Wide-scope distributivity

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NELS

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A puzzle about scope and a paradox about dependent plurals

Q-distributivity

(1) The women from Boxborough brought a salad (Roberts, 1987)

a. **collective:** one salad overall

b. **distributive:** one salad per woman

Q-distributivity

(1) The women from Boxborough **D** brought a salad (Roberts, 1987)

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Q-distributivity

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a. **collective:** one salad overall

b. **distributive:** one salad per woman

$$[\![\mathrm{D}]\!](\mathit{predicate}) = \lambda X.\forall x \in X,\ \mathbf{atom}(x) \rightarrow \mathit{predicate}(x)$$

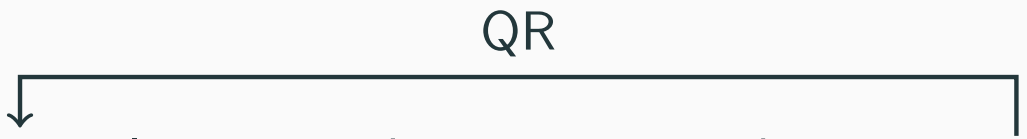
Q-distributivity

(2) John gave a pumpkin pie to the two girls (Roberts, 1987)

a. **collective:** one pumpkin pie overall

b. **distributive:** one pumpkin pie per girl

Q-distributivity



(2) the two girls λ_1. John gave a pumpkin pie to t_1

a. **collective:** one pumpkin pie overall

b. **distributive:** one pumpkin pie per girl

Q-distributivity

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Q-distributivity

(3) John gave a pumpkin pie to the two girls.

(Other analysis of (3): generalizing the operator (Lasersohn, 1998), thematic-role based account of distributivity (Champollion, 2016))

[1] Assuming Roberts (1987) and QR clause-boundedness. *A minima*, one can say that its scope is local to the **DP**, where the notion of *locality* depends on the theory of distributive readings.

Q-distributivity

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Locality conditions on distributivity

The universal force associated with the distributive reading of a **DP** has its scope within the same clause as the **DP** itself[1].

[1] Assuming Roberts (1987) and QR clause-boundedness. *A minima*, one can say that its scope is local to the **DP**, where the notion of *locality* depends on the theory of distributive readings.

(4) a. **Context:** *we're experimenting a new drug ; Anna just came back with the results of the experiment.*

b. Well, either the drug made the subjects sick or it made them sleepy ; none of them was cured.

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- **Other reading:** either the drug made all of the subjects sick or it made all of them sleepy

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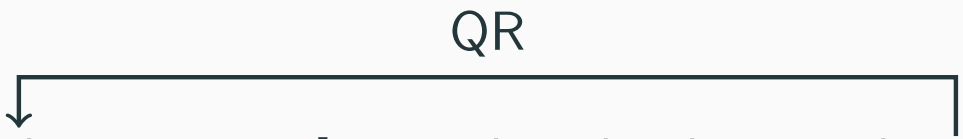

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(5) ??Either the drug made every participant sick or it made him sleepy.

More examples

(6) a. **Context:** *Ten 3D printers are currently running ; they're not expected to finish their prints at the same time.*

b. When the printers are done with their prints, they will emit a long high-pitched noise.

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(6) a. **Context:** *Ten 3D printers are currently running ; they're not expected to finish their prints at the same time.*

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- **WSD reading:** for each printer p, when p will be done with p's print, p will emit a long high-pitched noise.
- ~~**Other reading:** when all the printers are done with their prints, they will emit a long high-pitched noise~~

More examples

Some previously known cases may be subsumed under this paradigm.

(7) a. The people who voted for the rightwing candidates thought that they would win the election.

(Dimitriadis (2000), adapted)

b. **Reading:** for each of the rightwing candidates x, the people who voted for x thought x would win.

Data summary

- In a wide range of environments, a plural definite description may be interpreted distributively with an arbitrary wide-scope.
  - $\rightsquigarrow$ let's call these readings *wide-scope distributivity* readings

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Data summary

- In a wide range of environments, a plural definite description may be interpreted distributively with an arbitrary wide-scope.

  $\rightsquigarrow$ let's call these readings *wide-scope distributivity* readings

- Standard approaches to Q-distributivity predict local distributive readings.
- What's happening?

Idea

Let's restrict ourselves to pronominal examples for now. This will reveal a second challenge raised by these sentences.

(8) a. Either it made them sick or it made them sleepy.

b. When they are done, they will emit a long high-pitched sounds.

c. The people who voted for them thought they would win.

Remarks

- **Remark #1:** pronouns in WSD sentences are plural pronouns with singular reference.
- **Remark #2:**
- **Remark #3:**

Remark #1: pronouns in WSD have singular reference

(9) a. Either they were all sick or they were all sleepy.

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(9) a. Either they were all sick or they were all sleepy.

b. ~~**Reading:** every subject was either made sick or sleepy.~~

c. **Other reading:** either all of the subjects were sick or all of them were sleepy.

Remark #1: pronouns in WSD have singular reference

(10) a. When they are all done, they will emit a long high-pitched sound.

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(10) a. When they are all done, they will emit a long high-pitched sound.

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c. **Other reading:** when all the printers are done with their prints, they will emit a long high-pitched noise

Remark #1: pronouns in WSD have singular reference

This behaviour is familiar : bound plural pronouns.

(11) a. All the children thought they would win.
$\rightsquigarrow$ ✓ one winner.

b. All the children thought they would all win.
$\rightsquigarrow$# one winner.

Remarks

- **Remark #1:** pronouns in WSD sentences are plural pronouns with singular reference.
- **Remark #2:** WSD sentences license dependent plurals
- **Remark #3:**

Remark #2: WSD sentences license dependent plurals

Dependent plurals are expressions that seem equivalent to their singular counterparts[2].

(12) a. All the boys flew their kites/kites.
$\rightsquigarrow$ ✓ one kite per boy

b. All the boys flew their 10 kites/several kites/ten kites.
$\rightsquigarrow$ *one kite per boy.

[2] *Mise en abyme*.

Descriptive generalizations about *dependent plurals*

- They need to be "*licensed*".
- They are licensed by *all*, *plural definite descriptions*, etc.
- The licensing is subject to intervention effects by e.g. singular indefinites

(Roberts, 1987; Spector, 2003; Zweig, 2008; Ivlieva, 2013; Minor, 2017, a.o.)

Remark #2: WSD sentences license dependent plurals

(13) a. **Pretext:** *The participants of our survival game are in critical conditions.*

b. Either they have finished their ration boxes or they lost them to mountain lions.
$\rightsquigarrow$ ✓ one ration box per participant

Remarks

- **Remark #1:** pronouns in WSD sentences are plural pronouns with singular reference.
- **Remark #2:** WSD sentences license dependent plurals
- **Remark #3:** Pronouns with singular reference do not license dependent plurals

Remark #3: Pronouns with singular reference do not license dependent plurals

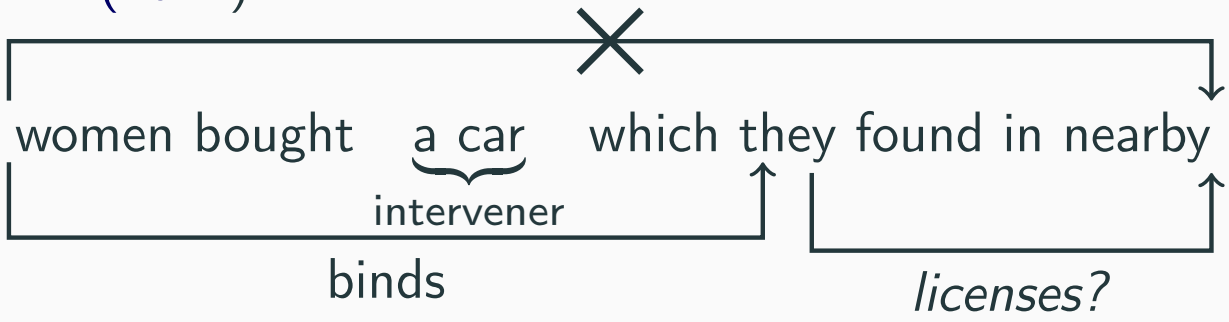
Data from Minor (2017)

(14) All the women bought $\underbrace{\text{a car}}$ which they found in nearby stores.

$\rightsquigarrow$ * *all* $\gg$ *a* **and** one car per woman **and** one store per car

Remark #3: Pronouns with singular reference do not license dependent plurals

Data from Minor (2017)



$\rightsquigarrow$ * *all* $\gg$ *a* **and** one car per woman **and** one store per car

Remarks

- **Remark #1:** pronouns in WSD sentences are plural pronouns with singular reference.
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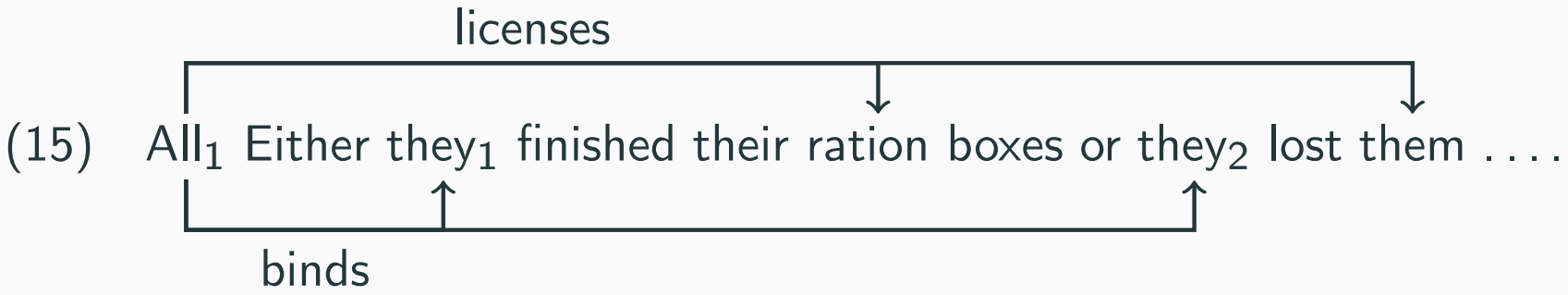
$\rightsquigarrow$ What licenses dependent plurals in WSD sentences?

Solution

Pronouns in WSD sentences are bound by a covert All operator ; it is this operator that licenses the dependent plurals.

Solution


licenses
(15) All$_1$ Either they$_1$ finished their ration boxes or they$_2$ lost them . . . .
binds

The pronominals do not need to move to get a distributive reading. They are simply bound.

The pronominals do not need to move to get a distributive reading. They are simply bound.

$$\checkmark\ \text{ALL}_1 \ldots [_{\text{island}} \ldots \text{they}_1$$

What about sentences with definite descriptions?

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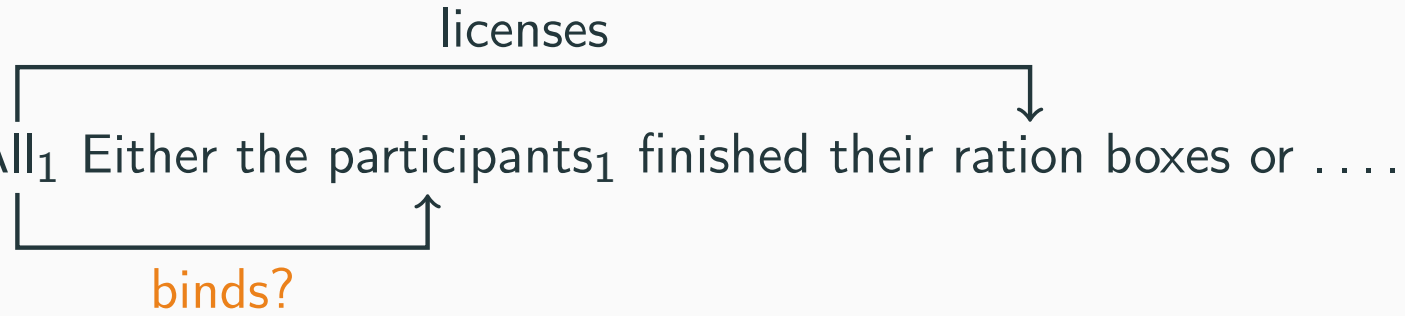


To extend this account to the case of definite descriptions, we have to assume that these definite decriptions can be interpreted anaphorically.

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

c. **Coordination of proper names:**
✓ When Printer 1 and Printer 2 are done with their prints, they will emit a high-pitched noise.

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

c. **Coordination of proper names:** ✓

d. **Numerals:**

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

c. **Coordination of proper names:** ✓

d. **Numerals:**
When two printers are done with their prints, they will emit a high-pitched noise.
✓ when there are two printers that are done with their prints, ...

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

c. **Coordination of proper names:** ✓

d. **Numerals:**
When two printers are done with their prints, they will emit a high-pitched noise.
✓ when there are two printers that are done with their prints, ...
✓ there are two printers such that when both of them are done with their prints, ...

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

c. **Coordination of proper names:** ✓

d. **Numerals:**
When two printers are done with their prints, they will emit a high-pitched noise.
✓ when there are two printers that are done with their prints, ...
✓ there are two printers such that when both of them are done with their prints, ...
* for each of two printers x, when x is done with its print, ...

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

c. **Coordination of proper names:** ✓

d. **Numerals:**
When two printers are done with their prints, they will emit a high-pitched noise.
✓ when there are two printers that are done with their prints, ...
✓ there are two printers such that when both of them are done with their prints, ...
* for each of two printers x, when x is done with its print, ...

$\rightsquigarrow$ cf *if two relatives of mine die, I'll inherit a house* (Ruys, 1992)

(17) a. **Definite descriptions:** ✓

b. **Pronouns:** ✓

c. **Coordination of proper names:** ✓

d. **Numerals:** *

e. **Plural quantifiers:**
* When all/most (of the) printers are done with their prints, they will emit a high-pitched noise.

Generalization

Only referential expressions (i.e. type e) can receive WSD readings.

The plot

- Adopt an already existing analysis of dependent plurals and bound plurals under a quantifier like *all*.
  $\rightsquigarrow$ plural assignment approach from Minor (2017) and also Champollion et al. (2017), Nouwen (2003)
- Adapt it so that referential expressions may act as anaphors.
  $\rightsquigarrow$ referential expressions contribute their descriptive content as a presupposition.

Formal implementation: bird's-eye view

Standard picture

Sentences are evaluated against a single assignment function

van den Berg (1996)'s proposal

Sentences are evaluated against multiple assignment functions

(18) a. Every boy_1 picked a flower_2 ...

b. ... They$_1$ gave them$_2$ to Bill.

Output assignment of the first sentence:

G	1	2	...
g_1	$\texttt{boy}'_1$	$\texttt{flower}'_1$	...
g_2	$\texttt{boy}'_2$	$\texttt{flower}'_2$	...
	...		
g_{47}	$\texttt{boy}'_{47}$	$\texttt{flower}'_{47}$	...

(18) a. Every boy_1 picked a flower_2 ...

b. ... They_1 gave them_2 to Bill.

Output assignment of the first sentence:

G	1	2	...	**Evaluating (18b)**
g_1	$\texttt{boy}'_1$	$\texttt{flower}'_1$	...	$g_1(1)$ gave $g_1(2)$ to B.
g_2	$\texttt{boy}'_2$	$\texttt{flower}'_2$	...	$g_2(1)$ gave $g_2(2)$ to B.
		...		
g_{47}	$\texttt{boy}'_{47}$	$\texttt{flower}'_{47}$	...	$g_{47}(1)$ gave $g_{47}(2)$ to B.

(18) a. Every boy_1 picked a flower_2 ...

b. ... They$_1$ gave them$_2$ to Bill.

Output assignment of the first sentence:

G	1	2	...	**Evaluating (18b)**
g_1	$\texttt{boy}'_1$	$\texttt{flower}'_1$	...	Boy 1 gave flower 1 to B.
g_2	$\texttt{boy}'_2$	$\texttt{flower}'_2$	...	*and* Boy 2 gave flower 2 to B.
		...		
g_{47}	$\texttt{boy}'_{47}$	$\texttt{flower}'_{47}$	...	*and* Boy 47 gave flower 47 to B.

$\rightsquigarrow$ (18b) is true iff [boy 1 gave flower 1 to Bill] and [boy 2 gave flower 2 to Bill] and ...

Principle of interpretation

A sentence is evaluated for every assignment function. The sentence comes out true if true under all evaluations. In other words, evaluation is row-wise[3].

[3] In the more fleshed-out version of this semantics, this principle comes out as a consequence of the way we define operators. Thus, different choices of implementation of the plural assignment semantics may fail to vindicate this principle.

Another ingredient is needed for bound plurals and dependent plurals: column-wise evaluation of number features.

(19) The students all$_1$ λ_1 t_1 thought they$_1$ would win.

The students introduces a plurality in the assignment at index 1.

$$\varnothing \longrightarrow \frac{G \qquad\qquad 1}{g_1 \quad \mathtt{student}'_1 \oplus \ldots \oplus \mathtt{student}'_{35}}$$

(19) The students all$_1$ λ_1 t_1 thought they$_1$ would win.

all$_1$ "*splits*" the singular assignment into a plural one.

G	1
g_1	$\texttt{student}'_1 \oplus \ldots \oplus \texttt{student}'_{35}$

$\longrightarrow$

G	1
g_1	$\texttt{student}'_1$
g_2	$\texttt{student}'_2$
	$\ldots$
g_{35}	$\texttt{student}'_{35}$

(19) The students all_1 λ_1 t_1 thought pro_1[+pl] would win.

G	1	...	**Evaluating (21)**
g_1	$\texttt{student}'_1$	...	student 1 thought student 1 would win
g_2	$\texttt{student}'_2$	...	student 2 thought student 2 would win
	...		
g_{35}	$\texttt{student}'_{35}$	...	student 35 thought student 35 would win

$\rightsquigarrow$ for all students s, s thought s would win. (singular reference reading)

What does [+pl] do?

(20) The students all$_1$ λ_1 t_1 thought pro$_1$[+pl] would win.

G	1	...
g_1	$\texttt{student}'_1$	...
g_2	$\texttt{student}'_2$	...
	...	
g_{35}	$\texttt{student}'_{35}$	...

Evaluating (20)

student 1 thought student 1 would win

student 2 thought student 2 would win

student 35 thought student 35 would win

[+pl] checks that sums of referents in column 1 isn't a singula

[4] I am assuming that plural means "*more than one*" ; whether the multiplicity inference should be derived as an implicature is, as far as I can tell, orthogonal to my concerns.

(21) # The students all$_1$ thought he$_1$ would win.

G	1	...
g_1	$\texttt{student}'_1$	...
g_2	$\texttt{student}'_2$	...
	...	
g_{35}	$\texttt{student}'_{35}$	...

Evaluating (21)

student 1 thought student 1 would win

student 2 thought student 2 would win

student 35 thought student 35 would win

Multiple students: the presupposition of **[+sg]** is not satisfie

Dichotomy

- Content is evaluated row-wise.
- Number feature presuppositions is evaluated column-wise.

(22) The boys all λ_1 [t_1 flew kites**[+pl]**]$_\alpha$

α is evaluated against the following plural assignment:

G	1	2
g_1	boy'_1	
g_2	boy'_2	
	...	
g_{47}	boy'_{47}	

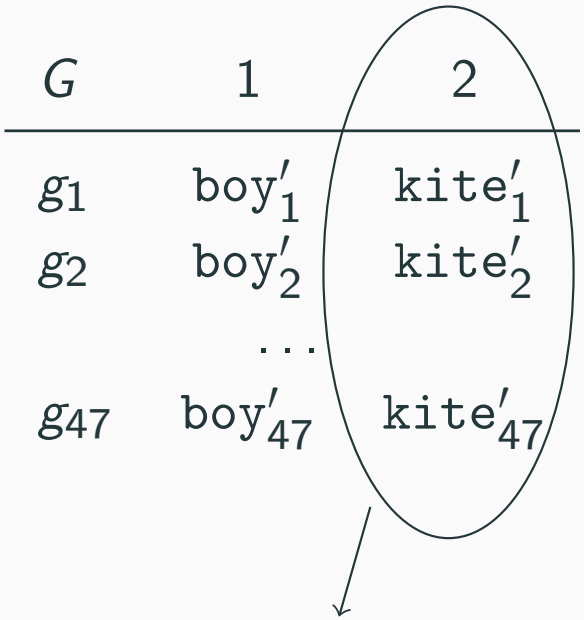
(22) The boys all λ_1 [t_1 flew kites**[+pl]**]$_\alpha$

α is evaluated against the following plural assignment:

G	1	2
g_1	$\texttt{boy}'_1$	$\texttt{kite}'_{11} \oplus \texttt{kite}'_{12}$
g_2	$\texttt{boy}'_2$	$\texttt{kite}'_{21}$
	...	
g_{47}	$\texttt{boy}'_{47}$	$\texttt{kite}'_{47}$

(22) The boys all λ_1 [t_1 flew kites**[+pl]**]$_\alpha$

α is evaluated against the following plural assignment:



G	1	2
g_1	$\mathtt{boy}'_1$	$\mathtt{kite}'_1$
g_2	$\mathtt{boy}'_2$	$\mathtt{kite}'_2$
	...	
g_{47}	$\mathtt{boy}'_{47}$	$\mathtt{kite}'_{47}$

[+pl] checks if sum of referents in column 1 isn't a singularity

(23) The boys all λ_1 [t_1 flew ten kites**[+pl]**]$_\alpha$

α is evaluated against the following plural assignment:

G	1	2
g_1	$\mathtt{boy}'_1$	$\mathtt{kite}'_1$
g_2	$\mathtt{boy}'_2$	$\mathtt{kite}'_2$
	...	
g_{47}	$\mathtt{boy}'_{47}$	$\mathtt{kite}'_{47}$

[+pl] checks if column forms a plurality

(23) The boys all λ_1 [t_1 flew ten kites**[+pl]**]$_\alpha$

α is evaluated against the following plural assignment:

G	1	2	**Evaluation**
g_1	$\mathtt{boy}'_1$	$\mathtt{kite}'_1$	$\#g_1(2) = 10$
g_2	$\mathtt{boy}'_2$	$\mathtt{kite}'_2$	$\#g_2(2) = 10$
	...		
g_{47}	$\mathtt{boy}'_{47}$	$\mathtt{kite}'_{47}$	$\#g_{47}(47) = 10$

ALL has the same meaning as *all*. It splits the assignment function

(24) ALL_1 [either it made them$_1$ sick or it made them$_1$ sleepy.]$_\alpha$

Input assignment to the sentence:

G	1
g_1	$p_1 \oplus \ldots \oplus p_{12}$

(24) ALL_1 [either it made them$_1$ sick or it made them$_1$ sleepy.]$_\alpha$

Input assignment to α:

G	1
g_1	p_1
g_2	p_2
...	
g_{12}	p_{12}

$\rightsquigarrow$ presupposition of [+pl] on pronouns is satisfied, presupposition of [+sg] isn't.

[5] Compositionally, for this analysis to go through, we need to treat a special version of plural logic disjunction, called "*splitjunction*". Ask me or cf Champollion (2016) for more details

(24) ALL_1 [either it made them$_1$ sick or it made them$_1$ sleepy.]$_\alpha$

Input assignment to α:

G	1	**Evaluation**[5]
g_1	p_1	it made $g_1(1)$ sick or it made $g_1(1)$ sleepy
g_2	p_2	it made $g_2(1)$ sick or it made $g_2(1)$ sleepy
...		
g_{12}	p_{12}	it made $g_{12}(1)$ sick or it made $g_{12}(1)$ sleepy

[5] Compositionally, for this analysis to go through, we need to treat a special version of plural logic disjunction, called "*splitjunction*". Ask me or cf Champollion (2016) for more details

(24) ALL_1 [either it made them$_1$ sick or it made them$_1$ sleepy.]$_\alpha$

Input assignment to α:

G	1	**Evaluation**[5]
g_1	p_1	it made p_1 sick or it made p_1 sleepy
g_2	p_2	it made p_2 sick or it made p_2 sleepy
...		
g_{12}	p_{12}	it made p_{12} sick or it made p_{12} sleepy

$\leftrightsquigarrow$ for each p_i, either it made p_i sick or it made p_i sleepy.

[5] Compositionally, for this analysis to go through, we need to treat a special version of plural logic disjunction, called "*splitjunction*". Ask me or cf Champollion (2016) for more details

(25) ALL_1 [either they_1 have finished their_1 ration boxes_2 or they_1 lost them_2 to mountain lions]$_\alpha$

G	1	2
g_1	$\texttt{participant}'_1$	$\texttt{ration-box}'_1$
g_2	$\texttt{participant}'_2$	$\texttt{ration-box}'_2$
	...	
g_{12}	$\texttt{participant}'_{12}$	$\texttt{ration-box}'_{12}$

(25) ALL$_1$ [either they$_1$ have finished their$_1$ ration boxes$_2$ or they$_1$ lost them$_2$ to mountain lions]$_\alpha$

G	1	2	Evaluation
g_1	$\texttt{participant}'_1$	$\texttt{ration-box}'_1$	either $g_1(1)$ finished $g_1(2)$ or $g_1(1)$ lost $g_1(2)$
g_2	$\texttt{participant}'_2$	$\texttt{ration-box}'_2$	either $g_2(1)$ finished $g_2(2)$ or $g_2(1)$ lost $g_2(2)$
	...		
g_{12}	$\texttt{participant}'_{12}$	$\texttt{ration-box}'_{12}$	either $g_{12}(1)$ finished $g_{12}(2)$ or $g_{12}(1)$ lost $g_{12}(2)$

(25) ALL_1 [either they_1 have finished their_1 ration boxes_2 or they_1 lost them_2 to mountain lions]$_\alpha$

G	1	2	Evaluation
g_1	$\texttt{participant}'_1$	$\texttt{ration-box}'_1$	either participant 1 finished ration box 1 or ...
g_2	$\texttt{participant}'_2$	$\texttt{ration-box}'_2$	either participant 2 finished ration box 2 or ...
	...		
g_{12}	$\texttt{participant}'_{12}$	$\texttt{ration-box}'_{12}$	either participant 12 finished ration box 12 or ...

$\leftrightsquigarrow$ for each participant p_i, either p_i finished r_i or p_i lost r_i.

(26) a. ALL$_1$ [they$_1$ were sick] or [they$_1$ were sleepy]

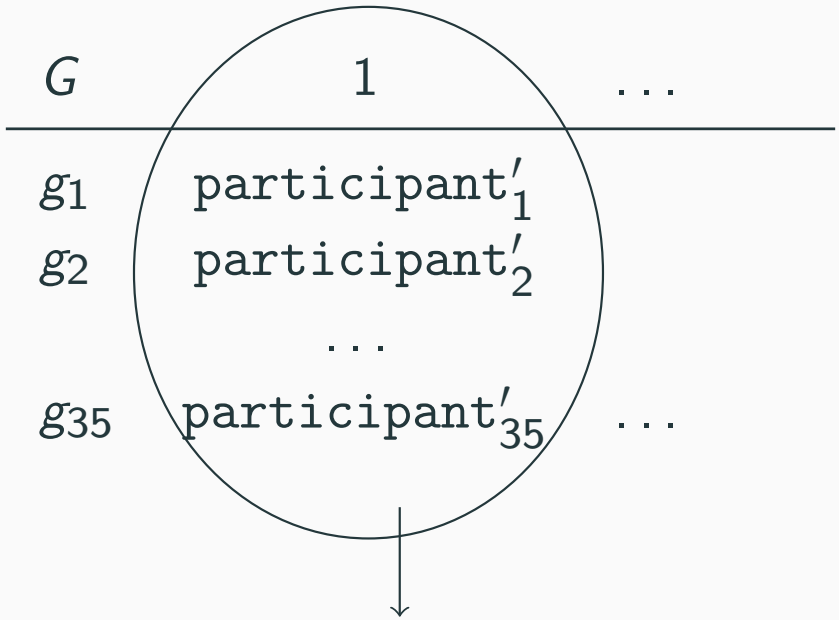
b. ALL$_1$ [the participants$_1$ were sick] or [they$_1$ were sleepy]

(27) a. pro[+pl]$_1$ presupposes that the sum of referents in column 1 is a plurality

b. the participants$_1$ presupposes that the sum of referents in column 1 is the maximal sum of participants.

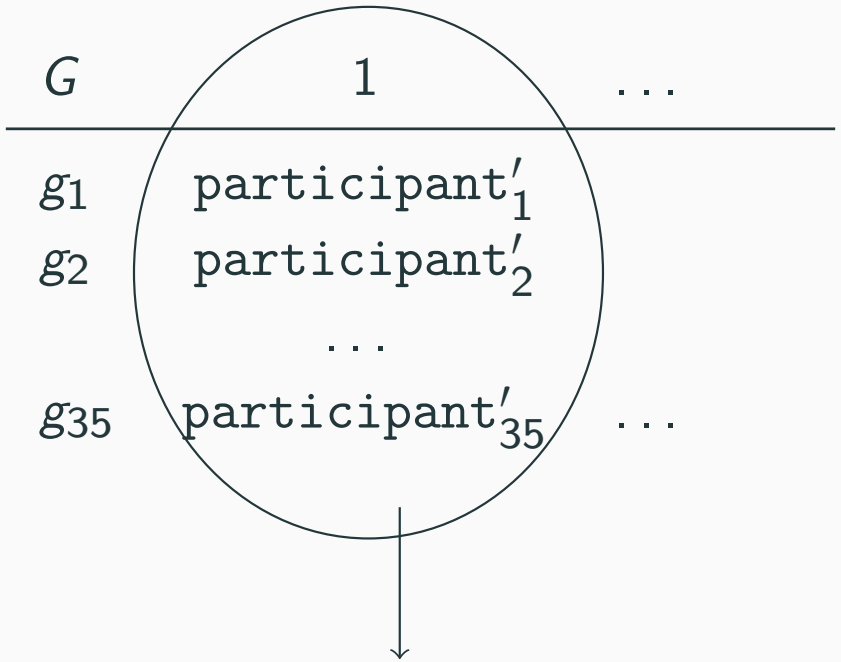
In some sense, referential expressions can act as "*pronominal features*".

(28) ALL_1 [they_1 were sick] or [they_1 were sleepy]



[+pl] presupposes that the sum of referents in column 1 is a plurality.

(29) ALL_1 [the participants$_1$ were sick] or [they$_1$ were sleepy]



"*the participants*" presupposes that the sum of referents in column 1 is the maximal sum of participants.

Recap and conclusion

Recap

- **Initial puzzle:** non-clause-bound distributive readings of referential expressions

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- **Initial puzzle:** non-clause-bound distributive readings of referential expressions
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Recap and conclusion

Recap

- **Initial puzzle:** non-clause-bound distributive readings of referential expressions
- **Illuminating paradox:** pronouns in WSD sentences have singular reference but seem to license dependent plurals.
- **Suggested solution:** covert index-based ALL operator
- **Extending to all referential expressions:** referential expressions may act as pronouns, contributing their content as a presupposition.

Future questions

- How do we deal with cases of first-mention definite descriptions in WSD sentences?
  - $\rightsquigarrow$ *referent accomodation* (Heim, 1982)
- More complicated cases:

(30) a. **Context:** *This year at the G7 summit, all Japanese ministers met their French counterparts. The meetings happened in different rooms.*

b. When the French ministers arrived, the Japanese ministers greeted them in French

c. **Reading:** for each specialty s, when the French minister of s arrived, the Japanese minister of s greeted him in French.

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Annex

Other WSD cases

(31) a. **Context:** *the employees have different work hours and do not all arrive at the same time.*

b. When these employees arrived this morning, Alex smiled. (but she didn't smile when those ones did.)

(32) a. **Pretext:**
_ Today was crazy ; I had three classes and in each class, there was an arrogant mathematician in the back asking obnoxious technical questions.
_ Well, how did you deal with them?

b. I put on the board a problem that they could not solve. (In my experience, that's the most effective way to shut them up.)

(33) a. **Context:** *Speaker is organizing the presidential debate ; she has to make sure that the candidates' every wish are granted ; otherwise, she'll be accused of favoring one over the other*

b. Unless Clinton and Trump ask me to, I won't give them water bottles.

Problematic singular cases for Sudo (2014)

Subject position

(34) a. **Context:** *I asked ten people to test my new video game. Because the first level is hard, they start the game with a randomly selected bonus in their inventory*

b. ✓ The item**s** that the player started with helped them defeat the dragon

c. ✓ The item_ that the players started with helped them defeat the dragon in the first level.

Problematic cases

Object position

(35) a. **Context:** *I asked ten people to test my new video game. Because the first level is hard, they start the game with a randomly selected bonus in their inventory*

b. The item that gave the players the most advantage wasn't the one that I placed in their inventory.

By contrast, functional RCs show a subject/object asymmetry (Sharvit, 1999).

(36) $[\![\text{ALL}_i]\!](G)(G') = \textbf{true}$ iff

a. $\bigoplus_{g \in G} g(i) = \bigoplus_{g \in G'} g'(i)$

b. for all $g' \in G'$, there exists $g \in G$, $g =_i g'$ and $g'(i)$ is an atom.