

YUKATEK: MAYAN

Chan t'u'ul ichil le sahkabo'
 "Little Rabbit in the Cave" (§1)

ONLINE UPDATE

Maria Bittner (4/24/2005)

TEXT: D. and A. Bolles, 1996, *A Grammar of the Yucatecan Mayan Language/The Exploits of Juan Thul, The Trickster Rabbit*. <http://www.famsi.org/reports/96072/grammar/section42.html>.

GLOSSES & TRANSLATION: See the *text* pdf at <http://www.rci.rutgers.edu/~mbittner/ym.html>.

ONLINE UPDATE: See Bittner 2004 'Online Update: Quantified *de se* and polysynthesis'.

The following table lists some basic symbols of the semantic representation language to be used:

TABLE 1. Variables, demonstratives, and logical constants of *Logic of Centering*

Type	Abbr.	Name of objects	[⊤] Var	[⊥] Var	[⊤] Dem	[⊥] Dem	Con
<i>t</i>		truth values					
ω		worlds	w	<i>w</i>			
ε		events	e	<i>e</i>			
σ		states	s	<i>s</i>			
α		animates	a	<i>a</i>			
β		inanimates	b	<i>b</i>			
τ		times	t	<i>t</i>			
π		places	l	<i>l</i>			
ωt	Ω	ω -domains (propositions)	p	<i>p</i>			
$\varepsilon \Omega$		ε -dependent propositions	p_{ε}	<i>p_{ε}</i>			
εt		ε -domains	E	<i>E</i>			
$\varepsilon \varepsilon$		ε -chains (processes)	ee	<i>ee</i>			
$\omega \varepsilon$	\exists	ε -concepts	ℰ	<i>ℰ</i>			
$\exists \exists$		ε -concept chains	ℰℰ	<i>ℰℰ</i>			
$\omega \tau t$	θ	τ -domain concepts	ℳ	<i>ℳ</i>			
$\omega \tau v$	η^v	v -habits ($v \in \{\varepsilon, \sigma, \varepsilon \varepsilon\}$)	h^v	<i>h^v</i>			
$\omega v n$	κ^n	n -kinds ($n \in \{\alpha, \beta, \tau, \pi\}$)	kⁿ	<i>kⁿ</i>			
\vdots	\vdots	\vdots					
<i>s</i>		stacks (of dref objects)					
$\omega \times s \times s$	<i>s</i>	information-and-attention states		<i>i, j</i>			
<i>sa</i>		a -demonstratives (a , dref type)			da_n	<i>da_n</i>	
<i>sst</i>		updates					
$\omega \sigma \varepsilon$		state onset					BG
$\omega \varepsilon \sigma$		result state					RS
$\omega \varepsilon \alpha$		agent					AG
$\omega e \alpha$		dative ($e \in \{\varepsilon, \sigma\}$)					DA
$\omega e \beta$		theme object ($e \in \{\varepsilon, \sigma\}$)					OB
$\omega e \tau$		time ($e \in \{\varepsilon, \sigma\}$)					ϑ
$\omega e \pi$		place ($e \in \{\varepsilon, \sigma\}$)					Π

Form MB gloss (stands for) 1st ex Presuppositional test (P); update; implicature (I)

NON-STATIVE markers:

<i>kéen</i>	[DEP (inchoative dep.)	§1.6	[$^1d\exists\exists \subseteq \vartheta RS \mathbf{d}\exists$];
<i>káa</i>	DEP] (completive dep.)	§1.2	[el $e \subseteq_{d\Omega} \vartheta RS \mathbf{d}\varepsilon$];
<i>kap'</i>	[V (inchoative)		[el $e \subseteq_{d\Omega} \mathbf{d}\tau$]; [$\mathcal{E}\mathcal{E} \mathbf{d}\varepsilon =_{d\Omega} \mathbf{^1}\mathcal{E}\mathcal{E}$]
<i>h-</i>	IV] (completive intr.)	§1.2	[$\mathbf{d}\varepsilon \subseteq_{d\Omega} \mathbf{d}\tau$]; [DA $\mathbf{d}\varepsilon =_{d\Omega} \mathbf{d}\alpha$]
<i>t-</i>	TV] (completive tr.)	§1.2	[$\mathbf{d}\varepsilon \subseteq_{d\Omega} \mathbf{d}\tau$]; [AG $\mathbf{d}\varepsilon \neq_{d\Omega} OB \mathbf{d}\varepsilon$]
<i>k-</i>	V (verbal concept)	§1.5	[$\mathcal{E} \mathcal{E} \subseteq \mathbf{d}\omega\tau$] (or [$h^\varepsilon \mathbf{d}\tau \subseteq_{d\Omega} h^\varepsilon$])

STATE markers:

<i>ts'o'k</i>	PRF (final result state)	§1.2	[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [el $\mathbf{d}\sigma =_{d\Omega} RS \mathbf{e}$]
<i>táan</i>	PRG (initial res state)	§1.1	[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [$\mathcal{E}\mathcal{E} \mathbf{d}\sigma =_{d\Omega} RS \mathbf{^1}\mathcal{E}\mathcal{E}$]
<i>òolak</i>	ALM (penult. res state)		[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [$\mathcal{E}\mathcal{E} \mathbf{d}\sigma =_{d\Omega} RS \mathbf{^{f-1}}\mathcal{E}\mathcal{E}$, $no_{d\Omega} \mathbf{^f}\mathcal{E}\mathcal{E}$]
<i>táak</i>	DES (state of desire)		[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [$\mathcal{E} (\mathbf{d}\sigma: DA \text{ want}_{d\Omega} \mathcal{E}), \mathcal{E} \subseteq \mathbf{d}\omega\tau$]
<i>k'a'náan</i>	NEED (state of need)		[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [$\mathcal{E} (\mathbf{d}\sigma: DA \text{ need}_{d\Omega} \mathcal{E}), \mathcal{E} \subseteq \mathbf{d}\omega\tau$]
<i>he'</i>	CRT (state of certainty)	§6.4	[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [$\mathcal{E} (\mathbf{d}\sigma: DA \text{ sure.of}_{d\Omega} \mathcal{E}), \mathcal{E} \subseteq \mathbf{d}\omega\tau$]
<i>yan</i>	EXP (st of expectation)	§1.5	[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [$\mathcal{E} (\mathbf{d}\sigma: DA \text{ expect}_{d\Omega} \{d\exists, \neg d\exists\}), \mathcal{E} \subseteq_{d\Omega} \mathbf{d}\omega\tau$]
<i>b'iin</i>	PRD (res st of prediction)		[s $\mathbf{d}\tau \subseteq_{d\Omega} s, s =_{d\Omega} RS \mathbf{d}\varepsilon$]; [$\mathcal{E} (\mathbf{d}\varepsilon: AG \text{ predict}_{d\Omega} \mathcal{E}), \mathcal{E} \subseteq \vartheta RS \mathbf{d}\varepsilon$]
<i>mukah</i>	PRE ('be about to')	§1.7	[s $\mathbf{d}\tau \subseteq_{d\Omega} s$]; [$\mathbf{d}\tau < d\exists\exists \subseteq \vartheta RS BG \mathbf{d}\sigma$]; [$\mathbf{d}\sigma: DA \text{ intend}_{d\Omega} d\exists\exists$]

STATE CONCEPT markers:

<i>ta'itak</i>	PRE ₁ ('be just about to')		P [$\mathbf{d}\omega\tau = \vartheta d\omega\sigma, \mathbf{d}\tau < d\exists \subseteq \mathbf{d}\omega\tau$]; [$kk^x \pm scale(kk^x, \vartheta d\omega\sigma, \cdot), \mathbf{d}\omega\tau = \mathbf{^1}kk^x \{d\omega\sigma\}$]; [s $s =_{d\Omega} d\omega\sigma$]
<i>táant</i>	PRF ₁ (short result state)		P [$\mathbf{d}\omega\tau = \vartheta RS \mathbf{d}\exists$]; [$kk^x \pm scale(kk^x, \vartheta RS \mathbf{d}\exists, \cdot), \mathbf{d}\omega\tau =_{d\Omega} \mathbf{^1}kk^x \{d\exists\}$]; [s $s =_{d\Omega} RS \mathbf{d}\exists$]
<i>sáam</i>	PRF ₂ (mid result state)	§2.1	P [$\mathbf{d}\omega\tau = \vartheta RS \mathbf{d}\exists$]; [$kk^x \pm scale(kk^x, \vartheta RS \mathbf{d}\exists, \cdot), \mathbf{^1}kk^x <_{d\Omega} \mathbf{d}\omega\tau <_{d\Omega} \mathbf{^f}kk^x$]; [s $BG \mathbf{s} \subseteq_{d\Omega} \mathbf{^f}d\omega\tau$]
<i>úuch</i>	PRF ₃ (long result state)		P [$\mathbf{d}\omega\tau = \vartheta RS \mathbf{d}\exists$]; [$kk^x \pm scale(kk^x, \vartheta RS \mathbf{d}\exists, \cdot), \mathbf{d}\omega\tau =_{d\Omega} \mathbf{^f}kk^x \{d\exists\}$]; [s $BG \mathbf{s} \subseteq_{d\Omega} \mathbf{^f}d\omega\tau$]

MOOD-CENTERING inflection ('status'):

IND	P [$\vartheta_{d\Omega} \mathbf{d}\varepsilon < \vartheta_{d\omega} \mathbf{d}\varepsilon$];	IV _A	[AG $\mathbf{d}\varepsilon =_{d\Omega} \mathbf{d}\alpha$]
ELA]	[$^f d\exists\exists \subseteq \vartheta RS BG \mathbf{d}\sigma$];	IV _U	[DA $\mathbf{d}\varepsilon =_{d\Omega} \mathbf{d}\alpha$]
ELA	[BG $\mathbf{d}\sigma \subseteq \vartheta RS \mathbf{^1}d\exists\exists$];	TV _A	[AG $d\exists\exists = \mathbf{d}\alpha, DA \mathbf{d}\exists\exists = d\alpha$];
		TV _U	[DA $d\exists\exists = \mathbf{d}\alpha, AG \mathbf{d}\exists\exists = d\alpha$]

Clause-final TOPIC UPDATE:

=e'	TM ^T (new tmp or mod topic)	§1.1	[t $\mathbf{t} =_{d\Omega} \vartheta RS \mathbf{d}\varepsilon$]	§1.8	[p _ω p _ω = dωΩ]
=i'	LM ^T (new loc or mod topic)	§1.2	[l $\mathbf{l} = d\tau$]	§2.1	[\mathcal{T} $\mathcal{T} = \vartheta RS \mathbf{d}\exists$]
=o'	DT ^T (topicalize <i>that</i>)	§1.9	[t $\mathbf{t} =_{d\Omega} \vartheta RS \mathbf{d}\varepsilon$]	§1.7	[\mathcal{T} $\mathcal{T} = \vartheta RS \mathbf{^1}d\exists\exists$]
=a'	DS ^T (topicalize <i>this</i>)	§1.8	[k ^β k ^β = dk ^β]	§1.3	[p _ε p _ε = dεΩ]

§1. *Hunted Rabbit finds a cave*

(•) *Speech start-up*

[**w** | **w** = *r*]; [**e** | **e**: AG *speak up*_{dω}]; [**t** | **t** =_{dω} **ϑ****dε**];

reality [⊤]*w**: • [⊤]*e**: speech event
| [⊤]*t**: *e**-now

(1) Once upon a time, they say, there was...¹

Yàan

initial field (*if*)

be.

.3s

[$\mathcal{E} k^\alpha$ | $\mathcal{E} \in \text{Dom } k^\alpha$]; ^P[*l* 3s $dk^\alpha\{d\mathfrak{D}\}$]; [**a** | **a** = $dk^\alpha\{d\mathfrak{D}\}$];

bin

x.SAY

[**p** | **e**: AG *say*_{dω} **p**], (AG **dε** =_{dω} DA *e*), **dε** ⊆_{dω} **ϑ**RS *e*];

...a little rabbit...²

hun- -túul

initial boundary (*ib*)

one- -CL_α

[*l* *one*_{dΩ}(**dα**, dk^α)]; ^P[*l* *animate* dk^α];

chan t'u'1 =*e*'

little *rabbit* =TM[⊤]

[*l* *small*_{dΩ}(**dα**, dk^α)]; [*l* *rabbit*_{dΩ} **dα**]; [**t** | **t** =_{dΩ} **ϑ**RS *d*];

reality [⊤]*w**: • [⊤]*e**: speech event
| [⊤]*t**: *e**-now
•===== *e*₁, RS_{w*} *e*₁: *e**-spkr is told [⊤]*p*₀, remembers [⊤]*p*₀

story world *w*₀ ∈ [⊤]*p*₀:

- $\mathcal{E}_0 w_0$: event with $k^\alpha_{1.1}$ -small rabbit [⊤]*a*₀
- || [⊤]*t*₁ = **ϑ**_{w₀} RS $\mathcal{E}_0 w_0$: \mathcal{E}_0 -result time

¹ • In any realization of \mathcal{E} , there is a k^α -animate

$$\mathcal{E} \in \text{Dom } k^\alpha \quad := \quad \lambda i. \forall w \in \text{Dom } \mathcal{E}: \mathcal{E}w \in \text{Dom } k^\alpha w$$

• In any realization of $d\mathfrak{D}$, **a** is the k^α -animate in $d\mathfrak{D}$

$$\mathbf{a} = dk^\alpha\{d\mathfrak{D}\} \quad := \quad \lambda i. \forall w \in \text{Dom } d\mathfrak{D}: \mathbf{a} = dk^\alpha_i w d\mathfrak{D}_i w$$

• In **dω**, *e*-agent says **p**, **dε**-speaker is the *e*-addressee, and **dε** occurs during *e*-result time

$$e: \text{AG } say_{d\omega} \mathbf{p} \quad := \quad \lambda i. say_{d\omega i}(e, \text{AG}_{d\omega i} e, \mathbf{p})$$

$$\text{AG } \mathbf{d\varepsilon} =_{d\omega} \text{DA } e \quad := \quad \lambda i. \text{AG}_{d\omega i} \mathbf{d\varepsilon}_i = \text{DA}_{d\omega i} e$$

$$\mathbf{d\varepsilon} \subseteq_{d\omega} \mathfrak{VRS } e \quad := \quad \lambda i. \mathfrak{V}_{d\omega i} \mathbf{d\varepsilon}_i \subseteq \mathfrak{V}_{d\omega i} \text{RS}_{d\omega i} e$$

² • In **dΩ**, *dα* is one dk^α -animate (i.e. *a* is a dk^α and no proper part of *a* is a dk^α), and is small for dk^α

$$one_{d\Omega}(d\alpha, dk^\alpha) \quad := \quad \lambda i. \forall w \in \mathbf{d}\Omega_i \forall a': a' \leq d\alpha_i \wedge a' \in \text{Ran } dk^\alpha_i w \Leftrightarrow a' = d\alpha_i$$

$$small_{d\Omega}(d\alpha, dk^\alpha) \quad := \quad \lambda i. \forall w \in \mathbf{d}\Omega_i: small_w(d\alpha_i, \text{Ran } dk^\alpha_i w)$$

...who was chased...³

túun

final field (*ff*)/ dep *ib*

PRG. (táan)

.3s (u)

[s| $\mathbf{d}\tau \subseteq_{\mathbf{d}\Omega} s$]; [$\mathcal{E}\mathcal{E}$] $d\sigma =_{\mathbf{d}\Omega} \text{RS } ^1\mathcal{E}\mathcal{E}$]; P [| 3s _{$\mathbf{d}\Omega$} $\mathbf{d}\alpha$]; [| DA $d\sigma =_{\mathbf{d}\Omega} \mathbf{d}\alpha$]

chuk-

dep *mf*

catch-

[\mathcal{E}] \mathcal{E} : AG *catch* DA];

+pàach+t

+try+iv_A\tv_A

[| $d\exists\exists$: AG *try.to* $d\exists$]; [| DA $d\exists\exists =_{\mathbf{d}\Omega} \text{DA } d\exists$]

-a'l

-ELA.

.TV_U

[| BG $d\sigma \subseteq \text{RS } ^1d\exists\exists$]; [a] DA $d\exists\exists = \mathbf{d}\alpha$, AG $d\exists\exists = a$];

...by a hunter. ⁴

tuméen

hun-

-túul

dep *ff*

by/because

one-

-CL _{α}

[| AG $d\exists\exists = \mathbf{d}\alpha$]; [k^α] $one_{\mathbf{d}\Omega}(\mathbf{d}\alpha, k^\alpha)$]; P [| $animate \mathbf{d}\kappa^\alpha$];

h-

ts'òon

=e'

M-

hunter

=TM^T

[| $male \mathbf{d}\kappa^\alpha$]; [| $hunter \mathbf{d}\kappa^\alpha$]; [\mathcal{J}] $\mathcal{J} = \mathcal{J}\text{RS } ^{f-1}d\exists\exists$];

-
- ³ • In $\mathbf{d}\Omega$, $d\sigma$ is the result state of the first stage of process $\mathcal{E}\mathcal{E}$ (where $^1\mathcal{E}\mathcal{E} := \iota\mathcal{E}(\mathcal{E} \in \text{Dom } \mathcal{E}\mathcal{E} \wedge \mathcal{E} \notin \text{Ran } \mathcal{E}\mathcal{E})$)
- $d\sigma =_{\mathbf{d}\Omega} \text{RS } ^1\mathcal{E}\mathcal{E} \quad := \quad \lambda i. \forall w \in \mathbf{d}\Omega_i: d\sigma_i = \text{RS}_w [^1\mathcal{E}\mathcal{E}](w)$
- In any event realizing \mathcal{E} , the agent catches the experiencer
 \mathcal{E} : AG *catch* DA $\quad := \quad \lambda i. \forall w \in \text{Dom } \mathcal{E}\exists e: e = \mathcal{E}w \wedge \text{catch}_w(e, \text{AG}_w e, \text{DA}_w e)$
 - Any realization of $d\exists\exists$ is a process whose agent tries to realize $d\exists$ during the result state of the final stage of $d\exists\exists$ ($d\exists\exists$: AG *try.to* $d\exists$) $\quad := \quad \lambda i. \text{process } \langle ^1d\exists\exists_i, \dots, ^f d\exists\exists_i, d\exists_i \rangle$
 $\quad \wedge \forall \mathcal{E} \in \text{Dom } d\exists\exists, \forall w \in \text{Dom } \mathcal{E}: \text{AG}_w \mathcal{E}w = \text{AG}_w d\exists_i w$
 - $\mathcal{E}\mathcal{E}$ characterizes a process (chain of event concepts, each contingent on & during RS of the preceding concept)
 $\text{process } \mathcal{E}\mathcal{E} \quad := \quad \forall \mathcal{E} \in \text{Dom } \mathcal{E}\exists \mathcal{E}': \mathcal{E}' = \mathcal{E}\mathcal{E}(\mathcal{E})$
 $\quad \wedge \text{Dom } \mathcal{E}' \subseteq \text{Dom } \mathcal{E}$
 $\quad \wedge \forall w \in \text{Dom } \mathcal{E}': \mathcal{J}_w \mathcal{E}'w \subseteq \mathcal{J}_w \text{RS}_w \mathcal{E}w$
 - In $d\Omega$, the experiencer of $d\exists\exists$ -process (chase) is the experiencer of $d\exists$ -event (catch)
 $\text{DA } d\exists\exists =_{\mathbf{d}\Omega} \text{DA } d\exists \quad := \quad \lambda i. \forall w \in \text{Dom } d\Omega \forall \mathcal{E} \in d\exists\exists_i: \text{DA}_w \mathcal{E}w = \text{DA}_w d\exists_i w$
 - The experiencer of any realized stage of $d\exists\exists$ -process (chase) is the topical animate $\mathbf{d}\alpha$
 $\text{DA } d\exists\exists = \mathbf{d}\alpha \quad := \quad \lambda i. \forall \mathcal{E} \in d\exists\exists, \forall w \in \text{Dom } \mathcal{E}: \text{DA}_w \mathcal{E}w = \mathbf{d}\alpha_i$
- ⁴ • Any $\mathbf{d}\kappa^\alpha$ -animate is a hunter
 $\text{hunter } \mathbf{d}\kappa^\alpha \quad := \quad \lambda i. \forall w \in \mathbf{d}\kappa^\alpha_i \forall a \in \text{Ran } \mathbf{d}\kappa^\alpha_i: \text{hunter}_w a$

reality $\top w^*$: •
|
•===== $\top e^*$: speech event
 t^* : e^* -now
 $e_1, RS_{w^*} e_1$: e^* -spkr is told $\top p_0$, remembers $\top p_0$

story world $w_0 \in \top p_0$:
 • $\mathcal{E}_0 w_0$: event with $k_{1.1}^\alpha$ -small rabbit $\top a_0$
 || $\top t_1 = \mathfrak{D}_{w_0} RS \mathcal{E}_0 w_0$: \mathcal{E}_0 -result time
 • $[^1 \mathcal{E} \mathcal{E}_1](w_0)$: 1st stage of $\mathcal{E} \mathcal{E}_1$ -chase of
 $k_{1.1}^\alpha$ -small rabbit $\top a_0$ by $k_{1.2}^\alpha$ -hunter a_1
 = $s_{1.2} = RS_{w_0} [^1 \mathcal{E} \mathcal{E}_1](w_0)$:
 result state of 1st stage of $\mathcal{E} \mathcal{E}_1$ -chase

$w_1 \in \text{Dom } \mathcal{E}_1 = p_1$ (success worlds of a_1 -hunter)
 •••••• $\langle [^1 \mathcal{E} \mathcal{E}_1](w_1), \dots [^f \mathcal{E} \mathcal{E}_1](w_1) \rangle$:
 hunter a_1 tries to realize \mathcal{E}_1 -catch during
 result state of final stage of $\mathcal{E} \mathcal{E}_1$ -chase
 • $\mathcal{E}_1 w_1$: hunter a_1 catches rabbit $\top a_0$
 || $\top \mathcal{T}_1 w_1 = \mathfrak{D}_{w_1} [^f \mathcal{E} \mathcal{E}_1](w_1)$:
 time of final stage of $\mathcal{E} \mathcal{E}_1$ -chase

§1.2_a He had already...

ts'o'k	túun	
PRF	then	main <i>if</i> : dep <i>ib</i>
[s dτ ⊆ _{dΩ} dσ]; [e dσ = _{dΩ} RS e]; ^P [dτ = _{dΩ} ∅RS ¹ dε];		
u		
3s		
^P [3s dα]; [DA dσ = _{dΩ} dα];		
...got tired of running when... ⁵		
ka'n-		dep <i>mf</i>
tire-		
[eel dε: DA get.tired.of _{dΩ} ee];		
-al		
ELA.	.IV _U	
^P [BG dσ ⊆ _{dΩ} ∅RS dε]; [DA dε = _{dΩ} dα]		
áalkab	=e'	dep <i>fb</i>
run	=TM [⊤]	
[dεε: AG run]; [t t = _{dΩ} ∅RS dε];		

⁵ • In $d\Omega$, $d\epsilon$ is a state change whose experiencer gets tired of ee -activity
 $d\epsilon$: DA get.tired.of_{dΩ} ee := $\lambda i. \forall w \in d\Omega; \exists s: \text{tired}_w(s, DA_w s) \wedge d\epsilon_i = BG_w s \wedge s = RS_w^f ee$
 $\wedge \forall e \in ee: AG_w e = DA_w s$

reality $\top w^*$:
 •
 |
 •===== $\top e^*$: speech event
 t^* : e^* -now
 $e_1, RS_{w^*} e_1$: e^* -spkr is told $\top p_0$, remembers $\top p_0$

 story world $w_0 \in \top p_0$:
 • $\mathcal{E}_0 w_0$: event with $k_{1.1}^\alpha$ -small rabbit $\top a_0$
 || $\top t_1 = \mathfrak{D}_{w_0} RS \mathcal{E}_0 w_0$: \mathcal{E}_0 -result time
 • $[^1 \mathcal{E} \mathcal{E}_1](w_0)$: 1st stage of $\mathcal{E} \mathcal{E}_1$ -chase of
 $k_{1.1}^\alpha$ -small rabbit $\top a_0$ by $k_{1.2}^\alpha$ -hunter a_1
 = $s_{1.2} = RS_{w_0} [^1 \mathcal{E} \mathcal{E}_1](w_0)$:
 result state of 1st stage of $\mathcal{E} \mathcal{E}_1$ -chase
 = $s_2 = RS_{w_0} {}^f e_{2.2}$: rabbit $\top a_0$ is tired of ee_2 -running
 • $e_{2.1} = BG_{w_0} s_2$: rab. $\top a_0$ gets tired of ee_2 -running
 ••• ee_2 : rabbit $\top a_0$ runs
 || $\top t_{2.1} = \mathfrak{D}_{w_0} RS_{w_0} e_{2.1}$: $e_{2.1}$ -result time

~~~~~  
 $w_1 \in \text{Dom } \mathcal{E}_1 = p_1$  (success worlds of  $a_1$ -hunter)  
 ••••••••  
 •  $\langle [^1 \mathcal{E} \mathcal{E}_1](w_1), \dots [^f \mathcal{E} \mathcal{E}_1](w_1) \rangle$ :  
 hunter  $a_1$  tries to realize  $\mathcal{E}_1$ -catch during  
 result state of final stage of  $\mathcal{E} \mathcal{E}_1$ -chase  
 •  $\mathcal{E}_1 w_1$ : hunter  $a_1$  catches rabbit  $\top a_0$   
 ||  $\top \mathcal{T}_1 w_1 = \mathfrak{D}_{w_1} [^f \mathcal{E} \mathcal{E}_1](w_1)$ :  
 time of final stage of  $\mathcal{E} \mathcal{E}_1$ -chase

§1.2<sub>b</sub> ...he saw a cave and...

káa if  
 DEP]  
 [el e  $\subseteq_{d\Omega} \mathfrak{D}RS d\epsilon$ ];  
 t- -u ib  
 TV]- -3s  
 [l d $\epsilon \subseteq_{d\Omega} d\tau$ ]; [l AG d $\epsilon =_{d\Omega} d\alpha$ , d $\alpha \neq_{d\Omega} OB d\epsilon$ ]; P[l 3s $_{d\Omega} d\alpha$ ];  
 y- il- mf  
 3s- see  
 P[l 3s $_{d\Omega} AG d\epsilon$ ]; [l d $\epsilon$ : AG see $_{d\Omega} OB$ ];  
 -ah  
 -IND.  
 P[l  $\mathfrak{D}_{d\Omega} d\epsilon < \mathfrak{D}_{d\omega} d\epsilon$ ];  
 -ah  
 .TV<sub>A</sub> .3s  
 [bl AG d $\epsilon =_{d\Omega} d\alpha$ , OB d $\epsilon =_{d\Omega} b$ ]; P[l 3s $_{d\Omega} d\beta$ ];  
 hun- -p'éel sahkab =e' fb  
 one- -CL $_{\beta}$  cave =TM $^{\top}$   
 [k $^{\beta}$ l one $_{d\Omega}(d\beta, k^{\beta})$ ]; P[l inanimate d $\kappa^{\beta}$ ]; [l cave d $\kappa^{\beta}$ ]; [tl t = $_{d\Omega} \mathfrak{D}RS d\epsilon$ ];



§1.3 He was...

túun ib  
 PRG. (*táan*)  
 $[s | \mathbf{d}\tau \subseteq_{\mathbf{d}\Omega} s]; [ee | d\sigma =_{\mathbf{d}\Omega} \text{RS } {}^1ee];$

.3s (*u*)  
 ${}^P [ | 3s_{\mathbf{d}\Omega} \mathbf{d}\alpha]; [ | \text{DA } d\sigma =_{\mathbf{d}\Omega} \mathbf{d}\alpha]$

...thinking... <sup>6</sup>

tukl- mf  
*think-*  
 $[p_\epsilon | d\epsilon\epsilon: \text{AG } \textit{think}_{\mathbf{d}\Omega} p_\epsilon];$

-ik  
 -ELA. .TV<sub>A</sub>  
 ${}^P [ | \text{BG } d\sigma \subseteq_{\mathbf{d}\Omega} \text{RS } d\epsilon]; {}^P [ | \text{AG } d\epsilon\epsilon =_{\mathbf{d}\Omega} \mathbf{d}\alpha, \mathbf{d}\alpha \neq d\epsilon\Omega];$

...like this:

bèey- =a' ff  
*thus-* =DS<sup>T</sup>  
 ${}^P [ | d\epsilon\epsilon: \text{AG } \textit{think}_{\mathbf{d}\Omega} d\epsilon\Omega]; [p_\epsilon | p_\epsilon = d\epsilon\Omega];$

|                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_0 \in {}^T p_0$<br>$\vdots$<br><ul style="list-style-type: none"> <li>•</li> <li>  </li> <li>•</li> <li>•••...</li> </ul><br>= | (story worlds)<br>$\vdots$<br>$e_{2,2}$ : rabbit ${}^T a_0$ sees $k^{\beta}_{2}$ -cave $b_2$<br>${}^T t_{2,2} = \text{RS}_{w_0} e_{2,2}$ : $e_{2,2}$ -result time<br>$e_{2,3}$ : rabbit ${}^T a_0$ enters the interior ${}^T l_2$ of cave $b_2$<br>$ee_3 = \langle {}^1ee_3, \dots, {}^f ee_3 \rangle$ : rabbit $a_0$ thinks s.t. for all<br>$e \in ee_3$ , in RS $e$ he believes he is in $p_{\epsilon,3}(e)$<br>$s_3 = \text{RS}_{w_0} {}^1ee_3$ : res st of 1st stage of $ee_3$ -thinking<br>rabbit $a_0$ believes he is in ${}^T p_{\epsilon,3}({}^1ee_3)$ |
|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

$w_3 \in {}^T p_{\epsilon,3}({}^1ee_3)$  (RS  ${}^1ee_3$ -belief)

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_1 \in \text{Dom } {}^f \mathcal{E}\mathcal{E}_1$<br>$\bullet \dots \bullet$<br><br> | (completed $\mathcal{E}\mathcal{E}_1$ -chase)<br>$\langle [{}^1 \mathcal{E}\mathcal{E}_1](w_1), \dots, [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_1), [{}^f \mathcal{E}\mathcal{E}_1](w_1) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}\mathcal{E}_1$ -chase<br>${}^T \mathcal{T}_1 w_1 = \text{RS}_{w_1} [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_1)$ : end of $\mathcal{E}\mathcal{E}_1$ -chase |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

<sup>6</sup> • In  $\mathbf{d}\Omega$ ,  $d\epsilon\epsilon$  is a thinking activity such that, in the result state of each stage  $e$ , the thinking agent believes  $p_\epsilon(e)$   
 $\textit{process}_w ee := \forall e \in \text{Dom } ee: \text{RS}_w ee(e) \subseteq \text{RS}_w e$   
 $d\epsilon\epsilon: \text{AG } \textit{think}_{\mathbf{d}\Omega} p_\epsilon := \lambda i. \forall w \in \mathbf{d}\Omega_i: \textit{process}_w d\epsilon\epsilon_i$   
 $\wedge \forall e \in d\epsilon\epsilon_i: \textit{think}_w(e, \text{AG}_w e) \wedge \textit{believe}_w(\text{RS}_w e, \text{AG}_w e, p_\epsilon e)$

§1.4 “Oh my!

“ (shift to rabbit’s voice)

[eel ee = dεε]; [pl p = dεΩ(<sup>1</sup>dεε)]; [l e = dεε(<sup>1</sup>dεε)];

Machis!

Oh my!

[l dε: AG express.worry<sub>dΩ</sub>];

§1.5 If...<sup>7</sup>

wáah

*if*

IF

<sup>P</sup>[l (<sup>f</sup>dε∂l dΩ ∩ Dom <sup>f</sup>dε∂) ⊆ dωτ]; [ℰ| ℰ = (<sup>f</sup>dε∂l dΩ ∩ Dom <sup>f</sup>dε∂)];

...the man comes in here...

k-

*ib*

[V-

[l dε ⊆ dωτ];

-u

-3s

<sup>P</sup>[l 3s<sub>dΩ</sub> dα]; [l DA dε = dα]; [al a = dα];

òok-

*mf*

enter-

[l dε: DA enter dπ];

-ol

-ELA.

.IV<sub>U</sub>

<sup>P</sup>[l dε ⊆ ∅RS <sup>f-1</sup>dε∂]; [l DA dε = dα];

le

wíinik

*fb*

the

man

<sup>P</sup>[l dα = dκ<sup>α</sup>{dε}]; [l man dκ<sup>α</sup>];

way

=e’

*ff*

here-

=TM<sup>T</sup>

<sup>P</sup>[l dσ ⊆<sub>dΩ</sub> dπ]; [l RS dε ⊆ dπ]; [ℱ| ℱ = ∅RS dε];

<sup>7</sup> • Any realization of the final stage of dε∂ in dΩ occurs during dωτ

$$(\sup{f}d\epsilon\partial l d\Omega \cap \text{Dom } \sup{f}d\epsilon\partial) \subseteq d\omega\tau \quad := \quad \lambda i. d\Omega_i \cap \text{Dom } \sup{f}d\epsilon\partial_i \neq \{\} \\ \wedge \forall w \in d\Omega_i \cap \text{Dom } \sup{f}d\epsilon\partial_i: \vartheta_w \sup{f}d\epsilon\partial_i w \subseteq d\omega\tau_i w$$

- ℰ is the restriction of the final stage of dε∂ to dΩ-worlds where that stage is realized

$$\mathcal{E} = (\sup{f}d\epsilon\partial l d\Omega \cap \text{Dom } \sup{f}d\epsilon\partial) \quad := \quad \lambda i. \mathcal{E} = \langle \sup{f}d\epsilon\partial_i w: w \in (d\Omega_i \cap \text{Dom } \sup{f}d\epsilon\partial_i) \rangle$$

- Any realization of dε is a state change whose experiencer enters dπ

$$d\epsilon: DA \text{ enter } d\pi \quad := \quad \lambda i. \forall w \in \text{Dom } d\epsilon_i \exists e: e = d\epsilon_i(w) \wedge \text{enter}_w(e, DA_w e, d\pi_i)$$

- Any realization of dε occurs during the result state of the penultimate stage of dε∂

$$d\epsilon \subseteq \vartheta RS \sup{f-1}d\epsilon\partial \quad := \quad \lambda i. \forall w \in \text{Dom } d\epsilon_i: \vartheta_w d\epsilon_i w \subseteq \vartheta_w RS_w \sup{f-1}d\epsilon\partial_i w$$

- In any realization of dε, dα instantiates dκ<sup>α</sup>

$$d\alpha = d\kappa^\alpha\{d\epsilon\} \quad := \quad \lambda i. \forall w \in \text{Dom } d\epsilon_i: d\alpha_i = d\kappa^\alpha_w(d\epsilon_i w)$$

- ℱ is the concept of the time of the result state of dε

$$\mathcal{F} = \vartheta RS d\epsilon \quad := \quad \lambda i. \mathcal{F} = \langle \vartheta_w RS_w d\epsilon_i w: w \in \text{Dom } d\epsilon_i \rangle$$

|                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_0 \in p_0$<br>$\vdots$<br>$\bullet$<br>$\parallel$<br>$\bullet$<br>$\bullet\bullet\bullet\dots$<br>$=$<br>$\bullet$ | (story worlds)<br>$\vdots$<br>$e_{2,2}$ : rabbit $\top a_0$ sees $k^b_2$ -cave $b_2$<br>$\top t_{2,2} = \mathfrak{D}_{w_0} \text{RS}_{w_0} e_{2,2}$ : $e_{2,2}$ -result time<br>$e_{2,3}$ : rabbit $\top a_0$ enters the interior $\top l_2$ of cave $b_2$<br>$\top ee_3 = \langle {}^1 ee_3 \dots {}^f ee_3 \rangle$ : rabbit $a_0$ thinks s.t. for all<br>$e \in ee_3$ , in RS $e$ he believes he is in $p_{\epsilon,3}(e)$<br>$s_3 = \text{RS}_{w_0} {}^1 ee_3$ : result of 1st stg of $ee_3$ -thinking,<br>rab $a_0$ believes $\top p_4 = \top p_{\epsilon,3}({}^1 ee_3)$<br>$\top e_4 = {}^2 ee_3$ : 2nd stage of $ee_3$ -thinking,<br>rabbit $a_0$ expresses worry |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_5 \in \text{Dom } \mathcal{E}_{5,1} = \top p_4 \cap \text{Dom } {}^f \mathcal{E}\mathcal{E}_1$<br>$= \text{Dom } \top \mathcal{T}_5$<br>$\bullet\bullet\bullet\bullet\bullet$<br>$\parallel\parallel\parallel$<br>$\bullet$<br>$\parallel\parallel$ | (RS ${}^1 ee_3$ -belief worlds w. ${}^f \mathcal{E}\mathcal{E}_1$ -chase = $\mathcal{E}_{5,1}$ -entry)<br>( $\mathcal{E}_{5,1}$ -entry result time)<br>$\langle [{}^1 \mathcal{E}\mathcal{E}_1](w_5), \dots [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_5), [{}^f \mathcal{E}\mathcal{E}_1](w_5) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\mathcal{T}_1 w_5 = \mathfrak{D}_{w_5} [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_5)$ : end of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\mathcal{E}_{5,1}(w_5) = [{}^f \mathcal{E}\mathcal{E}_1](w_5)$ : final stg of $\mathcal{E}\mathcal{E}_1$ -chase,<br>man $a_1$ enters the interior $\top l_2$ of cave $b_2$<br>$\top \mathcal{T}_5 w_5 = \mathfrak{D}_{w_5} \text{RS}_{w_5} \mathcal{E}_{5,1} w_5$ : $\mathcal{E}_{5,1}$ -entry result time |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_1 \in \text{Dom } {}^f \mathcal{E}\mathcal{E}_1$<br>$\bullet\bullet\bullet\bullet\bullet$<br>$\parallel\parallel\parallel$ | (completed $\mathcal{E}\mathcal{E}_1$ -chase)<br>$\langle [{}^1 \mathcal{E}\mathcal{E}_1](w_1), \dots [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_1), [{}^f \mathcal{E}\mathcal{E}_1](w_1) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\top \mathcal{T}_1 w_1 = \mathfrak{D}_{w_1} [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_1)$ : end of $\mathcal{E}\mathcal{E}_1$ -chase |
|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_0 \in p_0$<br>$\vdots$<br>$\bullet$<br>$\parallel$<br>$\bullet$<br>$\bullet\bullet\dots$<br>$=$<br>$\bullet$ | (story worlds)<br>$\vdots$<br>$e_{2,2}$ : rabbit $\top a_0$ sees $k^b_2$ -cave $b_2$<br>$\top t_{2,2} = \mathfrak{D}_{w_0} \text{RS}_{w_0} e_{2,2}$ : $e_{2,2}$ -result time<br>$e_{2,3}$ : rabbit $\top a_0$ enters the interior $\top l_2$ of cave $b_2$<br>$\top ee_3 = \langle {}^1 ee_3 \dots {}^f ee_3 \rangle$ : rabbit $a_0$ thinks s.t. for all<br>$e \in ee_3$ , in RS $e$ he believes he is in $p_{\varepsilon,3}(e)$<br>$s_3 = \text{RS}_{w_0} {}^1 ee_3$ : result of 1st stg of $ee_3$ -thinking,<br>rabbit $a_0$ believes $\top p_4 = \top p_{\varepsilon,3}({}^1 ee_3)$<br>$\top e_4 = {}^2 ee_3$ : 2nd stage of $ee_3$ -thinking<br>rabbit $a_0$ expresses worry |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                                                                       |
|-------------------------------|-------------------------------------------------------------------------------------------------------|
| $w_4 \in \top p_4$<br>$=====$ | (RS ${}^1 ee_3$ -belief)<br>$s_5$ : $s_5$ -experiencer expects $\mathcal{E}_{5,1}$ as a possible fut. |
|-------------------------------|-------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_5 \in \text{Dom } \mathcal{E}_{5,1} = \top p_4 \cap \text{Dom } {}^f \mathcal{E}\mathcal{E}_1$<br>$= \text{Dom } \top \mathcal{T}_5$<br>$\bullet\bullet\bullet\bullet$<br>$\parallel\parallel\parallel$<br>$\bullet$<br>$\parallel\parallel$<br>$\bullet$ | (RS ${}^1 ee_3$ -belief worlds w. ${}^f \mathcal{E}\mathcal{E}_1$ -chase = $\mathcal{E}_{5,1}$ -entry)<br>( $\mathcal{E}_{5,1}$ -entry result time, $s_5$ -expected future)<br>$\langle [{}^1 \mathcal{E}\mathcal{E}_1](w_5), \dots [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_5), [{}^f \mathcal{E}\mathcal{E}_1](w_5) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\mathcal{T}_1 w_5 = \mathfrak{D}_{w_5} [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_5)$ : end of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\mathcal{E}_{5,1}(w_5) = [{}^f \mathcal{E}\mathcal{E}_1](w_5)$ : final stg of $\mathcal{E}\mathcal{E}_1$ -chase,<br>man $a_1$ enters the interior $\top l_2$ of cave $b_2$<br>$\top \mathcal{T}_5 w_5 = \mathfrak{D}_{w_5} \text{RS}_{w_5} \mathcal{E}_{5,1} w_5$ : $\mathcal{E}_{5,1}$ -entry result time<br>$\mathcal{E}_{5,2}(w_5)$ : man $a_1$ shoots $\top e_4$ -thinker = rabbit $a_0$ |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_1 \in \text{Dom } {}^f \mathcal{E}\mathcal{E}_1$<br>$\bullet\bullet\bullet\bullet$<br>$\parallel\parallel\parallel$ | (completed $\mathcal{E}\mathcal{E}_1$ -chase)<br>$\langle [{}^1 \mathcal{E}\mathcal{E}_1](w_1), \dots [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_1), [{}^f \mathcal{E}\mathcal{E}_1](w_1) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\top \mathcal{T}_1 w_1 = \mathfrak{D}_{w_1} [{}^{f-1} \mathcal{E}\mathcal{E}_1](w_1)$ : end of $\mathcal{E}\mathcal{E}_1$ -chase |
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|                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_0 \in p_0$<br>$\vdots$<br>$\bullet$<br>$\bullet\bullet\dots$<br>$=$<br>$\bullet$<br>$\parallel$                                                                                                                                | (story worlds)<br>$\vdots$<br>$e_{2,3}$ : rabbit $\top a_0$ enters the interior $\top l_2$ of cave $b_2$<br>$\top ee_3 = \langle \top ee_3 \dots \top ee_3 \rangle$ : rabbit $a_0$ thinks s.t. for all<br>$e \in ee_3$ , in RS $e$ he believes he is in $p_{\epsilon,3}(e)$<br>$s_3 = RS_{w_0} \top ee_3$ : result of 1st stg of $ee_3$ -thinking,<br>rab $a_0$ believes $\top p_4 = \top p_{\epsilon,3}(\top ee_3)$<br>$\top e_4 = \top ee_3$ : 2nd stage of $ee_3$ -thinking, rabbit $a_0$<br>expresses worry & requests that $e_4$ -dat<br>(self) realize $\top \mathcal{E}_6$ -answer during $e_4$ result tm<br>$\top t_6 = \mathfrak{D}_{w_0} RS_{w_0} e_4$ : $\top e_4$ -result time                                                                                                                                                                         |
| $w_6 \in \text{Dom } \top \mathcal{E}_6$<br>$\parallel$<br>$\bullet$                                                                                                                                                              | ( $\top e_4$ -requested $\top \mathcal{E}_6$ -answer worlds)<br>$\mathfrak{D}_{w_6} RS_{w_6} e_4$ : $e_4$ -question result time<br>$\mathcal{E}_6 w_6$ : $e_4$ -dat answers, specifying $\top p_{\epsilon,3}$ -realistic<br>action plan $\mathcal{E}\mathcal{E}_6$ to prevent $\mathcal{E}_{5,2}$ -shooting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| $w_7 \in \top p_{\epsilon,3}(\top ee_3) - \top p_{\epsilon,3}(\top ee_3)$<br>$w_7 \in \text{Dom } \top \mathcal{E}\mathcal{E}_6$<br>$w_7 \notin \text{Dom } \mathcal{E}_{5,2}$<br>$\bullet\bullet\dots\bullet$                    | (RS $\top ee_3$ -belief worlds added to RS $\top ee_3$ -bel wrlds)<br>( $\mathcal{E}\mathcal{E}_6$ -plan successfully realized)<br>(no $\mathcal{E}_{5,2}$ -shooting)<br>$\langle \top \mathcal{E}\mathcal{E}_6 w_7, \dots, \top \mathcal{E}\mathcal{E}_6 w_7 \rangle$ : $e_4$ -dat = rabbit $a_0$ does<br>sth, during RS $\mathcal{E}_6$ , to prevent $\mathcal{E}_{5,2}$ -shooting                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| $w_5 \in \text{Dom } \mathcal{E}_{5,1} = \top p_{\epsilon,3}(\top ee_3) \cap \text{Dom } \top \mathcal{E}\mathcal{E}_1$<br>$\bullet\bullet\dots\bullet$<br>$\parallel\parallel\parallel$<br>$\bullet$<br>$\parallel$<br>$\bullet$ | (RS $\top ee_3$ -belief worlds w. $\top \mathcal{E}\mathcal{E}_1$ -chase = $\mathcal{E}_{5,1}$ -entry)<br>$\langle \top \mathcal{E}\mathcal{E}_1(w_5), \dots, \top \mathcal{E}\mathcal{E}_1(w_5) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\mathcal{T}_1 w_5 = \mathfrak{D}_{w_1} \top \mathcal{E}\mathcal{E}_1(w_5)$ : end of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\mathcal{E}_{5,1}(w_5) = \top \mathcal{E}\mathcal{E}_1(w_5)$ : final stage of $\mathcal{E}\mathcal{E}_1$ -chase,<br>man $a_1$ enters the interior $\top l_2$ of cave $b_2$<br>$\top \mathcal{T}_5 w_5 = \mathfrak{D}_{w_5} RS_{w_5} \mathcal{E}_{5,1} w_5$ : $\mathcal{E}_{5,1}$ -entry result time<br>$\mathcal{E}_{5,2}(w_5)$ : man $a_1$ shoots $\top e_4$ -thinker = rabbit $a_0$ |
| $w_1 \in \text{Dom } \top \mathcal{E}\mathcal{E}_1$<br>$\bullet\bullet\dots\bullet$<br>$\parallel\parallel\parallel$                                                                                                              | (completed $\mathcal{E}\mathcal{E}_1$ -chase)<br>$\langle \top \mathcal{E}\mathcal{E}_1(w_1), \dots, \top \mathcal{E}\mathcal{E}_1(w_1) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}\mathcal{E}_1$ -chase<br>$\mathcal{T}_1 w_1 = \mathfrak{D}_{w_1} \top \mathcal{E}\mathcal{E}_1(w_1)$ : end of $\mathcal{E}\mathcal{E}_1$ -chase                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

§1.7 (?-final pause, next  $\mathbf{d}\varepsilon\varepsilon$ -stage) (= the  $\mathbf{d}\omega\varepsilon$ -answer)

[ $\mathbf{p} \mid \mathbf{p} = \mathbf{d}\varepsilon\Omega(\mathbf{d}\varepsilon)$ ]; [ $\mathbf{e} \mid \mathbf{e} = \mathbf{d}\varepsilon\varepsilon(\mathbf{d}\varepsilon)$ ]; [ $\mathbf{d}\varepsilon = {}_{\mathbf{d}\Omega} \mathbf{d}\omega\varepsilon$ ]

I'm going to...<sup>10</sup>

Ninkah

*ib*

PRE. (mukah)

[ $s \mid \mathbf{d}\tau \subseteq {}_{\mathbf{d}\Omega} s$ ]; [ $\mathbf{d}\tau < {}^1 d\varepsilon\varepsilon \subseteq \vartheta\text{RS BG } d\sigma$ ]; [ $\mathbf{d}\sigma$ : DA *intend* <sub>$\mathbf{d}\Omega$</sub>   $d\varepsilon\varepsilon$ ];

.1s (in)

<sup>P</sup>[ $\mathbf{1}s \mathbf{d}\alpha$ ]; [ $\mathbf{1} \text{ DA } d\sigma = {}_{\mathbf{d}\Omega} \mathbf{d}\alpha$ ];

in

1s

<sup>P</sup>[ $\mathbf{1}s \mathbf{d}\alpha$ ]; [ $\mathbf{1} \text{ AG } d\varepsilon\varepsilon = \mathbf{d}\alpha$ ]

...hold up the cave.

lat

*mf*

*hold.up*

[ $d\varepsilon\varepsilon$ : AG *hold.up* OB];

-Ø

-ELA].

.TV<sub>A</sub>

.3s

<sup>P</sup>[ ${}^f d\varepsilon\varepsilon \subseteq \vartheta\text{RS BG } d\sigma$ ]; <sup>P</sup>[ $\mathbf{1} \text{ AG } d\varepsilon\varepsilon = \mathbf{d}\alpha$ , OB  $d\varepsilon\varepsilon = d\beta$ ]; [ $\mathbf{3}s_{\mathbf{d}\Omega} d\beta$ ]

le

sahkab

=o'

*fb*

the

cave

=DT<sup>T</sup>

<sup>P</sup>[ $d\beta = d\kappa^\beta\{d\varepsilon\varepsilon\}$ ]; [ $\text{cave } d\kappa^\beta$ ]; [ $\mathcal{J} \mid \mathcal{J} = \vartheta\text{RS } {}^1 d\varepsilon\varepsilon$ ];

- 
- <sup>10</sup> • Any realization of the first stage of  $d\varepsilon\varepsilon$  occurs in the future of  $\mathbf{d}\tau$  during the result state of  $d\sigma$ -onset  
 $\mathbf{d}\tau < {}^1 d\varepsilon\varepsilon \subseteq \vartheta\text{RS BG } d\sigma \quad := \quad \lambda i. \forall w \in \text{Dom } {}^1 d\varepsilon\varepsilon_i: \mathbf{d}\tau_i < \vartheta_w {}^1 d\varepsilon\varepsilon_i w \subseteq \vartheta_w \text{RS}_w (\text{BG}_w d\sigma_i)$
- In  $\mathbf{d}\Omega$ ,  $d\sigma$  is a mental state whose experiencer intends to realize (entire)  $d\varepsilon\varepsilon$  during the result state of  $d\sigma$ -beg.  
 $d\sigma$ : DA *intend* <sub>$\mathbf{d}\Omega$</sub>   $d\varepsilon\varepsilon \quad := \quad \lambda i. \forall w \in \mathbf{d}\Omega_i \exists p: \text{intend}_w(d\sigma_i, \text{DA}_w d\sigma_i, p)$   
 $\wedge \forall \mathcal{E} \in d\varepsilon\varepsilon_i: p \subseteq \text{Dom } \mathcal{E}$   
 $\wedge \forall w' \in p: \vartheta_w' \mathcal{E} w' \subseteq \vartheta_w \text{RS}_w (\text{BG}_w d\sigma_i)$
- In  $\mathbf{d}\Omega$ ,  $d\sigma$  is a state experienced by  $\mathbf{d}\alpha$   
 $\text{DA } d\sigma = {}_{\mathbf{d}\Omega} \mathbf{d}\alpha \quad := \quad \lambda i. \forall w \in \mathbf{d}\Omega_i: \text{DA}_w d\sigma_i = \mathbf{d}\alpha_i$
- Any realization of any stage of  $d\varepsilon\varepsilon$  is an action by  $\mathbf{d}\alpha$   
 $\text{AG } d\varepsilon\varepsilon = \mathbf{d}\alpha \quad := \quad \lambda i. \forall \mathcal{E} \in d\varepsilon\varepsilon_i \forall w \in \text{Dom } \mathcal{E}: \text{AG}_w \mathcal{E} w = \mathbf{d}\alpha_i$
- Any realization of the final stage of  $d\varepsilon\varepsilon$  occurs during the result state of the onset of  $d\sigma$ (intention)  
 ${}^f d\varepsilon\varepsilon \subseteq \vartheta\text{RS BG } d\sigma \quad := \quad \lambda i. \forall w \in \text{Dom } {}^f d\varepsilon\varepsilon_i: \vartheta_w {}^f d\varepsilon\varepsilon_i(w) \subseteq \vartheta_w \text{RS}_w (\text{BG}_w d\sigma_i)$

|                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_0 \in p_0$<br>$\vdots$<br>$\bullet$<br>$\bullet \dots \bullet$<br>$=$<br>$\bullet$<br>$\parallel$<br>$\bullet$                                                                                                                           | (story worlds)<br>$\vdots$<br>$e_{2,3}$ : rabbit $\top a_0$ enters the interior $\top l_2$ of cave $b_2$<br>$\top ee_3 = \langle \top ee_3 \dots \top ee_3 \rangle$ : rabbit $a_0$ thinks s.t. for all<br>$e \in ee_3$ , in RS $e$ he believes he is in $p_{\epsilon,3}(e)$<br>$s_3 = RS_{w_0} \top ee_3$ : result of 1st stg of $ee_3$ -thinking,<br>rabbit $a_0$ believes $p_4 = \top p_{\epsilon,3}(\top ee_3)$<br>$e_4 = \top ee_3$ : 2nd stage of $ee_3$ -thinking, rabbit $a_0$<br>expresses worry & requests that $e_4$ -dat<br>(self) realize $\top \mathcal{E}_6$ -answer during $e_4$ result tm<br>$\top t_6 = \mathfrak{D}_{w_0} RS_{w_0} e_4$ : $e_4$ -result time<br>$\top e_7 = \top ee_3$ : 3rd stage of $ee_3$ -thinking<br>rabbit $a_0$ believes $\top p_7 = \top p_{\epsilon,3}(\top ee_3)$ |
| $w_6 \in \text{Dom } \top \mathcal{E}_6$<br>$\parallel$<br>$\bullet$<br><br>=====                                                                                                                                                           | ( $\top e_4$ -requested $\top \mathcal{E}_6$ -answer worlds)<br>$\mathfrak{D}_{w_6} RS_{w_6} e_4$ : $e_4$ -question result time<br>$\top e_7 = \mathcal{E}_6 w_6$ : $e_4$ -dat (rabb $a_0$ ) gives $e_4$ -requested<br>answer $\mathcal{E}_6$ , specifying $\top p_{\epsilon,3}$ -realistic action<br>plan $\mathcal{E}_6$ to prevent $\mathcal{E}_{5,2}$ -shooting<br>$s_7$ : rabbit $a_0$ intends to realize (all of) $\mathcal{E}_6$                                                                                                                                                                                                                                                                                                                                                                       |
| $w_7 \in \top p_{\epsilon,3}(\top ee_3) - \top p_{\epsilon,3}(\top ee_3)$<br>$w_7 \in \text{Dom } \top \mathcal{E}_6$<br>$w_7 \notin \text{Dom } \mathcal{E}_{5,2}$<br>$\bullet \dots \bullet$<br>$\parallel \parallel \parallel \parallel$ | (RS $\top ee_3$ -belief worlds added to RS $\top ee_3$ -belief worlds)<br>( $\mathcal{E}_6$ -plan successfully realized)<br>(no $\mathcal{E}_{5,2}$ -shooting)<br>$\langle \top \mathcal{E}_6 w_7, \dots, \top \mathcal{E}_6 w_7 \rangle$ : rabb $a_0$ holds up cave $b_2$<br>during $\mathcal{E}_6$ -answer result time<br>$\top \mathcal{T}_7 w_7 = \mathfrak{D}_{w_7} RS_{w_7} \top \mathcal{E}_6 w_7$ : aft. 1st stage of $\mathcal{E}_6$                                                                                                                                                                                                                                                                                                                                                                 |
| $w_5 \in \text{Dom } \mathcal{E}_{5,1} = \top p_{\epsilon,3}(\top ee_3) \cap \text{Dom } \top \mathcal{E}_1$<br>$\bullet \dots \bullet$<br>$\parallel \parallel \parallel \parallel$<br>$\bullet$<br>$\parallel$<br>$\bullet$               | (RS $\top ee_3$ -belief worlds w. $\top \mathcal{E}_1$ -chase = $\mathcal{E}_{5,1}$ -entry)<br>$\langle [\top \mathcal{E}_1](w_5), \dots, [\top \mathcal{E}_1](w_5) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}_1$ -chase<br>$\mathcal{T}_1 w_5 = \mathfrak{D}_{w_1} [\top \mathcal{E}_1](w_5)$ : end of $\mathcal{E}_1$ -chase<br>$\mathcal{E}_{5,1}(w_5) = [\top \mathcal{E}_1](w_5)$ : final stage of $\mathcal{E}_1$ -chase,<br>man $a_1$ enters the interior $\top l_2$ of cave $b_2$<br>$\mathcal{T}_5 w_5 = \mathfrak{D}_{w_5} RS_{w_5} \mathcal{E}_{5,1} w_5$ : $\mathcal{E}_{5,1}$ -entry result time<br>$\mathcal{E}_{5,2}(w_5)$ : man $a_1$ shoots $\top e_4$ -thinker = rabbit $a_0$                                 |
| $w_1 \in \text{Dom } \top \mathcal{E}_1$<br>$\bullet \dots \bullet$<br>$\parallel \parallel \parallel \parallel$                                                                                                                            | (completed $\mathcal{E}_1$ -chase)<br>$\langle [\top \mathcal{E}_1](w_1), \dots, [\top \mathcal{E}_1](w_1), [\top \mathcal{E}_1](w_1) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}_1$ -chase<br>$\mathcal{T}_1 w_1 = \mathfrak{D}_{w_1} [\top \mathcal{E}_1](w_1)$ : end of $\mathcal{E}_1$ -chase                                                                                                                                                                                                                                                                                                                                                                                                                                |

§1.8 If...

wáah *if*

IF

$P[{}^f d\exists_1 | \mathbf{d}\Omega \cap \text{Dom } {}^f d\exists] \subseteq \mathbf{d}\omega\tau$ ; [ $\mathcal{E} | \mathcal{E} = ({}^f d\exists_1 | \mathbf{d}\Omega \cap \text{Dom } {}^f d\exists)$ ];

...he comes in here...

k- *ib*

[V-

[ $| d\exists \subseteq \mathbf{d}\omega\tau$ ];

-uy

-3s

$P[3s_{d\Omega} \mathbf{d}\alpha_1]$ ; [ $| DA d\exists =_{d\Omega} \mathbf{d}\alpha_1$ ]; [ $\mathbf{a} | \mathbf{a} = \mathbf{d}\alpha_1$ ];

òok-

enter-

[ $| d\exists: DA \text{ enter } \mathbf{d}\pi$ ]; *mf*

-ol

-ELA.

.IV<sub>U</sub>

$P[| d\exists \subseteq \vartheta RS {}^1 d\exists]$ ;  $P[| DA d\exists = \mathbf{d}\alpha]$ ;

way *ff*  
=e'

here- *ff*  
=TM<sup>T</sup>

$P[| \mathbf{d}\varepsilon \subseteq_{d\Omega} \mathbf{d}\pi]$ ; [ $| RS d\exists \subseteq \mathbf{d}\pi$ ]; [ $\mathcal{F} | \mathcal{F} = \vartheta RS d\exists$ ];

|                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $w_0 \in p_0$<br>$\vdots$<br>$\bullet$<br>$\bullet\bullet\dots$<br>$=$<br>$\bullet$<br>$\parallel$<br>$\bullet$                                                                                                                                                    | (story worlds)<br>$\vdots$<br>$e_{2,3}$ : rabbit $\top a_0$ enters the interior $\top l_2$ of cave $b_2$<br>$\top ee_3 = \langle \top ee_3 \dots \top ee_3 \rangle$ : rabbit $a_0$ thinks s.t. for all<br>$e \in ee_3$ , in RS $e$ he believes he is in $p_{\epsilon,3}(e)$<br>$s_3 = RS_{w_0} \top ee_3$ : result of 1st stg of $ee_3$ -thinking,<br>rabbit $a_0$ believes $p_4 = \top p_{\epsilon,3}(\top ee_3)$<br>$e_4 = \top ee_3$ : 2nd stage of $ee_3$ -thinking, rabbit $a_0$<br>expresses worry & requests that $e_4$ -dat<br>(self) realize $\top \mathcal{E}_6$ -answer during $e_4$ result tm<br>$\top t_6 = \mathfrak{D}_{w_0} RS_{w_0} e_4$ : $e_4$ -result time<br>$\top e_7 = \top ee_3$ : 3rd stage of $ee_3$ -thinking<br>rabbit $a_0$ believes $\top p_7 = \top p_{\epsilon,3}(\top ee_3)$ |
| $w_6 \in \text{Dom } \top \mathcal{E}_6$<br>$\parallel$<br>$\bullet$<br>$=====$                                                                                                                                                                                    | ( $\top e_4$ -requested $\top \mathcal{E}_6$ -answer worlds)<br>$\mathfrak{D}_{w_6} RS_{w_6} e_4$ : $e_4$ -question result time<br>$\top e_7 = \top \mathcal{E}_6 w_6$ : $e_4$ -dat ( $a_0$ ) specifies $\top p_{\epsilon,3}$ -realistic<br>action plan $\mathcal{E}_6$ to prevent $\mathcal{E}_{5,2}$ -shooting<br>$s_7$ : rabbit $a_0$ intends to realize (all of) $\mathcal{E}_6$                                                                                                                                                                                                                                                                                                                                                                                                                          |
| $w_7 \in \top p_{\epsilon,3}(\top ee_3) - \top p_{\epsilon,3}(\top ee_3)$<br>$w_7 \in \text{Dom } \top \mathcal{E}_6$<br>$w_7 \notin \text{Dom } \mathcal{E}_{5,2}$<br>$\bullet\bullet\bullet\bullet$<br>$\parallel\parallel\parallel$<br>$\bullet$<br>$\parallel$ | (RS $\top ee_3$ -belief worlds added to RS $\top ee_3$ -belief worlds)<br>( $\mathcal{E}_6$ -plan successfully realized)<br>(no $\mathcal{E}_{5,2}$ -shooting)<br>$\langle \top \mathcal{E}_6 w_7, \dots, \top \mathcal{E}_6 w_7 \rangle$ : rabb $a_0$ holds up cave $b_2$<br>during $\mathcal{E}_6$ -answer result time<br>$\mathcal{T}_7 w_7 = \mathfrak{D}_{w_7} RS_{w_7} \top \mathcal{E}_6 w_7$ : aft. 1st stage of $\mathcal{E}_6$<br>$\mathcal{E}_{8,1}(w_7) = [\top \mathcal{E}_6](w_7)$ : final stage of $\mathcal{E}_6$ -chase,<br>man $a_1$ enters the interior $\top l_2$ of cave $b_2$<br>$\top \mathcal{T}_{8,1} w_7 = \mathfrak{D}_{w_7} RS_{w_7} \mathcal{E}_{8,1} w_7$ : result tm of $\mathcal{E}_{8,1}$ -entry                                                                             |
| $w_5 \in \text{Dom } \mathcal{E}_{5,1} = \top p_{\epsilon,3}(\top ee_3) \cap \text{Dom } \top \mathcal{E}_1$<br>$\bullet\bullet\bullet\bullet$<br>$\parallel\parallel\parallel$<br>$\bullet$<br>$\parallel$<br>$\bullet$                                           | (RS $\top ee_3$ -belief worlds w. $\top \mathcal{E}_1$ -chase = $\mathcal{E}_{5,1}$ -entry)<br>$\langle [\top \mathcal{E}_1](w_5), \dots, [\top \mathcal{E}_1](w_5) \rangle$ :<br>hunter $a_1$ tries to realize $\mathcal{E}_1$ -catch during<br>result state of final stage of $\mathcal{E}_1$ -chase<br>$\mathcal{T}_1 w_5 = \mathfrak{D}_{w_1} [\top \mathcal{E}_1](w_5)$ : end of $\mathcal{E}_1$ -chase<br>$\mathcal{E}_{5,1}(w_5) = [\top \mathcal{E}_1](w_5)$ : final stage of $\mathcal{E}_1$ -chase,<br>man $a_1$ enters the interior $\top l_2$ of cave $b_2$<br>$\mathcal{T}_5 w_5 = \mathfrak{D}_{w_5} RS_{w_5} \mathcal{E}_{5,1} w_5$ : result tm of $\mathcal{E}_{5,1}$ -entry<br>$\mathcal{E}_{5,2}(w_5)$ : man $a_1$ shoots $\top e_4$ -thinker = rabbit $a_0$                                |

§1.8 ...I'll say to him that...<sup>11</sup>

k- -in ib  
[V- -1s  
[ $\mathcal{E}$   $\mathcal{E} \subseteq_{d\exists} \mathbf{d}\omega\tau$ ];  $P$ [| 1s  $\mathbf{d}\alpha_1$ ] [| AG  $d\exists = \mathbf{d}\alpha_1$ ]; [**a** **a** =  $\mathbf{d}\alpha_1$ ]

w- a'l- mf  
1s- say-  
 $P$ [| 1s  $\mathbf{d}\alpha$ ]; [| AG  $d\exists = \mathbf{d}\alpha$ ]; [ $p_\omega$ |  $d\exists$ : AG say  $p_\omega$ ];

-ik  
-ELA. .TV<sub>A</sub>  
 $P$ [|  $d\exists \subseteq \vartheta\text{RS } d\exists_1$ ]; [**a**| AG  $d\exists = \mathbf{d}\alpha$ , DA  $d\exists = a$ ];

ti' =e' fb  
OBL. .3s =TM<sup>†</sup>  
[| DA  $d\exists = d\alpha$ ];  $P$ [| 3s  $\mathbf{d}\alpha_1$ ]; [|  $d\alpha = \mathbf{d}\alpha_1$ ]; [ $p_\omega$ |  $p_\omega = d\omega\Omega$ ];

...since I was born...

desde síih- ff: if  
since get.born-  
[ $\mathcal{A} d\exists \subseteq \mathcal{S}$ ]; [ $\mathcal{E}$   $d\omega\sigma = \text{RS } \mathcal{E}$ ]; [|  $d\exists$ : DA get.born];

-ik -en =e'  
-ELA. .IV<sub>U</sub> -1s =TM<sup>†</sup>  
 $P$ [|  $^f\vartheta d\omega\sigma \subseteq \vartheta\text{RS } d\exists$ ];  $P$ [| DA  $d\exists = \mathbf{d}\alpha$ ];  $P$ [| 1s  $\mathbf{d}\alpha$ ]; [| DA  $d\exists = \mathbf{d}\alpha$ ]; [ $\mathcal{J}$ |  $\mathcal{J} = \vartheta\text{RS } d\exists$ ];

...I've been holding up this cave.

tíin ib  
PRG. (táan) .1s (in)  
[ $\mathcal{A} \mathbf{d}\omega\tau \subseteq_{d\omega\Omega} \mathcal{S}$ ]; [|  $d\omega\sigma =_{d\omega\Omega} \text{RS } ^1d\exists$ ];  $P$ [| 1s  $\mathbf{d}\alpha$ ]; [| DA  $d\omega\sigma = \mathbf{d}\alpha$ ]

lat- mf  
hold.up-  
 $P$ [|  $d\exists$ : AG hold.up OB]; [ $\mathcal{E}$   $\mathcal{E} =_{d\omega\Omega} ^2d\exists$ ];

-ik  
-ELA. .TV<sub>A</sub> .3s  
[| BG  $d\omega\sigma \subseteq \vartheta\text{RS } ^1d\exists$ ]; [| AG  $d\exists = \mathbf{d}\alpha$ , OB  $d\exists = d\beta$ ]; [| 3s  $d\beta$ ];

le sahkab =a' fb  
the cave =DS<sup>†</sup>  
 $P$ [|  $d\beta =_{d\omega\Omega} d\kappa^\beta\{\mathbf{d}\varepsilon\}$ ]; [| cave  $d\kappa^\beta$ ]; [ $\mathbf{k}^\beta$ |  $\mathbf{k}^\beta = d\kappa^\beta$ ];

<sup>11</sup> • Any realization of  $d\exists$  is a speech act whose agent claims to be in  $p_\omega$ -accessible worlds

$d\exists$ : AG say  $p_\omega$  :=  $\lambda i. \forall w \in \text{Dom } d\exists; \exists e: e = d\exists; w \wedge \text{say}_w(e, \text{AG}_w e, p_\omega w)$   
 $\wedge \forall w' \in p_\omega w: e = d\exists; w' \wedge \vartheta_{w'} e = \vartheta_w e \wedge \text{AG}_{w'} e = \text{AG}_w e$

• In any  $d\exists$ -world, state  $\mathcal{S}$  holds at  $d\exists$ -time;  $d\omega\sigma$  is the concept of the result state of  $\mathcal{E}$

$d\exists \subseteq \mathcal{S}$  :=  $\lambda i. \forall w \in \text{Dom } d\exists; \vartheta_w d\exists; w \subseteq \vartheta_w \mathcal{S} w$

$d\omega\sigma = \text{RS } \mathcal{E}$  :=  $\lambda i. d\omega\sigma_i = \langle \text{RS}_w \mathcal{E} w: w \in \text{Dom } \mathcal{E} \rangle$

• In any  $\mathbf{d}\omega\Omega$ -accessible world,  $\mathcal{S}$  is a state which holds at  $\mathbf{d}\omega\tau$

$\mathbf{d}\omega\tau \subseteq_{d\omega\Omega} \mathcal{S}$  :=  $\lambda i. \forall w \in \text{Dom } \mathbf{d}\omega\Omega; \forall w' \in \mathbf{d}\omega\Omega; w: \mathbf{d}\omega\tau; w' \subseteq \vartheta_w \mathcal{S} w'$



§1.9 ” (shift back to narrator’s voice)

[**p** | **p** = **d**Ω<sub>2</sub>]; [**t** | **t** =<sub>dΩ</sub> **ϑ**RS **d**ε]; [**e** | **e** = **d**ε<sub>2</sub>];

So then he began to hold up the cave.

káa

*if*

DEP]

[**e** | **e** ⊆<sub>dΩ</sub> **ϑ**RS <sup>f</sup>**d**εε];

túun

*then*

[ | **d**τ =<sub>dΩ</sub> **ϑ**RS <sup>f</sup>**d**εε];

t-

*ib*

TV]-

[ | **d**ε ⊆<sub>dΩ</sub> **d**τ]; [ | AG **d**ε ≠<sub>dΩ</sub> OB **d**ε];

-u

-3s

<sup>P</sup>[ | 3<sub>s</sub><sub>dΩ</sub> **d**α]; [ | AG **d**ε =<sub>dΩ</sub> **d**α]

lat-

*mf*

*hold.up-*

<sup>P</sup>[ | **d**ε: AG *hold.up* OB]; [ | **d**ε =<sub>dΩ</sub> <sup>1</sup>**d**εε];

-ah

-IND.

.TV<sub>A</sub>

<sup>P</sup>[ | **ϑ**<sub>dΩ</sub> **d**ε < **ϑ**<sub>dω</sub> **d**ε]; <sup>P</sup>[ | AG **d**ε =<sub>dΩ</sub> **d**α, OB **d**ε =<sub>dΩ</sub> **d**β];

-∅

-3s

<sup>P</sup>[ | 3<sub>s</sub> **d**β];

le

sahkab

=o'

*fb*

*the*

*cave*

=DT<sup>T</sup>

<sup>P</sup>[ | **d**β =<sub>dΩ</sub> **d**κ<sup>β</sup>{**d**ε}]; [ | *cave* **d**κ<sup>β</sup>]; [**T** | **T** = **ϑ**RS <sup>1</sup>**d**εε];

$w_0 \in {}^T p_0$  (story worlds)  
 $\vdots$   
 $\parallel$   
 $\bullet$   
 $\text{=====}$   
 $\text{|||||}$   
 $\bullet$   
 $\text{|||||}$   
 $t_6 = \vartheta_{w_0} \text{RS}_{w_0} {}^2 ee_3$ : result tm of 2nd stg of  ${}^T ee_3$   
 $e_7 = {}^3 ee_3 = {}^f ee_3$ : 3rd-&-fin stg of  $ee_3$ -thinking,  
 rabbit  $a_0$  believes  ${}^T p_7 = {}^T p_{\varepsilon,3}({}^2 ee_3)$   
 $s_7$ : rabbit  $a_0$  intends to realize (all of)  $\mathcal{E}\mathcal{E}_6$   
 ${}^T t_8 = \vartheta_{w_0} \text{RS}_{w_0} e_7$ :  $e_7$ -result time  
 $e_9 = {}^1 \mathcal{E}\mathcal{E}_6 w_0$ : 1st stage of  $\mathcal{E}\mathcal{E}_6$ -plan,  
 rabbit  $a_0$  begins to hold up cave  $b_2$   
 ${}^T \mathcal{T}_9 w_0 = \vartheta_{w_0} \text{RS}_{w_0} {}^1 \mathcal{E}\mathcal{E}_6 w_0$ : after 1st  $\mathcal{E}\mathcal{E}_6$ -stg

$w_7 \in {}^T p_{\varepsilon,3}({}^2 ee_3) - {}^T p_{\varepsilon,3}({}^1 ee_3)$  (RS  ${}^2 ee_3$ -belief worlds added to RS  ${}^1 ee_3$ -belief worlds)  
 $w_7 \in \text{Dom } \mathcal{E}_{8.1} = {}^T p_{\varepsilon,3}({}^2 ee_3) \cap \text{Dom } {}^f \mathcal{E}\mathcal{E}_6$  (RS  ${}^2 ee_3$ -belief worlds w.  ${}^f \mathcal{E}\mathcal{E}_6$ -chase =  $\mathcal{E}_{8.1}$ -entry)  
 $w_7 \notin \text{Dom } \mathcal{E}_{5.2}$  (no  $\mathcal{E}_{5.2}$ -shooting)  
 $\bullet \dots \bullet$   
 $\text{|||||}$   
 $\bullet$   
 $\text{|||}$   
 $\bullet$   
 $\bullet$   
 $\text{=====}$   
 $\langle {}^1 \mathcal{E}\mathcal{E}_6 w_7, \dots, {}^f \mathcal{E}\mathcal{E}_6 w_7 \rangle$ : rab  $a_0$  holds up cave  $b_2$   
 $\mathcal{T}_7 w_7 = \vartheta_{w_7} \text{RS}_{w_7} {}^1 \mathcal{E}\mathcal{E}_6 w_7$ : during  $\mathcal{E}\mathcal{E}_6$ -holding  
 $\mathcal{E}_{8.1}(w_7) = [{}^f \mathcal{E}\mathcal{E}_6](w_7)$ : final stage of  $\mathcal{E}\mathcal{E}_6$ -chase,  
 man  $a_1$  enters the interior  ${}^T l_2$  of cave  $b_2$   
 $\mathcal{T}_{8.1} w_7 = \vartheta_{w_7} \text{RS}_{w_7} \mathcal{E}_{8.1} w_7$ : result tm of  $\mathcal{E}_{8.1}$ -entry  
 $\mathcal{E}_{8.2} w_7$ :  $e_7$ -thinker = rabbit  $a_0$  tells man  $a_1$   
 they are in  ${}^T p_{\omega,8} w_7$   
 $\mathcal{E}_{8.3} w_7$ : rabbit  $a_0$  gets born  
 $\mathcal{S}_{8.1} w_8 = \text{RS}_{w_8} \mathcal{E}_{8.3} w_8$ : result state of  $\mathcal{E}_{8.3}$ -birth  
 still current at the time  $\mathcal{E}_{8.2}$ -speech act

$w_8 \in {}^T p_{\omega,8}(w_7)$  ( $\mathcal{E}_{8.2}(w_7)$ -tale)  
 $\bullet$   
 $\text{=====}$   
 $\text{|||||}$   
 $\bullet$   
 $\text{=====}$   
 $\bullet \dots \bullet$   
 $\mathcal{E}_{8.3} w_8$ : rabbit  $a_0$  gets born  
 $\mathcal{S}_{8.1} w_8 = \text{RS}_{w_8} \mathcal{E}_{8.3} w_8$ : result state of  $\mathcal{E}_{8.3}$ -birth  
 $\mathcal{T}_{8.2} w_8 = \vartheta_{w_8} \text{RS}_{w_8} \mathcal{E}_{8.3} w_8$ :  $\mathcal{S}_{8.1}$ -time  
 ${}^1 \mathcal{E}\mathcal{E}_6 w_8$ : rabbit  $a_0$  takes  $\mathcal{E}\mathcal{E}_6$ -hold of cave  $b_2$   
 $\mathcal{S}_{8.2} w_8 = \text{RS}_{w_8} {}^1 \mathcal{E}\mathcal{E}_6 w_8$ : result state of  ${}^1 \mathcal{E}\mathcal{E}_6$ ,  
 $\mathcal{E}_{8.4} w_8 = {}^2 \mathcal{E}\mathcal{E}_6 w_8$ : 2nd stage of  $\mathcal{E}\mathcal{E}_6$ -holding up