Dynamic Semantics (5) Quantification

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NASSLLI 2016
Rutgers, New Brunswick NJ

Quantifiers in discourse

Observation:

In discourse, quantified noun phrases function both as **antecedents** and **anaphors**.

e.g.

(1) i. Al invited **some**^{X1} friends.

ii. **Most**$_{X1}{}^{X2}$ people came, and **they all**$_{X2}$ had a good time.

iii. **One**$_{X1}{}^{X3}$ girl had a prior engagement.

DPlL: Quantification as structured reference

- *Dynamic Plural Logic* (DPlL, van den Berg 1993, 1994)
  - **plural info-state** (set of *assignments*) represents both *drefs* and *relations*
  - **update** relates plural info-states (i.e. input info-state to a set of outputs)
  - **minimal info-state** (no drefs) is the singleton of the *dummy assignment,* $g_\star$, which assigns the *dummy individual*, ★, to all variables

x_1	x_2	x_3	x_4	x_5	…
★	★	★	★	★	

$= \{g_\star\} =: G_0$

(1) i. Al^{x1} invited **some**$^{x2,\,x3}$ friends.

$$(\varepsilon_{x1} \wedge x_1 = al) \wedge \mathbf{M}_{x2}(\varepsilon_{x2} \wedge \Delta_{x2}(F^2 x_2 x_1)) \wedge \mathbf{M}_{x3}(\varepsilon_{x3} \wedge \Delta_{x3}(x_3 = x_2 \wedge I^2 x_1 x_3)) \wedge \mathbf{2}^+ x_3$$

x_1	x_2	x_3	x_4	x_5	…
a	f_1	f_1	★	★	
a	f_2	f_2	★	★	
a	f_3	f_3	★	★	
a	f_4	f_4	★	★	
a	f_5	★	★	★	

$=: G_1$
output of update by (1i),
if Al (a) has 5 friends (f_1, …, f_5)
and invited 4 of them (f_1, …, f_4)

DPIL: Quantified antecedents & anaphors

(1) ii$_a$. **Most**$_{x3}{}^{x4}$ *people* came and …

$(\Delta_{x3}(P^1 x_3) \wedge \mathbf{2}^+ x_3) \wedge \mathbf{M}_{x4}(\varepsilon_{x4} \wedge \Delta_{x4}(x_4 = x_3 \wedge C^1 x_4)) \wedge \textbf{\textit{most}}(x_3, x_4) \wedge \ldots$

x_1	x_2	x_3	x_4	x_5	…
a	f_1	f_1	f_1	★	
a	f_2	f_2	f_2	★	
a	f_3	f_3	f_3	★	=: G_2
a	f_4	f_4	★	★	
a	f_5	★	★	★	

ii$_b$. they$_{x4}$ **all**$_{x4}{}^{x5}$ had a good time.

$\mathbf{2}^+ x_4 \wedge \mathbf{M}_{x5}(\varepsilon_{x5} \wedge \Delta_{x5}(x_5 = x_4 \wedge H^1 x_5)) \wedge x_4 \subseteq x_5$

x_1	x_2	x_3	x_4	x_5	…
a	f_1	f_1	f_1	f_1	
a	f_2	f_2	f_2	f_2	
a	f_3	f_3	f_3	f_3	=: G_3
a	f_4	f_4	★	★	
a	f_5	★	★	★	

$UC_{\delta||}$: Quantification as structured reference

- UC_0 with ranked sets of individuals ($UC_{\delta||}$, Bittner 2014)
  - **plural info-state** (set of *dref hierarchies*) represents both *drefs* and *relations*
  - ***local* anaphors** refer to ranked *individuals* (e.g. $\top\delta$) or *ranked sets* (e.g. $\top\delta t$)
    ***global* anaphors** refer to ranked *global values* (e.g. $\top\delta||$)
  - **update** *function* an input plural info-state to *the output* info
  - **minimal info-state** (no drefs) is the singleton of the *empty hierarchy* (as in UC_0)

$UC_{\delta||}$: Cardinality predicate of *global value*

UC v. DPIL:

maximization and *distributivity* built into UC **update function** (no need for distributive or maximizing operators, such as van den Berg's Δ_u, $\mathbf{M}_u$, or for dummies)

(1') i. Al^x [invited] **some** friends$_{\top}{}^x$.

$^{\top}[x|\ x =_i al]$; $[x|\ friend\langle x, \top\delta\rangle]$; $[invite\langle \top\delta, \bot\delta\rangle]$; $[\mathbf{2}^+\{\bot\delta||\}]$

c_1	c_2	c_3	✓c_3
$\langle\langle a\rangle, \langle\rangle\rangle$	$\langle\langle a\rangle, \langle f_1\rangle\rangle$	$\langle\langle a\rangle, \langle f_1\rangle\rangle$	
	$\langle\langle a\rangle, \langle f_2\rangle\rangle$	$\langle\langle a\rangle, \langle f_2\rangle\rangle$	
	$\langle\langle a\rangle, \langle f_3\rangle\rangle$	$\langle\langle a\rangle, \langle f_3\rangle\rangle$	
	$\langle\langle a\rangle, \langle f_4\rangle\rangle$	$\langle\langle a\rangle, \langle f_4\rangle\rangle$	
	$\langle\langle a\rangle, \langle f_5\rangle\rangle$		

output c_3

for same model,

i.e. Al's friends: f_1, …, f_5

invited friends: f_1, …, f_4

$UC_{\delta||}$: Quantified subject as topic-comment

(1') ii$_a$. **Most**$_{\perp}^{x,X}$ people …

$^{\top}[x|\, person\langle x\rangle, x =_i \perp\delta]\ ^{\top};\ (^{\top}[X|\, X =_I \top\delta||]\ ^{\top};$

c_4	c_5
$\langle\langle f_1, a\rangle, \langle f_1\rangle\rangle$	$\langle\langle F_{1\text{-}4}, f_1, a\rangle, \langle f_1\rangle\rangle$
$\langle\langle f_2, a\rangle, \langle f_2\rangle\rangle$	$\langle\langle F_{1\text{-}4}, f_2, a\rangle, \langle f_2\rangle\rangle$
$\langle\langle f_3, a\rangle, \langle f_3\rangle\rangle$	$\langle\langle F_{1\text{-}4}, f_3, a\rangle, \langle f_3\rangle\rangle$
$\langle\langle f_4, a\rangle, \langle f_4\rangle\rangle$	$\langle\langle F_{1\text{-}4}, f_4, a\rangle, \langle f_4\rangle\rangle$
[came]	
$([come\langle\top\delta\rangle];$	$[\textbf{\textit{most}}\{\top\delta t\ ,\ \top\delta\|\|\}]))$
c_6	✓c_6
$\langle\langle F_{1\text{-}4}, f_1, a\rangle, \langle f_1\rangle\rangle$	
$\langle\langle F_{1\text{-}4}, f_2, a\rangle, \langle f_2\rangle\rangle$	
$\langle\langle F_{1\text{-}4}, f_3, a\rangle, \langle f_3\rangle\rangle$	

output c_6, if out of
4 invitess, $F_{1\text{-}4} = \{f_1, \ldots, f_4\}$
3 came, $F_{1\text{-}3} = \{f_1, \ldots, f_3\}$

$UC_{\delta||}$: Distributive subject as topic-comment

(1') ii$_b$. and they$_{\top}$ **all**$_{\top}{}^{X}$

$[\mathbf{2}^{+}\{\top\delta||\}]; ({}^{\top}[X|\, X =_I \top\delta||]$ $\quad {}^{\top};$

✓c_6 $\quad c_7$

$\langle\langle F_{1\text{-}3}, F_{1\text{-}4}, f_1, a\rangle, \langle f_1\rangle\rangle$

$\langle\langle F_{1\text{-}3}, F_{1\text{-}4}, f_2, a\rangle, \langle f_2\rangle\rangle$

$\langle\langle F_{1\text{-}3}, F_{1\text{-}4}, f_3, a\rangle, \langle f_3\rangle\rangle$

[had a good time]

$([hv.gt\langle\top\delta\rangle];$ $[\top\delta t =_I \top\delta||]))$

c_8 (= c_7) ✓c_8

$\langle\langle F_{1\text{-}3}, F_{1\text{-}4}, f_1, a\rangle, \langle f_1\rangle\rangle$

$\langle\langle F_{1\text{-}3}, F_{1\text{-}4}, f_2, a\rangle, \langle f_2\rangle\rangle$

$\langle\langle F_{1\text{-}3}, F_{1\text{-}4}, f_3, a\rangle, \langle f_3\rangle\rangle$

output c_8, if each invited friend who came, $F_{1\text{-}3} = \{f_1, \ldots, f_3\}$ had a good time

$UC_{\delta||}$: Partitive subject as topic-comment

(1′) iii. **One**$_{\top'\delta t}^{x, X}$ girl

$^{\top}[x|\ girl\langle x\rangle, x \in_i \top'\delta t]\ ^{\top}$;

c_9

$\langle\langle f_3, F_{1\text{-}3}, F_{1\text{-}4}, f_1, a\rangle, \langle f_1\rangle\rangle$
$\langle\langle f_3, F_{1\text{-}3}, F_{1\text{-}4}, f_1, a\rangle, \langle f_2\rangle\rangle$
$\langle\langle f_3, F_{1\text{-}3}, F_{1\text{-}4}, f_2, a\rangle, \langle f_3\rangle\rangle$
$\langle\langle f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_2, a\rangle, \langle f_1\rangle\rangle$
$\langle\langle f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_3, a\rangle, \langle f_2\rangle\rangle$
$\langle\langle f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_3, a\rangle, \langle f_3\rangle\rangle$

[had a prior engagement

$([hv.prior.engagement\langle \top\delta\rangle];$

c_{11}

$\langle\langle F_{3\text{-}4}, f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_1, a\rangle, \langle f_1\rangle\rangle$
$\langle\langle F_{3\text{-}4}, f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_2, a\rangle, \langle f_2\rangle\rangle$
$\langle\langle F_{3\text{-}4}, f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_3, a\rangle, \langle f_3\rangle\rangle$

$(^{\top}[X|\ X =_I \top\delta||]\ ^{\top}$;

c_{10}

$\langle\langle F_{3\text{-}4}, f_3, F_{1\text{-}3}, F_{1\text{-}4}, f_1, a\rangle, \langle f_1\rangle\rangle$
$\langle\langle F_{3\text{-}4}, f_3, F_{1\text{-}3}, F_{1\text{-}4}, f_1, a\rangle, \langle f_2\rangle\rangle$
$\langle\langle F_{3\text{-}4}, f_3, F_{1\text{-}3}, F_{1\text{-}4}, f_2, a\rangle, \langle f_3\rangle\rangle$
$\langle\langle F_{3\text{-}4}, f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_2, a\rangle, \langle f_1\rangle\rangle$
$\langle\langle F_{3\text{-}4}, f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_3, a\rangle, \langle f_2\rangle\rangle$
$\langle\langle F_{3\text{-}4}, f_4, F_{1\text{-}3}, F_{1\text{-}4}, f_3, a\rangle, \langle f_3\rangle\rangle$

]

$[\textbf{\textit{one}}\{\top\delta t, \top\delta||\}]))$

✓c_{11}

output c_{11},
if $F_{1\text{-}4}$ (invited friends)
includes 2 girls: f_3 & f_4

Global conclusion (whole course)

- **Dynamic semantics**, which explicitly represents *context change*, is motivated by *e*vidence from a wide variety of phenomena in diverse languages.
- The **phenomena** at issue include: *nominal reference, indexicality*, *temporal reference, plurality and quantification*, *presupposition, vagueness*, … (long list, keeps growing)
- To represent such phenomena, we need a **logical representation** system that can represent:
  - current *discourse referents* (drefs)
  - current *rank* of each dref
  - ranked drefs in *center* v. *background* of attention
  - semantic type of each dref: e.g.
    - *individual*, *event*, *state*, *time*, *world*, …
    - *set of individuals*, *set of events*, *set of states*, *set of times*, *set of worlds*, …
  - current *relations* between drefs

References (1)

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