\text{RES}_{w0}\, e_1) \wedge t_2 = \vartheta_{w0}\, e_2$
2.2 test: $\Pi_{w0}\, e_2 \subseteq l_1$
new: $l_2 \subseteq l_1$
2.3 $l_2 = \Pi_{w0}\, s_2 \wedge s_2 \in \text{Dom}\ k^{\alpha}{}_2 w_0$
2.4 test: $t_2 < \vartheta_{w0}\, e_0$
new: $t_2 \subseteq \vartheta_{w0}\, s_2$
2.5 $a_2 = k^{\alpha}{}_2 w_0 s_2$
2.6 $\forall w \in \text{Dom}\ k^{\alpha}{}_2 \forall e^{\bullet} \in \text{Dom}\ k^{\alpha}{}_2 w \exists a, t$:
$a = k^{\alpha}{}_2 w e^{\bullet} \wedge \vartheta_w e^{\bullet} \subseteq t \wedge mt.lion_{w,t}\ a$
2.7 $\Pi_{w0}\, s_2 \subseteq on_{w0}\, b_2$
2.8 $b_2 = b_{\pi,2}\, l_1 \wedge \forall l \in \text{Dom}\ b_{\pi,2}$: $b_{\pi,2} l = roof.of_{w0,\,t2}\ l$

<table>
<tr><td>i_3-reality: $^{\top}w_0$</td><td>•</td><td>$^{\top}e_0$: e_0-agent speaks up</td></tr>
<tr><td></td><td>|</td><td>$t_0 = \vartheta_{w0}\, e_0$</td></tr>
<tr><td></td><td>||||||||||||||||||||||||||</td><td>$k^{\tau}{}_1 w_0 e_0$: e_0-day</td></tr>
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<tr><td></td><td>•</td><td>$e_2 = \text{BEG}_{w0}(\text{RES}_{w0}\, e_1)$</td></tr>
<tr><td></td><td>|</td><td>$^{\top}t_2 = \vartheta_{w0}\, e_2$</td></tr>
<tr><td></td><td>—</td><td>s_2: $k^{\alpha}{}_2$-mt.lion a_2 on $b_{\pi,2}$-roof b_2 of l_1
(s_2-location = $^{\top}l_1$)</td></tr>
</table>

Appendix

Sample derivations

(6) $i_0 = \langle w_0, \langle\,\rangle, \langle\,\rangle\rangle$

(7a) $i_0[\mathbf{w}|\ \mathbf{w} = r]i_1$

1	$\equiv \lambda ij[\exists \mathbf{w}(j = (\mathbf{w} \cdot i) \wedge (\mathbf{w} = r)i)]i_0 i_1$	A1iii
2	$\equiv \exists \mathbf{w}(i_1 = (\mathbf{w} \cdot i_0) \wedge \lambda i[\mathbf{w} = w_i]i_0)$	A2**w**, λ
3	$\equiv \exists \mathbf{w}(i_1 = \langle w_{i0}, \mathbf{w} \cdot \top_{i0}, \bot_{i0}\rangle \wedge \mathbf{w} = w_{i0})$	A1iii, λ
4	$\equiv \exists \mathbf{w}(i_1 = \langle w_0, \mathbf{w} \cdot \langle\,\rangle, \langle\,\rangle\rangle \wedge \mathbf{w} = w_0)$	(6), A1
5	$\equiv \exists \mathbf{w}(i_1 = \langle w_0, \langle \mathbf{w}\rangle, \langle\,\rangle\rangle \wedge \mathbf{w} = w_0)$	ftn. 4
6	$\equiv (i_1 = \langle w_0, \langle w_0\rangle, \langle\,\rangle\rangle)$	simplify

(7b) $i_1[\mathbf{e}|\ \mathbf{e}\text{: AGT } \mathit{speak.up}_{\mathbf{d}\omega}]i_2$

1	$\equiv \exists \mathbf{e}[i_2 = (\mathbf{e} \cdot i_1)$ $\wedge (\mathbf{e}\text{: AGT } \mathit{speak.up}_{\mathbf{d}\omega})i_1]$	A1iii, λ
2	$\equiv \exists \mathbf{e}[i_2 = \langle w_{i1}, \mathbf{e} \cdot \top_{i1}, \bot_{i1}\rangle$ $\wedge \lambda i[\mathit{speak.up}_{\mathbf{d}\omega i}(\mathbf{e}, \text{AGT}_{\mathbf{d}\omega i}\ \mathbf{e})]i_1]$	A1i A2**e**
3	$\equiv \exists \mathbf{e}[i_2 = \langle w_{i1}, \mathbf{e} \cdot \top_{i1}, \bot_{i1}\rangle$ $\wedge \mathit{speak.up}_{\mathbf{d}\omega i1}(\mathbf{e}, \text{AGT}_{\mathbf{d}\omega i1}\ \mathbf{e})]$	λ
4	$\equiv \exists \mathbf{e}[i_2 = \langle w_{i1}, \mathbf{e} \cdot \top_{i1}, \bot_{i1}\rangle$ $\wedge \mathit{speak.up}((\mathbf{d}\omega_0)_{i1})(\text{AGT}((\mathbf{d}\omega_0)_{i1})(\mathbf{e}))(\mathbf{e})]$	A1ii, –abr
5	$\equiv \exists \mathbf{e}[i_2 = \langle w_{i1}, \mathbf{e} \cdot \top_{i1}, \bot_{i1}\rangle$ $\wedge \mathit{speak.up}({}^{0+1}({}^{\omega}\top_{i1}))(\text{AGT}({}^{0+1}({}^{\omega}\top_{i1}))(\mathbf{e}))(\mathbf{e})]$	A1ii
6	$\equiv \exists \mathbf{e}[i_2 = \langle w_0, \mathbf{e} \cdot \langle w_0\rangle, \langle\,\rangle\rangle$ $\wedge \mathit{speak.up}({}^{0+1}({}^{\omega}\langle w_0\rangle))(\text{AGT}({}^{0+1}({}^{\omega}\langle w_0\rangle))(\mathbf{e}))(\mathbf{e})]$	(7a), A1
7	$\equiv \exists \mathbf{e}[i_2 = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\,\rangle\rangle$ $\wedge \mathit{speak.up}({}^{1}\langle w_0\rangle)(\text{AGT}({}^{1}\langle w_0\rangle)(\mathbf{e}))(\mathbf{e})]$	Ax2, ftn. 4 Ax3, 1
8	$\equiv \exists \mathbf{e}[i_2 = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\,\rangle\rangle$ $\wedge \mathit{speak.up}(w_0)(\text{AGT}(w_0)(\mathbf{e}))(\mathbf{e})]$	ftn. 4, Ax2, 1
9	$\equiv \exists \mathbf{e}[i_2 = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\,\rangle\rangle$ $\wedge \mathit{speak.up}_{w0}(\text{AGT}_{w0}\ \mathbf{e})(\mathbf{e})]$	$f_a := f(a)$
10	$\equiv \exists \mathbf{e}[i_2 = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\,\rangle\rangle$ $\wedge \mathit{speak.up}_{w0}(\mathbf{e}, \text{AGT}_{w0}\ \mathbf{e})]$	df. $f(a, b)$

(7c)	$i_1([\mathbf{e}\vert\ \mathbf{e}\text{: } \textsc{agt}\ \mathit{speak.up}_{\mathbf{d}\omega}];\ [\mathbf{t}\vert\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\mathbf{d}\varepsilon])i_3$	
1	$\equiv\ \exists j([\mathbf{e}\vert\ \mathbf{e}\text{: } \textsc{agt}\ \mathit{speak.up}_{\mathbf{d}\omega}]i_1 j$	A1iii, λ
	$\quad \wedge\ [\mathbf{t}\vert\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\mathbf{d}\varepsilon]ji_3)$	
2	$\equiv\ \exists j(\exists \mathbf{e}[j = \langle w_{i1}, \mathbf{e} \cdot \top_{i1}, \bot_{i1}\rangle$	A1iii, i, λ
	$\qquad \wedge\ \mathit{speak.up}_{\mathbf{d}\omega i1}(\mathbf{e}, \mathrm{AGT}_{\mathbf{d}\omega i1}\ \mathbf{e})]$	A2, λ
	$\quad \wedge\ \exists \mathbf{t}[i_3 = \langle w_j, \mathbf{t} \cdot \top_j, \bot_j\rangle$	A1iii, i, λ
	$\qquad\quad \wedge\ \mathbf{t} = \vartheta_{\mathbf{d}\omega j}\ \mathbf{d}\varepsilon_j])$	A2, λ
3	$\equiv\ \exists j(\exists \mathbf{e}[j = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\rangle\rangle$	(7b), ftn. 4
	$\qquad \wedge\ \mathit{speak.up}_{w0}(\mathbf{e}, \mathrm{AGT}_{w0}\ \mathbf{e})]$	Ax2, 1
	$\quad \wedge\ \exists \mathbf{t}[i_3 = \langle w_j, \mathbf{t} \cdot \top_j, \bot_j\rangle$	
	$\qquad\quad \wedge\ \mathbf{t} = \vartheta((\mathbf{d}\omega_0)_j)((\mathbf{d}\varepsilon_0)_j)])$	–abbrev’s
4	$\equiv\ \exists j(\exists \mathbf{e}[j = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\rangle\rangle$	
	$\qquad \wedge\ \mathit{speak.up}_{w0}(\mathbf{e}, \mathrm{AGT}_{w0}\ \mathbf{e})]$	
	$\quad \wedge\ \exists \mathbf{t}[i_3 = \langle w_j, \mathbf{t} \cdot \top_j, \bot_j\rangle$	
	$\qquad\quad \wedge\ \mathbf{t} = \vartheta(^{0+1}(^{\omega}\top_j))(^{0+1}(^{\varepsilon}\top_j))])$	A1ii
5	$\equiv\ \exists j(\exists \mathbf{e}[j = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\rangle\rangle$	
	$\qquad \wedge\ \mathit{speak.up}_{w0}(\mathbf{e}, \mathrm{AGT}_{w0}\ \mathbf{e})]$	
	$\quad \wedge\ \exists \mathbf{t}[i_3 = \langle w_0, \mathbf{t} \cdot \langle \mathbf{e}, w_0\rangle, \langle\ \rangle\rangle$	A1.$\top_i$
	$\qquad\quad \wedge\ \mathbf{t} = \vartheta(^{1}(^{\omega}\langle \mathbf{e}, w_0\rangle))\,(^{1}(^{\varepsilon}\langle \mathbf{e}, w_0\rangle))])$	
6	$\equiv\ \exists j(\exists \mathbf{e}[j = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\rangle\rangle$	ftn. 4,
	$\qquad \wedge\ \mathit{speak.up}_{w0}(\mathbf{e}, \mathrm{AGT}_{w0}\ \mathbf{e})]$	Ax1–3
	$\quad \wedge\ \exists \mathbf{t}[i_3 = \langle w_0, \langle \mathbf{t}, \mathbf{e}, w_0\rangle, \langle\ \rangle\rangle$	
	$\qquad\quad \wedge\ \mathbf{t} = \vartheta(^{1}\langle w_0\rangle)\,(^{1}\langle \mathbf{e}\rangle)])$	
7	$\equiv\ \exists j(\exists \mathbf{e}[j = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\rangle\rangle$	ftn. 4,
	$\qquad \wedge\ \mathit{speak.up}_{w0}(\mathbf{e}, \mathrm{AGT}_{w0}\ \mathbf{e})]$	Ax1-2
	$\quad \wedge\ \exists \mathbf{t}[i_3 = \langle w_0, \langle \mathbf{t}, \mathbf{e}, w_0\rangle, \langle\ \rangle\rangle$	
	$\qquad\quad \wedge\ \mathbf{t} = \vartheta(w_0)\,(\mathbf{e})])$	
8	$\equiv\ \exists j(\exists \mathbf{t} \exists \mathbf{e}[j = \langle w_0, \langle \mathbf{e}, w_0\rangle, \langle\rangle\rangle$	
	$\qquad\quad \wedge\ i_3 = \langle w_0, \langle \mathbf{t}, \mathbf{e}, w_0\rangle, \langle\ \rangle\rangle$	
	$\qquad\quad \wedge\ \mathit{speak.up}_{w0}(\mathbf{e}, \mathrm{AGT}_{w0}\ \mathbf{e})$	rearrange
	$\qquad\quad \wedge\ \mathbf{t} = \vartheta_{w0}\,\mathbf{e}])$	+abbrev’s
9	$\equiv\ \exists \mathbf{e} \exists \mathbf{t}(i_3 = \langle w_0, \langle \mathbf{t}, \mathbf{e}, w_0\rangle, \langle\ \rangle\rangle$	
	$\qquad \wedge\ \mathit{speak.up}_{w0}(\mathbf{e}, \mathrm{AGT}_{w0}\ \mathbf{e})$	
	$\qquad \wedge\ \mathbf{t} = \vartheta_{w0}\ \mathbf{e})$	Ax1–5

Sample i_3 (output of speech start-up):

$i_3 = \langle w_0, \langle t_0, e_0, w_0\rangle, \langle\ \rangle\rangle$
such that: $speak.up_{w0}(e_0, \mathrm{AGT}_{w0}\ e_0)$
$t_0 = \vartheta_{w0}\ e_0$

Model for i_3 ($^{\top}$ on current topics):

i_3-reality: $^{\top}w_0$ • | $^{\top}e_0$: e_0-agent speaks up
$^{\top}t_0 = \vartheta_{w0}\ e_0$

MB: online update **RS**: essential effect

(8) I
$i_3[\mathbf{a}|\ \mathit{1s}_{\mathbf{d}\omega}\ \mathbf{a}]j_1$

1	≡	$\exists\mathbf{a}[j_1 = \langle w_{i3}, (\mathbf{a} \cdot \top_{i3}), \bot_{i3}\rangle$ $\wedge (\mathit{1s}_{\mathbf{d}\omega}\ \mathbf{a})i_3]$	A1iii, i
2	≡	$\exists\mathbf{a}[j_1 = \langle w_{i3}, (\mathbf{a} \cdot \top_{i3}), \bot_{i3}\rangle$ $\wedge\ \mathrm{AGT}_{\mathbf{d}\omega i3}\ \mathbf{d}\varepsilon_{i3} = \mathbf{a}]$	A3.*1s*
3	≡	$\exists\mathbf{a}[j_1 = \langle w_{i3}, (\mathbf{a} \cdot \top_{i3}), \bot_{i3}\rangle$ $\wedge\ \mathrm{AGT}((\mathbf{d}\omega_0)_{i3})((\mathbf{d}\varepsilon_0)_{i3}) = \mathbf{a}]$	–abbr
4	≡	$\exists\mathbf{a}[j_1 = \langle w_{i3}, (\mathbf{a} \cdot \top_{i3}), \bot_{i3}\rangle$ $\wedge\ \mathrm{AGT}(^1(^{\omega}\top_{i3}))(^1(^{\varepsilon}(\top_{i3})) = \mathbf{a}]$	A1ii
5	≡	$\exists\mathbf{a}[j_1 = \langle w_0, (\mathbf{a} \cdot \langle t_0, e_0, w_0\rangle), \langle\ \rangle\rangle$ $\wedge\ \mathrm{AGT}(^1(^{\omega}\langle t_0, e_0, w_0\rangle))(^1(^{\varepsilon}\langle t_0, e_0, w_0\rangle)) = \mathbf{a}]$	i_3, A1.⊤
6	≡	$\exists\mathbf{a}[j_1 = \langle w_0, \langle \mathbf{a}, t_0, e_0, w_0\rangle, \langle\ \rangle\rangle$ $\wedge\ \mathrm{AGT}(^1\langle w_0\rangle)(^1\langle e_0\rangle) = \mathbf{a}]$	ftn. 4, Ax1–3
7	≡	$\exists\mathbf{a}[j_1 = \langle w_0, \langle \mathbf{a}, t_0, e_0, w_0\rangle, \langle\ \rangle\rangle$ $\wedge\ \mathrm{AGT}(w_0)(e_0) = \mathbf{a}]$	ftn. 4, Ax1–2
8	≡	$\exists\mathbf{a}[j_1 = \langle w_0, \langle \mathbf{a}, t_0, e_0, w_0\rangle, \langle\ \rangle\rangle$ $\wedge\ \mathrm{AGT}_{w0}\ e_0 = \mathbf{a}]$	+abr

$j_1 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, \langle\ \rangle\rangle$
such that: $speak.up_{w0}(e_0, \mathrm{AGT}_{w0}\ e_0)$
$t_0 = \vartheta_{w0}\ e_0$
$a_1 = \mathrm{AGT}_{w0}\ e_0$

(8) be-

$j_1[s\ k^{\alpha}|\ \mathbf{d}\alpha =_{\mathbf{d}\omega} k^{\alpha}\{s\}]j_2$

1	$\equiv$	$\exists s, k^{\alpha}[j_2 = (s \cdot (k^{\alpha} \cdot j_1))$ $\wedge\ (\mathbf{d}\alpha =_{\mathbf{d}\omega} k^{\alpha}\{s\})j_1]$	A1iii
2	$\equiv$	$\exists s, k^{\alpha}[j_2 = (s \cdot \langle w_{j1}, \top_{j1}, (k^{\alpha} \cdot \bot_{j1})\rangle)$ $\wedge\ \lambda i[\mathbf{d}\alpha_i = k^{\alpha}\mathbf{d}\omega_i s]j_1]$	A1i spell.out
3	$\equiv$	$\exists s, k^{\alpha}[j_2 = \langle w_{j1}, \top_{j1}, (s \cdot (k^{\alpha} \cdot \bot_{j1}))\rangle$ $\wedge\ (\mathbf{d}\alpha_0)_{j1} = k^{\alpha}((\mathbf{d}\omega_0)_{j1})(s)]$	A1i λ, –abr
4	$\equiv$	$\exists s, k^{\alpha}[j_2 = \langle w_{j1}, \top_{j1}, (s \cdot (k^{\alpha} \cdot \bot_{j1}))\rangle$ $\wedge\ {}^{0+1}({}^{\alpha}(\top_{j1})) = k^{\alpha}({}^{0+1}({}^{\omega}(\top_{j1})))(s)]$	 A1ii
5	$\equiv$	$\exists s, k^{\alpha}[j_2 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, (s \cdot (k^{\alpha} \cdot \langle\ \rangle))\rangle$ $\wedge\ {}^{1}({}^{\alpha}\langle a_1, t_0, e_0, w_0\rangle)$ $= k^{\alpha}({}^{1}({}^{\omega}\langle a_1, t_0, e_0, w_0\rangle))(s)]$	j_1, A1.$\top$,$\bot$
6	$\equiv$	$\exists s, k^{\alpha}[j_2 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, (s \cdot \langle k^{\alpha}\rangle)\rangle$ $\wedge\ {}^{1}\langle a_1\rangle = k^{\alpha}({}^{1}\langle w_0\rangle)(s)]$	ftn. 4, Ax1–3
7	$\equiv$	$\exists s, k^{\alpha}[j_2 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, \langle s, k^{\alpha}\rangle\rangle$ $\wedge\ a_1 = k^{\alpha}(w_0)(s)]$	ftn. 4, Ax1–2
8	$\equiv$	$\exists s, k^{\alpha}[j_2 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, \langle s, k^{\alpha}\rangle\rangle$ $\wedge\ a_1 = k^{\alpha}w_0 s]$	 +abr

Sample j_2:

$j_2 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, \langle s_1, k^{\alpha}{}_1\rangle\rangle$

such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\ e_0)$

$t_0 = \vartheta_{w0}\ e_0$

$a_1 = \text{AGT}_{w0}\ e_0 \wedge a_1 = k^{\alpha}{}_1 w_0 s_1$

(8) -PRS
$j_2([\mid \mathbf{d}\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau];\ [\mid \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma])j_2$

1	$\equiv$	$\exists j[\lambda ij[j = i \wedge \vartheta_{\mathbf{d}\omega i}\ \mathbf{d}\varepsilon_i \subseteq \mathbf{d}\tau_i]j_2 j$ $\wedge\ \lambda ij[j = i \wedge \mathbf{d}\tau_i \subseteq \vartheta_{\mathbf{d}\omega i}\ d\sigma_i]jj_2]$	A1iii, A6
2	$\equiv$	$\exists j[j = j_2 \wedge \vartheta((\mathbf{d}\omega_0)_{j2})((\mathbf{d}\varepsilon_0)_{j2}) \subseteq (\mathbf{d}\tau_0)_{j2}$ $\wedge\ j_2 = j \wedge (\mathbf{d}\tau_0)_j \subseteq \vartheta((\mathbf{d}\omega_0)_j)((d\sigma_0)_j)]$	λ, –abr
3	$\equiv$	$\vartheta((\mathbf{d}\omega_0)_{j2})((\mathbf{d}\varepsilon_0)_{j2}) \subseteq (\mathbf{d}\tau_0)_{j2}$ $\wedge\ (\mathbf{d}\tau_0)_{j2} \subseteq \vartheta((\mathbf{d}\omega_0)_{j2})((d\sigma_0)_{j2})$	simplify
4	$\equiv$	$\vartheta({}^1({}^\omega(\top_{j2})))({}^1({}^\varepsilon(\top_{j2}))) \subseteq {}^1({}^\tau(\top_{j2}))$ $\wedge\ {}^1({}^\tau(\top_{j2})) \subseteq \vartheta({}^1({}^\omega(\top_{j2})))({}^1({}^\sigma(\bot_{j2})))$	A1ii
5	$\equiv$	$\vartheta({}^1({}^\omega\langle a_1, t_0, e_0, w_0\rangle))({}^1({}^\varepsilon\langle a_1, t_0, e_0, w_0\rangle))$ $\subseteq {}^1({}^\tau\langle a_1, t_0, e_0, w_0\rangle)$ $\wedge\ {}^1({}^\tau\langle a_1, t_0, e_0, w_0\rangle)$ $\subseteq \vartheta({}^1({}^\omega\langle a_1, t_0, e_0, w_0\rangle))({}^1({}^\sigma\langle s_1, k^\alpha{}_1\rangle))$	j_2, A1.$\top$,$\bot$
6	$\equiv$	$\vartheta({}^1\langle w_0\rangle)({}^1\langle e_0\rangle) \subseteq {}^1\langle t_0\rangle$ $\wedge\ {}^1\langle t_0\rangle \subseteq \vartheta({}^1\langle w_0\rangle)({}^1\langle s_1\rangle)$	ftn. 4, Ax1–3
7	$\equiv$	$\vartheta(w_0)(e_0) \subseteq t_0$ $\wedge\ t_0 \subseteq \vartheta(w_0)(s_1)$	ftn. 4, Ax1–2
8	$\equiv$	$\vartheta_{w0}\ e_0 \subseteq t_0 \subseteq \vartheta_{w0}\ s_1$	+abr
9	$\equiv$	$t_0 \subseteq \vartheta_{w0}\ s_1$	$t_0 = \vartheta_{w0}\ e_0$

Information update (no re-centering):
$j_2 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, \langle s_1, k^\alpha{}_1\rangle\rangle$
such that: $speak.up_{w0}(e_0, \mathrm{AGT}_{w0}\ e_0)$
$t_0 = \vartheta_{w0}\ e_0 \wedge t_0 \subseteq \vartheta_{w0}\ s_1$
$a_1 = \mathrm{AGT}_{w0}\ e_0 \wedge a_1 = k^\alpha{}_1 w_0 s_1$

Model for j_2 ($^\top$ on current topics):
j_2-reality: $^\top w_0$

•	$^\top e_0$: e_0-agent speaks up
|	$^\top t_0 = \vartheta_{w0}\ e_0$
—	s_1: e_0-speaker $^\top a_1$ instantiates $k^\alpha{}_1$

(8) busy
$j_2[\mathsf{I}\ \mathit{busy}\ d\kappa^{\alpha}]i_4$

1	$\equiv$	$\lambda ij[j = i$ $\wedge\ \forall w \in \mathrm{Dom}\ d\kappa^{\alpha}{}_{i}\forall s \in \mathrm{Dom}\ d\kappa^{\alpha}{}_{i}w$: $\mathit{busy}_w(s, d\kappa^{\alpha}{}_{i}ws)]j_2i_4$	A1iii df. *busy* $d\kappa^{\alpha}$
2	$\equiv$	$i_4 = j_2$ $\wedge\ \forall w \in \mathrm{Dom}\ (d\kappa^{\alpha}{}_{0})_{j2}\forall e^{\bullet} \in \mathrm{Dom}\ (d\kappa^{\alpha}{}_{0})_{j2}w\exists s$: $s = e^{\bullet} \wedge \mathit{busy}_w(s, (d\kappa^{\alpha}{}_{0})_{j2}\, ws)$	–abr, λ
3	$\equiv$	$i_4 = j_2$ $\wedge\ \forall w \in \mathrm{Dom}\ {}^{1}({}^{\omega\varepsilon\bullet\alpha}(\bot_{j2}))\forall e^{\bullet} \in \mathrm{Dom}\ {}^{1}({}^{\omega\varepsilon\bullet\alpha}(\bot_{j2}))w\exists s$: $s = e^{\bullet} \wedge \mathit{busy}_w(s, {}^{1}({}^{\omega\varepsilon\bullet\alpha}(\bot_{j2}))\, ws)$	A1ii
4	$\equiv$	$i_4 = j_2$ $\wedge\ \forall w \in \mathrm{Dom}\ {}^{1}({}^{\omega\varepsilon\bullet\alpha}\langle s_1, k^{\alpha}{}_{1}\rangle)$ $\forall e^{\bullet} \in \mathrm{Dom}\ {}^{1}({}^{\omega\varepsilon\bullet\alpha}\langle s_1, k^{\alpha}{}_{1}\rangle)w\exists s$: $s = e^{\bullet} \wedge \mathit{busy}_w(s, {}^{1}({}^{\omega\varepsilon\bullet\alpha}\langle s_1, k^{\alpha}{}_{1}\rangle)\, ws)$	A1ii, j_2
5	$\equiv$	$i_4 = j_2$ $\wedge\ \forall w \in \mathrm{Dom}\ {}^{1}\langle k^{\alpha}{}_{1}\rangle\forall e^{\bullet} \in \mathrm{Dom}\ {}^{1}\langle k^{\alpha}{}_{1}\rangle w\exists s$: $s = e^{\bullet} \wedge \mathit{busy}_w(s, {}^{1}\langle k^{\alpha}{}_{1}\rangle\, ws)$	ftn. 4, Table 1, Ax1–3
6	$\equiv$	$i_4 = j_2$ $\wedge\ \forall w \in \mathrm{Dom}\ k^{\alpha}{}_{1}\forall e^{\bullet} \in \mathrm{Dom}\ k^{\alpha}{}_{1}w\exists s$: $s = e^{\bullet} \wedge \mathit{busy}_w(s, k^{\alpha}{}_{1}\, ws)$	ftn. 4, Ax1–2

$i_4 = \langle w_0, \langle a_1, t_0, e_0, w_0\rangle, \langle s_1, k^{\alpha}{}_{1}\rangle\rangle$
such that: $\mathit{speak.up}_{w0}(e_0, \mathrm{AGT}_{w0}\ e_0)$
$t_0 = \vartheta_{w0}\ e_0 \wedge t_0 \subseteq \vartheta_{w0}\ s_1$
$a_1 = \mathrm{AGT}_{w0}\ e_0 \wedge a_1 = k^{\alpha}{}_{1}w_0s_1$
$\forall w \in \mathrm{Dom}\ k^{\alpha}{}_{1}\forall e^{\bullet} \in \mathrm{Dom}\ k^{\alpha}{}_{1}w\exists s$: $s = e^{\bullet} \wedge \mathit{busy}_w(s, k^{\alpha}{}_{1}\, ws)$

Model for i_4 ($^{\top}$ on current topics):
i_4-reality: $^{\top}w_0$ • $^{\top}e_0$: e_0-agent speaks up
| $^{\top}t_0 = \vartheta_{w0}\ e_0$
__ s_1: e_0-speaker $^{\top}a_1$ is $k^{\alpha}{}_{1}$-busy

(11) Sample output of speech start-up) + FAMILIAR e_1 (antec. for $d\varepsilon$)

$j_3 = \langle w_0, \langle t_0, e_0, w_0\rangle, \langle e_1\rangle\rangle$
such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\, e_0)$
$t_0 = \vartheta_{w0}\, e_0$

Model for j_3 ($^{\top}$ on current topics):

j_3-reality: $^{\top}w_0$	•	$^{\top}e_0$: e_0-agent speaks up
	|	$^{\top}t_0 = \vartheta_{w0}\, e_0$
	•	e_1:

MB: online update **RS**: essential effect

(11′) Today…
day -sg.LOC

$$j_3([k^\tau|\ k^\tau\ day.of\ \varepsilon^\bullet];\ [\mathbf{t}|\ \mathbf{t} \subseteq_{\mathbf{d}\omega} d\kappa^\tau\{\mathbf{d}\varepsilon\}])j_4$$

$$\begin{aligned} \equiv\ & \exists j([k^\tau|\ k^\tau\ day.of\ \varepsilon^\bullet]i_3 j \\ & \quad \wedge [\mathbf{t}|\ \mathbf{t} \subseteq_{\mathbf{d}\omega} d\kappa^\tau\{\mathbf{d}\varepsilon\}]jj_4) \end{aligned} \qquad \text{A1iii}$$

$$\begin{aligned} \equiv\ & \exists j[\exists k^\tau(j = \langle w_{i3}, \top_{i3}, (k^\tau \cdot \bot_{i3})\rangle && \text{A1iii, i} \\ & \qquad \wedge \forall w \in \text{Dom}\ k^\tau \forall e^\bullet \in \text{Dom}\ k^\tau w \exists t: && \text{ftn. 5} \\ & \qquad\quad t = k^\tau w e^\bullet \wedge day_w\ t \wedge \vartheta_w\ e^\bullet \subseteq t) \\ & \quad \wedge \exists \mathbf{t}(j_4 = \langle w_j, (\mathbf{t} \cdot \top_j), \bot_j\rangle \\ & \qquad \wedge \mathbf{t} \subseteq (d\kappa^\tau{}_0)_j((\mathbf{d}\omega_0)_j)((\mathbf{d}\varepsilon_0)_j))] \end{aligned}$$

$$\begin{aligned} \equiv\ & \exists j[\exists k^\tau(j = \langle w_0, \langle t_0, e_0, w_0\rangle, (k^\tau \cdot \langle e_1\rangle)\rangle && i_3\text{, A1.}\top,\bot \\ & \qquad \wedge \forall w \in \text{Dom}\ k^\tau \forall e^\bullet \in \text{Dom}\ k^\tau w \exists t: \\ & \qquad\quad t = k^\tau w e^\bullet \wedge day_w\ t \wedge \vartheta_w\ e^\bullet \subseteq t) \\ & \quad \wedge \exists \mathbf{t}(j_4 = \langle w_j, (\mathbf{t} \cdot \top_j), \bot_j\rangle && \text{Table 1,} \\ & \qquad \wedge \mathbf{t} \subseteq {}^1({}^{\omega\varepsilon\bullet\tau}(\bot_j))({}^1({}^{\omega}(\top_j)))({}^1({}^{\varepsilon}(\top_j))))] && \text{A1ii} \end{aligned}$$

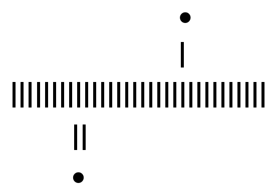
$$\begin{aligned} \equiv\ & \exists j \exists \mathbf{t} \exists k^\tau[j = \langle w_0, \langle t_0, e_0, w_0\rangle, \langle k^\tau, e_1\rangle\rangle && \text{ftn. 4,} \\ & \qquad \wedge j_4 = \langle w_0, (\mathbf{t} \cdot \langle t_0, e_0, w_0\rangle, \langle k^\tau, e_1\rangle\rangle && \text{Ax1–2} \\ & \qquad \wedge \forall w \in \text{Dom}\ k^\tau \forall e^\bullet \in \text{Dom}\ k^\tau w \exists t: && \text{A1.}\top, \bot \\ & \qquad\quad t = k^\tau w e^\bullet \wedge day_w\ t \wedge \vartheta_w\ e^\bullet \subseteq t) \\ & \qquad \wedge \mathbf{t} \subseteq {}^1({}^{\omega\varepsilon\bullet\tau}\langle k^\tau, e_1\rangle)({}^1({}^{\omega}\langle t_0, e_0, w_0\rangle))({}^1({}^{\varepsilon}\langle t_0, e_0, w_0\rangle)))] \end{aligned}$$

$$\begin{aligned} \equiv\ & \exists \mathbf{t} \exists k^\tau[j_4 = \langle w_0, \langle \mathbf{t}, t_0, e_0, w_0\rangle, \langle k^\tau, e_1\rangle\rangle && \text{ftn. 4,} \\ & \qquad \wedge \forall w \in \text{Dom}\ k^\tau \forall e^\bullet \in \text{Dom}\ k^\tau w \exists t: && \text{Ax1–5} \\ & \qquad\quad t = k^\tau w e^\bullet \wedge day_w\ t \wedge \vartheta_w\ e^\bullet \subseteq t) \\ & \qquad \wedge \mathbf{t} \subseteq {}^1\langle k^\tau\rangle({}^1\langle w_0\rangle)({}^1\langle e_0\rangle)] \end{aligned}$$

$$\begin{aligned} \equiv\ & \exists \mathbf{t} \exists k^\tau[j_4 = \langle w_0, \langle \mathbf{t}, t_0, e_0, w_0\rangle, \langle k^\tau, e_1\rangle\rangle && \text{ftn. 4} \\ & \qquad \wedge \forall w \in \text{Dom}\ k^\tau \forall e^\bullet \in \text{Dom}\ k^\tau w \exists t: && \text{Ax1–2} \\ & \qquad\quad t = k^\tau w e^\bullet \wedge day_w\ t \wedge \vartheta_w\ e^\bullet \subseteq t) \\ & \qquad \wedge \mathbf{t} \subseteq k^\tau w_0 e_0] && \text{+abr} \end{aligned}$$

Sample j_4:
$j_4 = \langle w_0, \langle t_{1.1}, t_0, e_0, w_0\rangle, \langle k^{\tau}{}_1, e_1\rangle\rangle$
such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\ e_0)$
$t_0 = \vartheta_{w0}\ e_0$ (e_0-now)
$\forall w \in \text{Dom}\ k^{\tau}{}_1 \forall e^{\bullet} \in \text{Dom}\ k^{\tau}{}_1 w \exists t$:
$t = k^{\tau}{}_1 we^{\bullet} \wedge day_w\ t \wedge \vartheta_w\ e^{\bullet} \subseteq t$ ($k^{\tau}{}_1 we^{\bullet}$ = day of $e^{\bullet}$)
$t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$ (subint. of e_0-day)

Model for j_4 ($^{\top}$ on current topics, note the new topic time):
j_4-reality: $^{\top}w_0$



$^{\top}e_0$: e_0-agent speaks up
$t_0 = \vartheta_{w0}\ e_0$
$k^{\tau}{}_1 w_0 e_0$: e_0-day
$^{\top}t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$
e_1:

(11′) … my dad…
dad- -1s.sg (⊥-subject)
$j_4([k_\alpha |\ k_\alpha\ dad.of\,\alpha];\ ^{\text{P}}[|\ 1s_{\mathbf{d}\omega}\ \text{AGT}\ \mathbf{d}\varepsilon];\ [a|\ a =_{\mathbf{d}\omega} d\alpha\kappa\{\text{AGT}, \mathbf{d}\varepsilon\}])j_5$

$\equiv\ \exists a, k_\alpha[j_5 = \langle w_0, \langle t_{1.1}, t_0, e_0, w_0\rangle, \langle a, k^{\alpha}, k^{\tau}{}_1, e_1\rangle\rangle$
$\wedge\ \forall a' \in \text{Dom}\ k_\alpha \forall w \in \text{Dom}\ k_\alpha a' \forall e^{\bullet} \in \text{Dom}\ k_\alpha a' w \exists a''$:
$a'' = k_\alpha a' w e^{\bullet} \wedge t = \vartheta_w\ e^{\bullet} \wedge dad.of_{w,t}(a'', a')$
$\wedge\ a = k_\alpha(\text{AGT}_{w0}\ e_0) w_0 e_0]$

Sample j_5:
$j_5 = \langle w_0, \langle t_{1.1}, t_0, e_0, w_0\rangle, \langle a_1, k_{\alpha,1}, k^{\tau}{}_1, e_1\rangle\rangle$
such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\ e_0)$
⋮
$\forall a \in \text{Dom}\ k_\alpha \forall w \in \text{Dom}\ k_\alpha a \forall e^{\bullet} \in \text{Dom}\ k_\alpha a w \exists a'$:
$a' = k_\alpha a w e^{\bullet} \wedge t = \vartheta_w\ e^{\bullet} \wedge dad.of_{w,t}(a', a)$
$a_1 = k_{\alpha,1}(\text{AGT}_{w0}\ e_0) w_0 e_0$ (dad of e_0-spkr)

(11′) … came by…
enter-
$j_5([l|\ d\varepsilon\text{: AGT}\ enter_{\mathbf{d}\omega}\ l];\ ^{\text{I}}[|\ \mathbf{d}\varepsilon \subseteq_{\mathbf{d}\omega} d\pi];$

-FCT$_{\perp}$
$^{\text{P}}[|\ \text{AGT}\ d\varepsilon =_{\mathbf{d}\omega} d\alpha];\ [|\ d\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau])j_6$

$\equiv\ \exists l[j_6 = \langle w_0, \langle t_{1.1}, t_0, e_0, w_0\rangle, \langle l, a_1, k^{\alpha}{}_1, k^{\tau}{}_1, e_1\rangle\rangle$
$\wedge\ enter_{w0}(e_1, \text{AGT}_{w0}\ e_1, l)$
$\wedge\ \Pi_{w0}\ e_0 \subseteq l$
$\wedge\ \text{AGT}_{w0}\ e_1 = a_1$
$\wedge\ \vartheta_{w0}\ e_1 \subseteq t_{1.1}]$

Sample j_6:

$j_6 = \langle w_0, \langle t_{1.1}, t_0, e_0, w_0\rangle, \langle l_1, a_1, k_{\alpha,1}, k^{\tau}{}_1, e_1\rangle\rangle$

such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\, e_0)$

$\vdots$

$enter_{w0}(e_1, \text{AGT}_{w0}\, e_1, l_1) \wedge \text{AGT}_{w0}\, e_1 = a_1$

$\Pi_{w0}\, e_0 \subseteq l_1$

$\vartheta_{w0}\, e_1 \subseteq t_{1.1}$

Model for j_6 ($^{\top}$ on current topics):

j_6-reality: $^{\top}w_0$	•	$^{\top}e_0$: e_0-agent speaks up
	|	$t_0 = \vartheta_{w0}\, e_0$
	||||||||||||||||||||||||||||||	$k^{\tau}{}_1 w_0 e_0$: e_0-day
	||	$^{\top}t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$
	•	e_1: e_0-speaker's father a_1 enters e_0-here l_1

(11′) … when… (**update** $^{\top}\tau$ by -FCT$_{\perp}$, $^{\top}\alpha$ by -3s$_{\perp}$)

$$j_6([\mathbf{t}|\ \mathbf{t} =_{\mathbf{d}\omega} \vartheta\text{RES}\ d\varepsilon];\ ^{\text{P}}[|\ \overset{\text{-3s}_{\perp}}{3s}_{\mathbf{d}\omega}\ d\alpha];\ [\mathbf{a}|\ \mathbf{a} \neq d\alpha])j_7$$

$$\equiv\ \exists \mathbf{a}, \mathbf{t}[j_7 = \langle w_0, \langle \mathbf{a}, \mathbf{t}, t_{1.1}, t_0, e_0, w_0\rangle, \langle l, a_1, k^{\alpha}{}_1, k^{\tau}{}_1, e_1\rangle\rangle$$

$$\wedge\ \mathbf{t} = \vartheta_{w0}\ \text{RES}_{w0}\ e_1$$

$$\wedge\ 3s_{w0}\ a_1 \qquad (\text{sg. } a_1, a_1 \notin \{\text{AGT}_{w0}\ e_0, \text{EXP}_{w0}\ e_0\})$$

$$\wedge\ \mathbf{a} \neq a_1]$$

Sample j_7:

$j_7 = \langle w_0, \langle a_2, t_{1.2}, t_{1.1}, t_0, e_0, w_0\rangle, \langle l_1, a_1, k_{\alpha,1}, k^{\tau}{}_1, e_1\rangle\rangle$

such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\, e_0)$

$\vdots$

$t_{1.2} = \vartheta_{w0}\ \text{RES}_{w0}\ e_1$

$3s_{w0}\ a_1$ (i.e. e_0-spkr's dad $a_1 \neq e_0$-addressee)

$a_2 \neq a_1$ (i.e. e_0-spkr's dad $a_1 \neq \alpha$-topic a_2)

Model for j_7 ($^{\top}$ on current topics, note new topic time)

j_7-reality: $^{\top}w_0$	•	$^{\top}e_0$: e_0-agent speaks up
	|	$t_0 = \vartheta_{w0}\, e_0$
	||||||||||||||||||||||||||||||	$k^{\tau}{}_1 w_0 e_0$: e_0-day
	||	$t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$
	•	e_1: e_0-speaker's father a_1 enters e_0-here l_1
	||	$^{\top}t_{1.2} = \vartheta_{w0}\, e_1$

(11′a) … you were asleep.

sleep-

$j_7([s|\ s\text{: EXP } sleep_{\mathbf{d}\omega}];$

-IND. .IV

$^{P}[|\ \text{BEG } d\sigma <_{\mathbf{d}\omega} \mathbf{d}\varepsilon];\ [|\ \mathbf{d}\tau \subseteq_{\mathbf{d}\omega} d\sigma];\ ^{P}[|\ \text{EXP } d\sigma =_{\mathbf{d}\omega} \mathbf{d}\alpha];$

-2s

$^{P}[|\ 2s_{\mathbf{d}\omega}\ \mathbf{d}\alpha])j_{8a}$

$$\equiv\ \exists s[j_{8a} = \langle w_0, \langle a_2, t_{1.2}, t_{1.1}, t_0, e_0, w_0\rangle, \langle s, l_1, a_1, k^{\alpha}{}_1, k^{\tau}{}_1, e_1\rangle\rangle$$
$$\wedge\ sleep_{w0}(s, \text{EXP}_{w0}\ s)$$
$$\wedge\ \vartheta_{w0}\ \text{BEG}_{w0}\ s < \vartheta_{w0}\ e_0$$
$$\wedge\ t_{1.2} \subseteq \vartheta_{w0}\ s$$
$$\wedge\ \text{EXP}_{w0}\ s = a_2$$
$$\wedge\ a_2 = \text{EXP}_{w0}\ e_0]$$

Sample j_{8a}:

$j_{8a} = \langle w_0, \langle a_2, t_{1.2}, t_{1.1}, t_0, e_0, w_0\rangle, \langle s_2, l_1, a_1, k_{\alpha,1}, k^{\tau}{}_1, e_1\rangle\rangle$

such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\ e_0)$

⋮

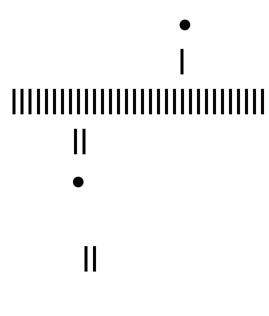
$sleep_{w0}(s_2, \text{EXP}_{w0}\ s_2) \wedge \text{EXP}_{w0}\ s_2 = a_2$

$\text{EXP}_{w0}\ e_0 = a_2$

$\vartheta_{w0}\ \text{BEG}_{w0}\ s_2 < \vartheta_{w0}\ e_0 \wedge t_{1.2} \subseteq \vartheta_{w0}\ s_2$

Model for j_{8a}

j_{8a}-reality: $^{\top}w_0$



$^{\top}e_0$: e_0-agent speaks up

$t_0 = \vartheta_{w0}\ e_0$

$k^{\tau}{}_1 w_0 e_0$: e_0-day

$t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$

e_1: e_0-speaker's father a_1 enters e_0-here l_1

$^{\top}t_{1.2} = \vartheta_{w0}\ e_1$

s_2: e_0-addr. $^{\top}a_2$ ($\neq a_1$) is asleep

(11′b) … I woke up.

wake.up-

$j_7([e|\ e\text{: EXP } \mathit{wake.up}_{\mathbf{d}\omega}];$

-IND. .IV

${}^{P}[|\ d\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon]; [|\ d\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau]; {}^{P}[|\ \text{EXP } d\varepsilon =_{\mathbf{d}\omega} \mathbf{d}\alpha];$

-1s

${}^{P}[|\ \mathit{1s}_{\mathbf{d}\omega}\, \mathbf{d}\alpha])j_{8b}$

$$\equiv\ \exists e[j_{8b} = \langle w_0, \langle a_2, t_{1.2}, t_{1.1}, t_0, e_0, w_0\rangle, \langle e, l_1, a_1, k^{\alpha}{}_1, k^{\tau}{}_1, e_1\rangle\rangle$$
$$\wedge\ \mathit{wake.up}_{w0}(e, \text{EXP}_{w0}\ e)$$
$$\wedge\ \vartheta_{w0}\ e < \vartheta_{w0}\ e_0$$
$$\wedge\ \vartheta_{w0}\ e \subseteq t_{1.2}$$
$$\wedge\ \text{EXP}_{w0}\ e = a_2$$
$$\wedge\ a_2 = \text{AGT}_{w0}\ e_0]$$

Sample j_{8b}:

$j_{8b} = \langle w_0, \langle a_2, t_{1.2}, t_{1.1}, t_0, e_0, w_0\rangle, \langle e_2, l_1, a_1, k_{\alpha,1}, k^{\tau}{}_1, e_1\rangle\rangle$

such that: $\mathit{speak.up}_{w0}(e_0, \text{AGT}_{w0}\ e_0)$

⋮

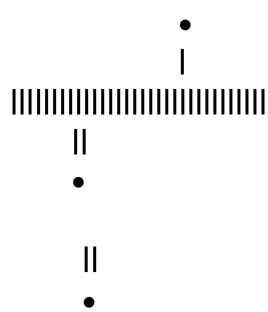
$\mathit{wake.up}_{w0}(e_2, \text{EXP}_{w0}\ e_2) \wedge \text{EXP}_{w0}\ e_2 = a_2$

$\text{AGT}_{w0}\ e_0 = a_2$

$\vartheta_{w0}\ e_2 < \vartheta_{w0}\ e_0 \wedge \vartheta_{w0}\ e_2 \subseteq t_{1.2}$

Model for j_{8b}

j_{8b}-reality: ${}^{\top}w_0$



${}^{\top}e_0$: e_0-agent speaks up

$t_0 = \vartheta_{w0}\ e_0$

$k^{\tau}{}_1 w_0 e_0$: e_0-day

$t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$

e_1: e_0-speaker’s father a_1 enters e_0-here l_1

${}^{\top}t_{1.2} = \vartheta_{w0}\ e_1$

e_2: e_0-speaker ${}^{\top}a_2\ (\neq a_1)$ wakes up

(11′c) …we played chess.

play.chess-

$j_7([ee|\ ee\text{: AGT } play.chess_{\mathbf{d}\omega}];$

-IND. .IV

$^{\mathrm{P}}[|\ {}^1d\varepsilon\varepsilon <_{\mathbf{d}\omega} \mathbf{d}\varepsilon]; [|\ {}^1d\varepsilon\varepsilon \subseteq_{\mathbf{d}\omega} \mathbf{d}\tau];\ {}^{\mathrm{P}}[|\text{ AGT } d\varepsilon\varepsilon =_{\mathbf{d}\omega} \mathbf{d}\alpha];$

-1p

$^{\mathrm{P}}[|\ 1p_{\mathbf{d}\omega}\ \mathbf{d}\alpha])j_{8c}$

$\equiv\ \exists ee[j_{8c} = \langle w_0, \langle a_2, t_{1.2}, t_{1.1}, t_0, e_0, w_0\rangle, \langle ee, l_1, a_1, k^{\alpha}{}_1, k^{\tau}{}_1, e_1\rangle\rangle$

$\wedge\ process_{w0}\ ee$

$(:= \forall e \in \text{Dom } ee\text{: } \vartheta_{w0}\ ee(e) \subseteq \vartheta_{w0}\ \text{RES}_{w0}\ e)$

$\wedge\ \forall e \in ee\text{: } play.chess_{w0}(e, \text{AGT}_{w0}\ e)$

$\wedge\ \text{AGT}_{w0}\ ee = \bigcup\{\text{AGT}_{w0}\ e\text{: } e \in ee\}$

$\wedge\ \vartheta_{w0}\ {}^1ee < \vartheta_{w0}\ e_0$

$\wedge\ \vartheta_{w0}\ {}^1ee \subseteq t_{1.2}$

$\wedge\ \text{AGT}_{w0}\ ee = a_2$

$\wedge\ \text{AGT}_{w0}\ e_0 \in a_2]$

Sample j_{8c}:

$j_{8c} = \langle w_0, \langle a_2, t_{1.2}, t_{1.1}, t_0, e_0, w_0\rangle, \langle ee_2, l_1, a_1, k_{\alpha,1}, k^{\tau}{}_1, e_1\rangle\rangle$

such that: $speak.up_{w0}(e_0, \text{AGT}_{w0}\ e_0)$

⋮

$process_{w0}\ ee_2$

$(:= \forall e \in \text{Dom } ee_2\text{: } \vartheta_{w0}\ ee_2(e) \subseteq \vartheta_{w0}\ \text{RES}_{w0}\ e)$

$\forall e \in ee_2\text{: } play.chess_{w0}(e, \text{AGT}_{w0}\ e)$

$a_2 = \text{AGT}_{w0}\ ee_2 = \bigcup\{\text{AGT}_{w0}\ e\text{: } e \in ee_2\}$

$\text{AGT}_{w0}\ e_0 \in a_2$

$\vartheta_{w0}\ {}^1ee_2 < \vartheta_{w0}\ e_0 \wedge \vartheta_{w0}\ {}^1e_2 \subseteq t_{1.2}$

Model for j_{8c}

j_{8c}-reality: $^{\top}w_0$		
	•	$^{\top}e_0$: e_0-agent speaks up
	|	$t_0 = \vartheta_{w0}\ e_0$
	||||||||||||||||||||||||||||||	$k^{\tau}{}_1 w_0 e_0$: e_0-day
	||	$t_{1.1} \subseteq k^{\tau}{}_1 w_0 e_0$
	•	e_1: e_0-speaker's father a_1 enters e_0-here l_1
	||	$^{\top}t_{1.2} = \vartheta_{w0}\ e_1$
	•••	ee_2: {e_0-spkr, ?} = $^{\top}a_2$ ($\neq a_1$) play chess (*implicature*: ? = a_1)