What cumulative asymmetries tell us about weak readings and vice-versa

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LFRG

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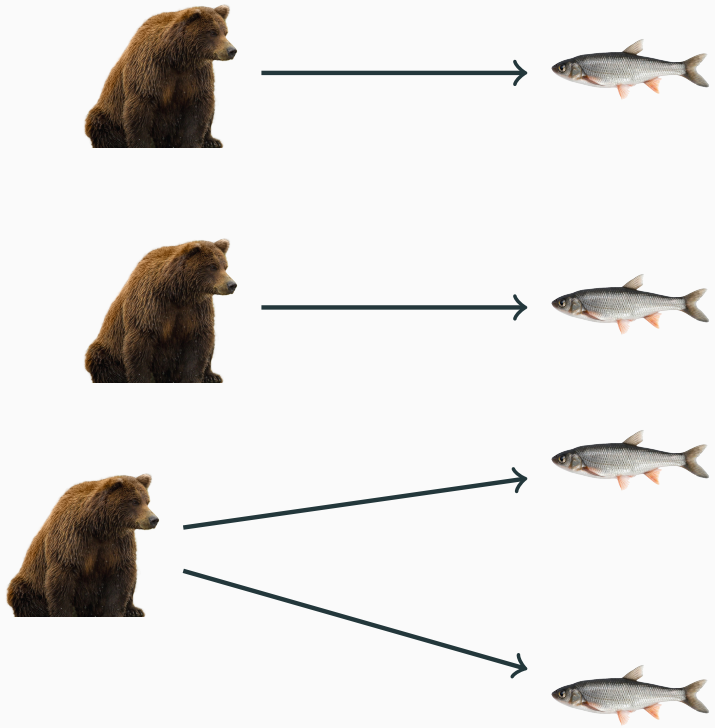
Introduction

Introduction

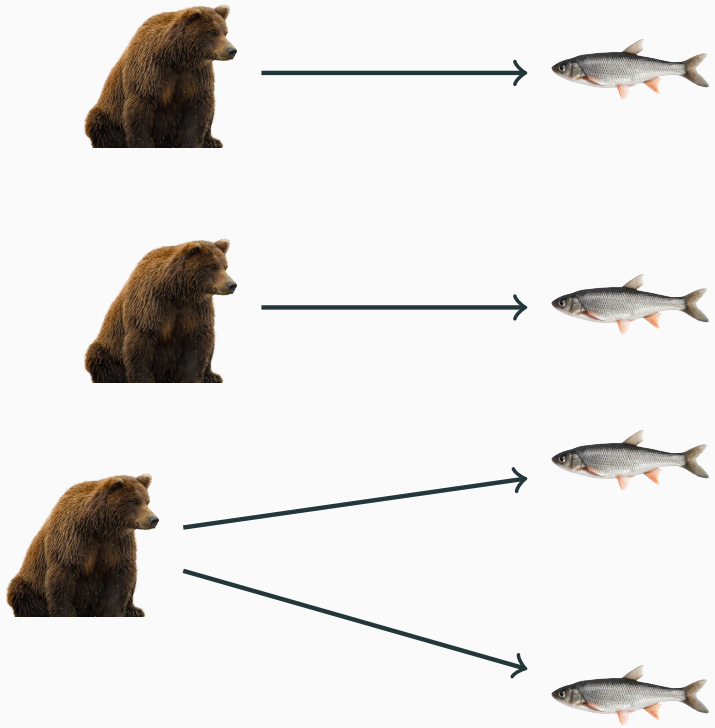
What are cumulative readings?

(1) The 3 bears ate the 4 fish.



What are cumulative readings?

(2) The 3 bears ate every fish.



What are cumulative readings?

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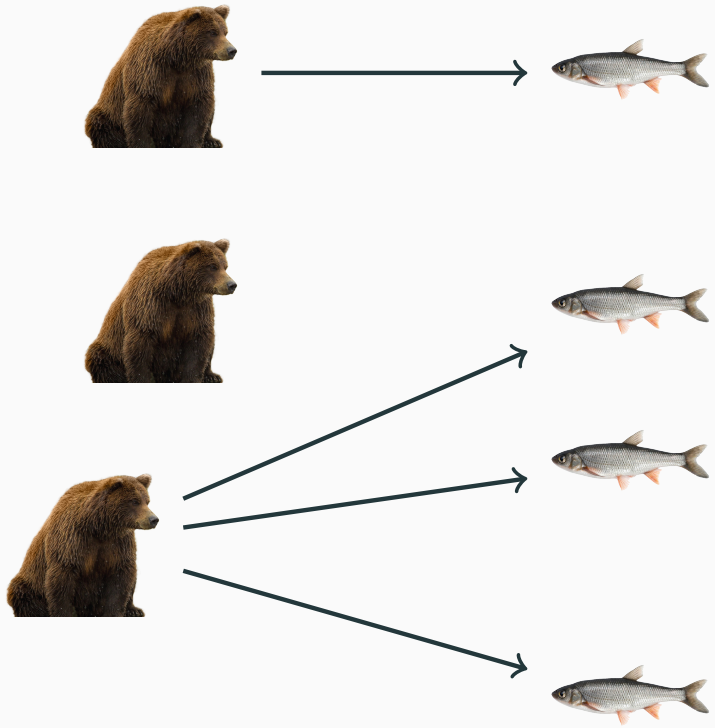
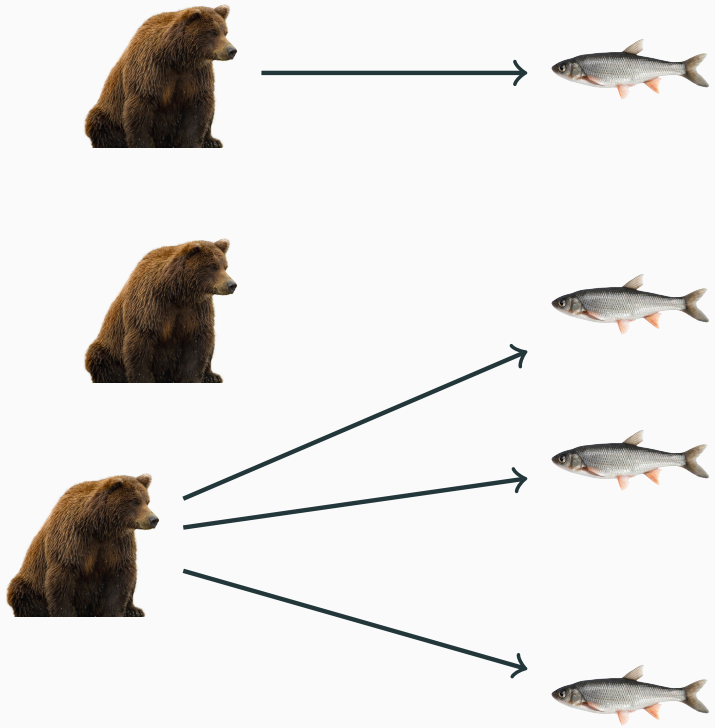


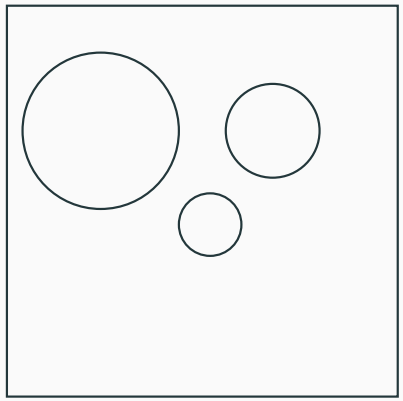
What are cumulative readings?

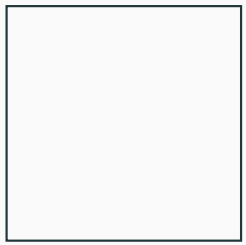
(4) # The 3 bears ate every fish.

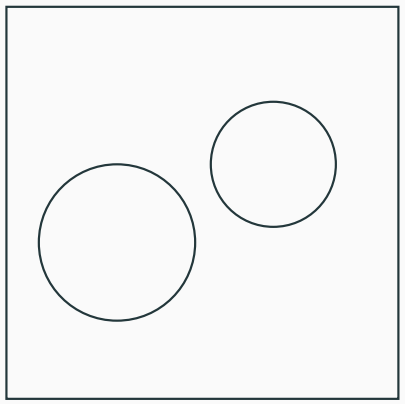


Weak readings

(5) The 3 squares contain the 5 circles Scha (1984)







Weak readings

(6) These 10 chickens laid these 25 eggs. Buccola and Spector (2016)

What are cumulative readings?

(7) The 3 bears ate the 4 fish.

a. **Strong reading:**
every one of the fish was eaten by a bear
and every one of the bears ate a fish

b. **Weak reading:**
every one of the fish was eaten by a bear
~~*and* every one of the bears ate a fish~~

Project

The claim

Cumulative readings (of both *every* and plurals) are underlyingly weak ; they do not require exhaustive participation of the subject.

Predicted

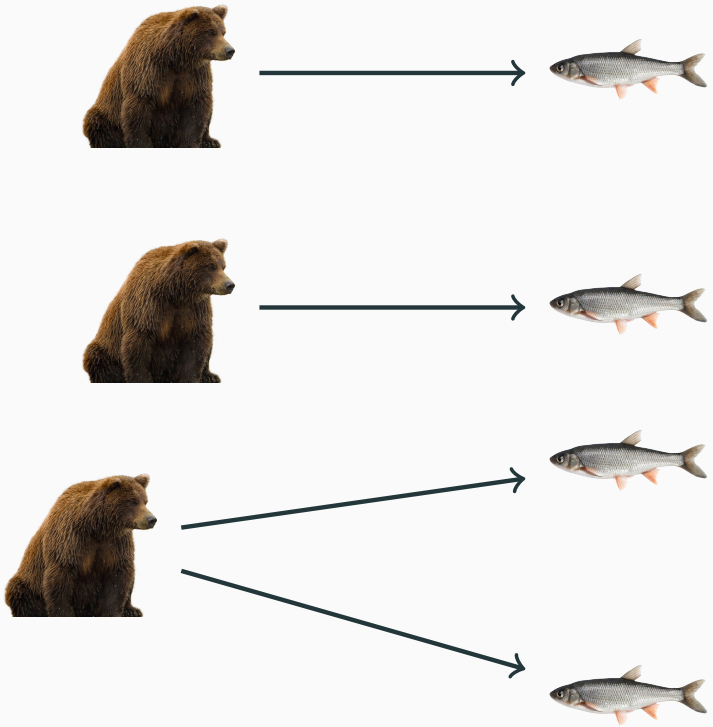
Explain some asymmetries in the availability of cumulative readings of *every*.

Explain some asymmetries in the availability of inferences with numerals.

Every

What are cumulative readings of every?

(8) The 3 bears ate every fish
≈*the 3 bears ate the 4 fish*

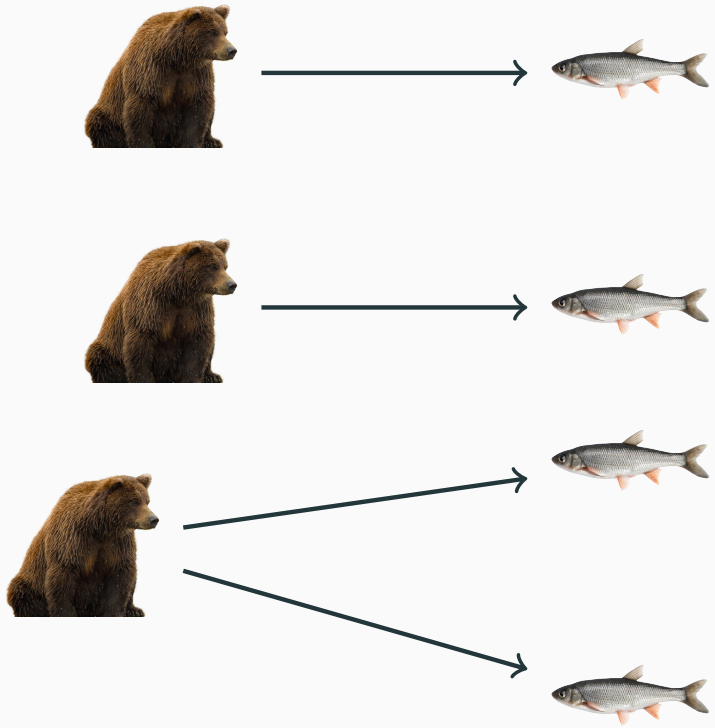


What are cumulative readings of every?

Quite surprising from the perspective of generalized quantifier theory!

Asymmetries

(9) # Every bear ate the 4 fish



Asymmetries

In transitive clauses, only object *every* seems to give rise to cumulative readings.

No rescue for subject every!

Scoping of the object above the subject does not make the missing cumulative reading appear.

[1] Even though cumulative readings can be fed by *wh*-movement Sauerland (2001)

No rescue for subject every!

Scoping of the object above the subject does not make the missing cumulative reading appear.

(10) Which 14 fish did every bear eat?[1] (*14 fish were eaten in total)

[1] Even though cumulative readings can be fed by *wh*-movement Sauerland (2001)

No rescue for subject every!

Scoping of the object above the subject does not make the missing cumulative reading appear.

(10) Which 14 fish did every bear eat?[1] (*14 fish were eaten in total)

(11) German (under the cumulative reading, Nina Haslinger, p.c.)

a. *(that) every copy-editor three mistakes caught

b. *(that) [three mistakes]$_1$ every copy-editor t_1 caught

c. (that) three copy-editors every mistake caught

d. *(that) [every mistake]$_1$ three copy-editors t_1 caught

[1] Even though cumulative readings can be fed by *wh*-movement Sauerland (2001)

Kratzer (2001): availability of cumulative readings is not about position of subjects and objects at LF ; there is something special about themes that prevent them to be read cumulatively.

?: this is not about thematic role

(12) **Goals**

a. The three police officers gave a fine to every car in the street (cumulative)

b. Every police officer gave a fine to the ten cars in the street (*cumulative)

Descriptive generalization

Generalization

A plural expression may be read cumulatively with *every NP* iff its argument position outranks the argument position of *every NP*

Hierarchy

Agent $\gg$ Theme

(13) a. I will donate every dime I earned in my life to 5 carefully selected charities
(cumulative)

b. I will donate the 25 dimes I earned in my life to every charity
(*cumulative)

Hierarchy of cumulative readings.

Agent $\gg$ Goal $\gg$ Theme

Is this c-command?

[2] Ask me why!

Is this c-command?

No, it is commonly believed that direct object c-commands indirect object in dative constructions.

[2] Ask me why!

Is this c-command?

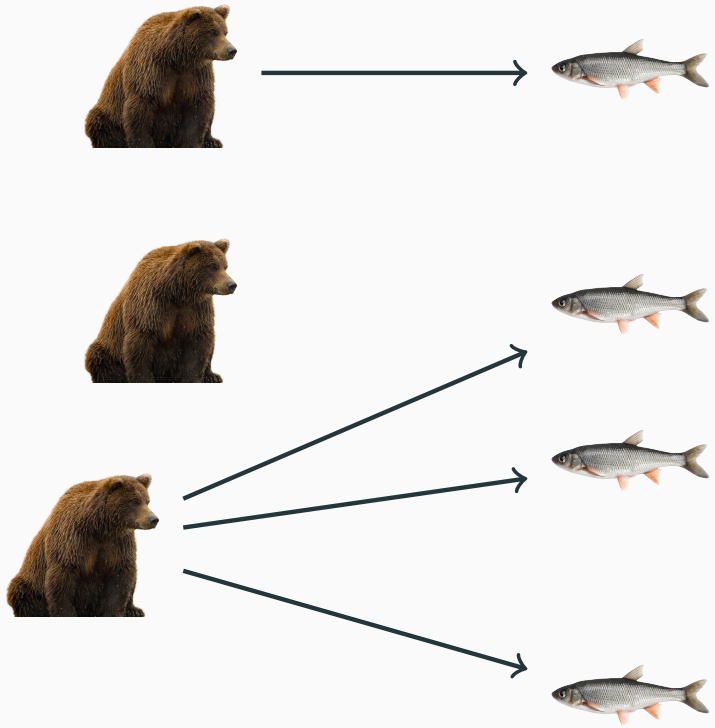
No, it is commonly believed that direct object c-commands indirect object in dative constructions.

But my account will predict it to be c-command[2].

[2] Ask me why!

Evidencing an underlying weak reading

(14) # The 3 bears ate every fish.



Evidencing an underlying weak reading

(15) The 3 bears ate every fish.

a. **Strong reading:**
every one of the fish was eaten by a bear
and every one of the bears ate a fish

b. **Weak reading:**
every one of the fish was eaten by a bear

Evidencing an underlying weak reading

No DE entailment in the restrictor under a strong reading.

(16) a. The 3 bears ate every fish.

b. The 3 bears ate every small fish.

(17) a. every one of the fish was eaten by a bear
and every one of the bears ate a fish

b. every one of the small fish was eaten by a bear
and every one of the bears ate a small fish

Evidencing an underlying weak reading

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(17) a. every one of the fish was eaten by a bear
and every one of the bears ate a fish

b. every one of the small fish was eaten by a bear
and every one of the bears ate a small fish

Evidencing an underlying weak reading

DE entailment in the restrictor under a weak reading.

(18) a. The 3 bears ate every fish.

b. The 3 bears ate every small fish.

(19) a. every one of the fish was eaten by a bear

b. ✓ every one of the small fish was eaten by a bear

Evidencing an underlying weak reading

Does cumulative *every* license NPIs?

Evidencing an underlying weak reading

Does cumulative *every* license NPIs?

Yes, even under the strong reading!

Evidencing an underlying weak reading

(20) These three books present every solution that has ever been proposed for the donkey problem.

Follow-up: *is it ok in Scenario I? is it ok in scenario II?*

Evidencing an underlying weak reading

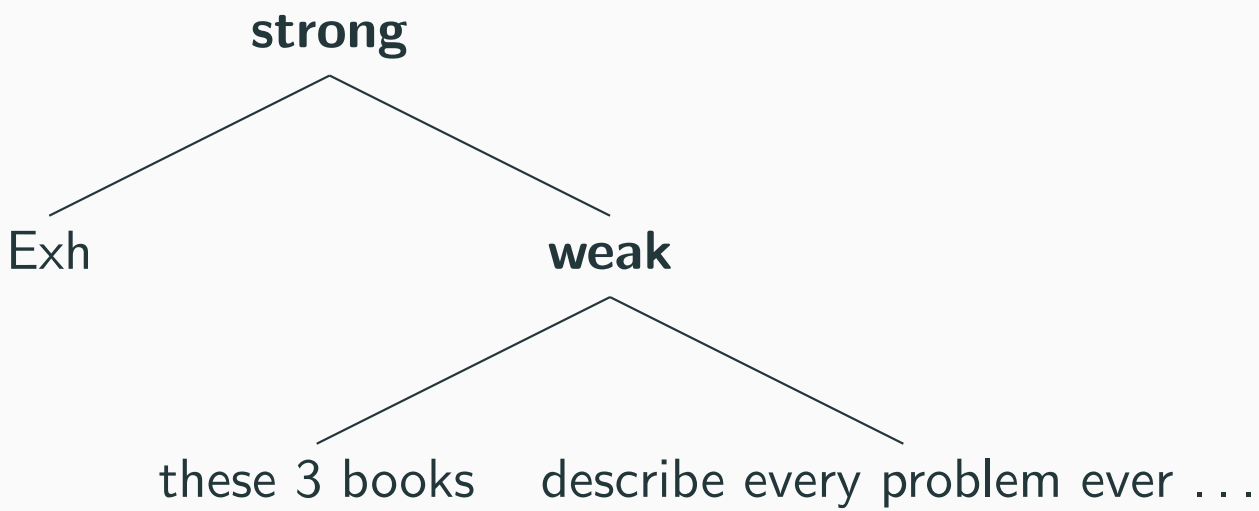
(20) These three books present every solution that has ever been proposed for the donkey problem.

Follow-up: *is it ok in Scenario I? is it ok in scenario II?*

(21) a. **Scenario I:**
book 1 presents one third of all solutions
book 2 presents one third of all solutions
book 3 presents one third of all solutions

b. **Scenario II:**
book 1 presents half of all solutions
book 2 presents half of all solutions
book 3 doesn't talk about the donkey problem

Evidencing an underlying weak reading



Other theories (Kratzer, 2001; Haslinger and Schmitt, 2018) that hard-code the strong reading in the meaning of *every* do not predict NPI licensing.

every NP

- Asymmetries between argument positions:

  $$\text{Agent} \gg \text{Goal} \gg \text{Theme}$$

- Underlying weak reading

Downward inferences in plural sentences: the logician's take

Goal.

The hierarchy of argument positions can be evidenced elsewhere.

Data is more noisy for reasons that will become clear later.

(22) **Premice:** I read 5 books.
Conclusion: I read 4 books.

(22) **Premice:** I read 5 books.
Conclusion: I read 4 books.

The logician's reasoning: if I read this set of five books, I read the first four in particular, so I read four books.

How does the logician's inferences extend to multiple numerals?

Agent + Theme: ↓Theme

Put your logician hat on

Agent + Theme: ↓Theme

Put your logician hat on

(23) **Premice:** 20 students solved 25 equations.
Conclusion I: *19 students solved 25 equations. [7/7]

Agent + Theme: ↓Theme

Put your logician hat on

(23) **Premice:** 20 students solved 25 equations.
Conclusion I: *19 students solved 25 equations. [7/7]
Conclusion II: 20 students solved 24 equations. [7/7]

Agent + Theme: ↓Theme

Put your logician hat on

(23) **Premice:** 20 students solved 25 equations.
Conclusion I: *19 students solved 25 equations. [7/7]
Conclusion II: 20 students solved 24 equations. [7/7]

Transitive sentences license downward inferences on the theme, but not the agent.

Turning to ditransitives. . .

Agent + Goal: ↓Goal

(24) a. **Premice:** 20 students donated money to 25 charities.
Conclusion I: *19 students donated money to 25 charities. [6/6]
Conclusion II: 20 students donated money to 24 charities. [6/6]

Downward inferences on the goal, but not the agent.

Agent + Theme: ↓Theme

(25) **Premice:** 20 students donated 25 checks to my charity
Conclusion I: *19 students donated 25 chairs to my charity
Conclusion II: 20 students donated 24 chairs to my charity

Downward inferences on the theme, but not the agent.

Goal + Theme: ↓Theme

(26) **Premice:** I donated 25 chairs to 10 charities
Conclusion I: *I donated 25 chairs to 9 charities [6/6]
Conclusion II: %I donated 24 chairs to 10 charities [3/6]

Downward inferences on the theme, but not the goal.

Which argument licenses downward inferences?

Position of the numerals	Agent	Goal	Theme
Agent + Theme			✓
Agent + Goal		✓	
Goal + Theme			✓

Numeral inferences

The lowest numeral licenses downward inferences

Hierarchy of downward inferences

Agent $\gg$ Goal $\gg$ Theme

This is the same hierarchy as was established for the cumulative readings of “*every*”

What are the logicians doing?

Logicians seem to be able to enforce weak readings:

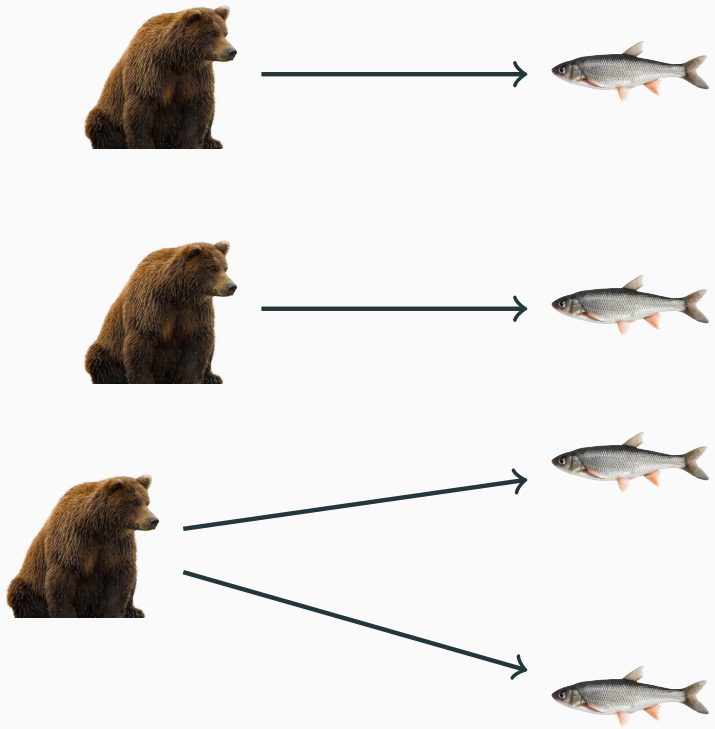
(27) 3 bears ate 4 fish

a. **Layperson's TCs:**
there were 3 bears and 4 fish ; each of the fish got eaten by a bear and each bear ate a fish.

b. **The logician's TCs:**
there were 3 bears and 4 fish ; each of the fish got eaten by a bear.

What are the logicians doing?

(28) **The logician's TCs:**
there were 3 bears X and 4 fish Y
each of the fish in Y got eaten by a bear in X.



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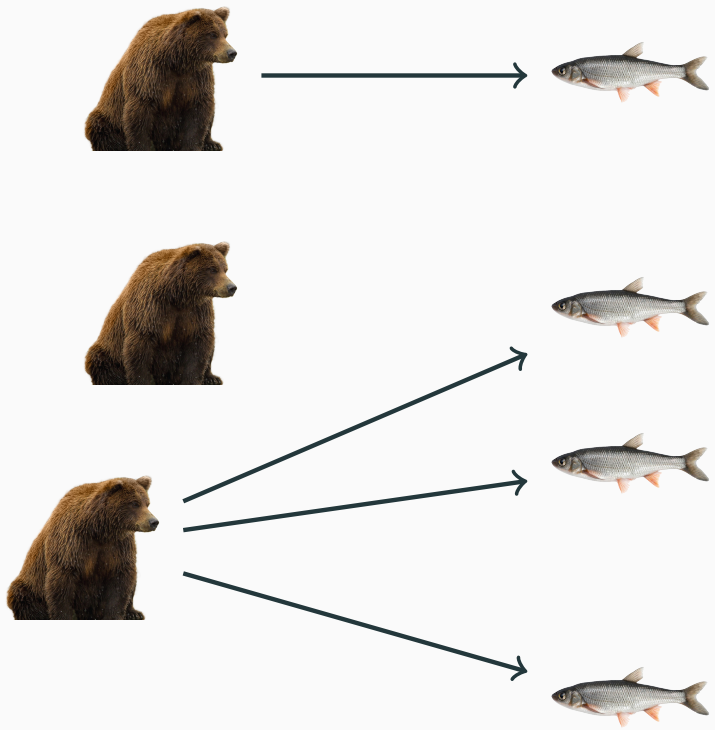

What are the logicians doing?

(28) **The logician's TCs:**
there were 3 bears X and 4 fish Y
each of the fish in Y got eaten by a bear in X.

The weak reading is always asymmetric ; it enforces exhaustive participation of one argument but not the other.

What are the logicians doing?

(28) **The logician's TCs:**
there were 3 bears X and 4 fish Y
each of the fish in Y got eaten by a bear in X.

Exhaustive participation is represented by universal quantification and universal quantification license downward inferences in its restrictor.

What are the logicians doing?

Informed version of the generalization

The thematic role that has exhaustive participation according to the logician is always the lowest one in the hierarchy.

What are the logicians doing?

(29) The 4 climate deniers donated the 25 checks to the 14 universities

Layperson's reading:

every one of the checks was given to a university by a climate denier

every one of the climate deniers donated a check to a university

every one of the universities was given a check by a climate denier

What are the logicians doing?

(29) The 4 climate deniers donated the 25 checks to the 14 universities

Logician's reading:

every one of the checks was given to a university by a climate denier

every NP

- Asymmetries between argument positions:

  Agent $\gg$ Goal $\gg$ Theme

- Underlying weak reading

Two numerals

- Asymmetries in inferences:

  Agent $\gg$ Goal $\gg$ Theme

- Weak readings explain pattern of inferences

Accounting for the hierarchies

Safe event semantics assumptions

- The domain of events is a plural domain
- Meta-language predicates like "be the agent of" are strongly cumulative

Safe event semantics assumptions

- The domain of events is a plural domain
- Meta-language predicates like "be the agent of" are strongly cumulative

(30) a. x is the agent of e_1

b. y is the agent of e_2

c. $x \oplus y$ is the agent of $e_1 \oplus e_2$

Safe event semantics assumptions

- The domain of events is a plural domain
- Meta-language predicates like "be the agent of" are strongly cumulative
- To each such meta-language predicate corresponds an object language operator that it denotes

(30) $[\![\textsc{Agent}]\!] = \lambda x.\lambda e.\ x$ is the agent of e

Safe event semantics assumptions

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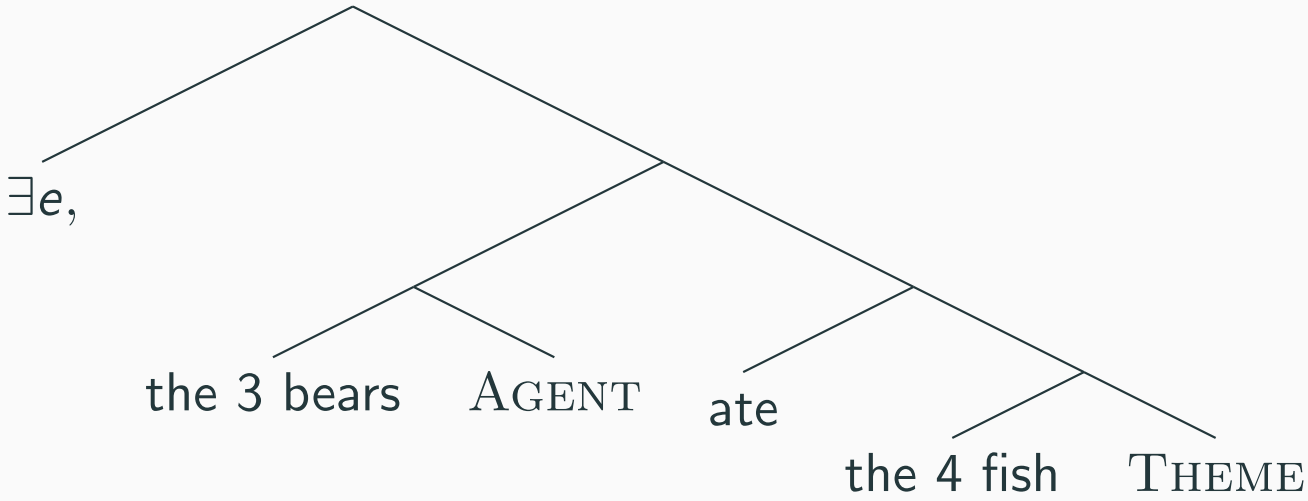
- These predicates combine intersectively with the verb predicate.

Safe event semantics assumptions

With these safe assumptions, a simple sentence will receive a strong cumulative reading.



there exists a plural event e,
e is an eating event,
the agents of e are the 3 bears
the themes of e are the 4 fish

How do we tweak our assumptions so that the same LF delivers weak cumulative truth conditions?

Unsafe event semantics assumptions

- The domain of events is a plural domain
- Meta-language predicates like "be the agent of" are strongly cumulative
- To each such meta-language predicate corresponds an object language operator that is related to it
- These predicates do not combine intersectively with the verb predicate.

Unsafe event semantics assumptions

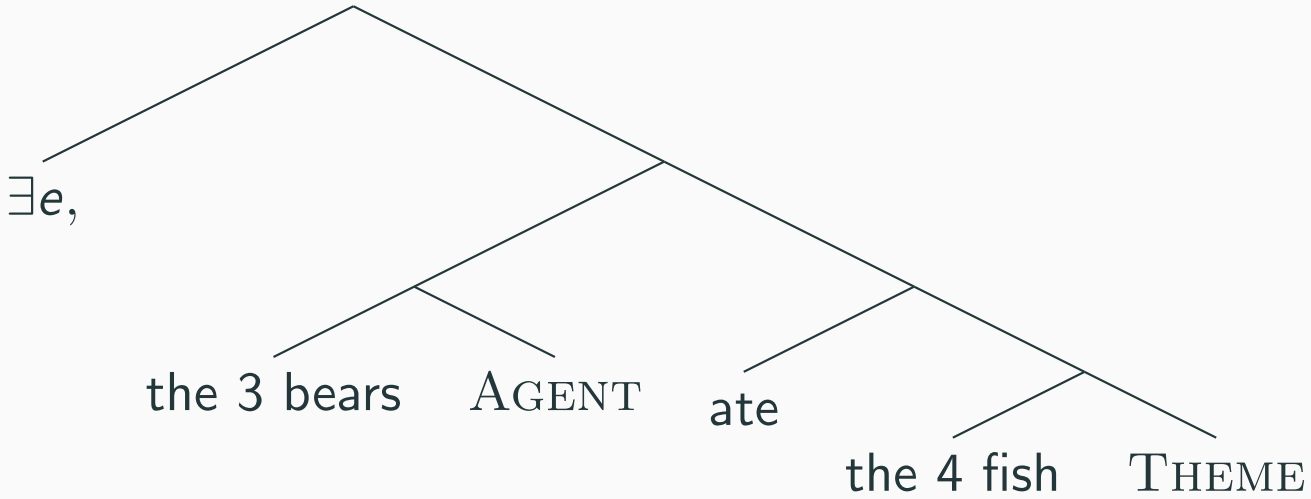
- The domain of events is a plural domain
- Meta-language predicates like "be the agent of" are strongly cumulative
- To each such meta-language predicate corresponds an object language operator that is related to it
- These predicates do not combine intersectively with the verb predicate.

(31) $[\![\textsc{Agent}]\!] = \lambda x_e.\lambda p_{vt}.\lambda e_v.\ \exists e' \prec e, x \text{ is the agent of } e \wedge p(e)$

(32) $[\![\textsc{Agent}]\!] = \lambda x_e.\lambda p_{vt}.\lambda e_v.\ \exists e' \prec e, x$ is the agent of $e \wedge p(e)$

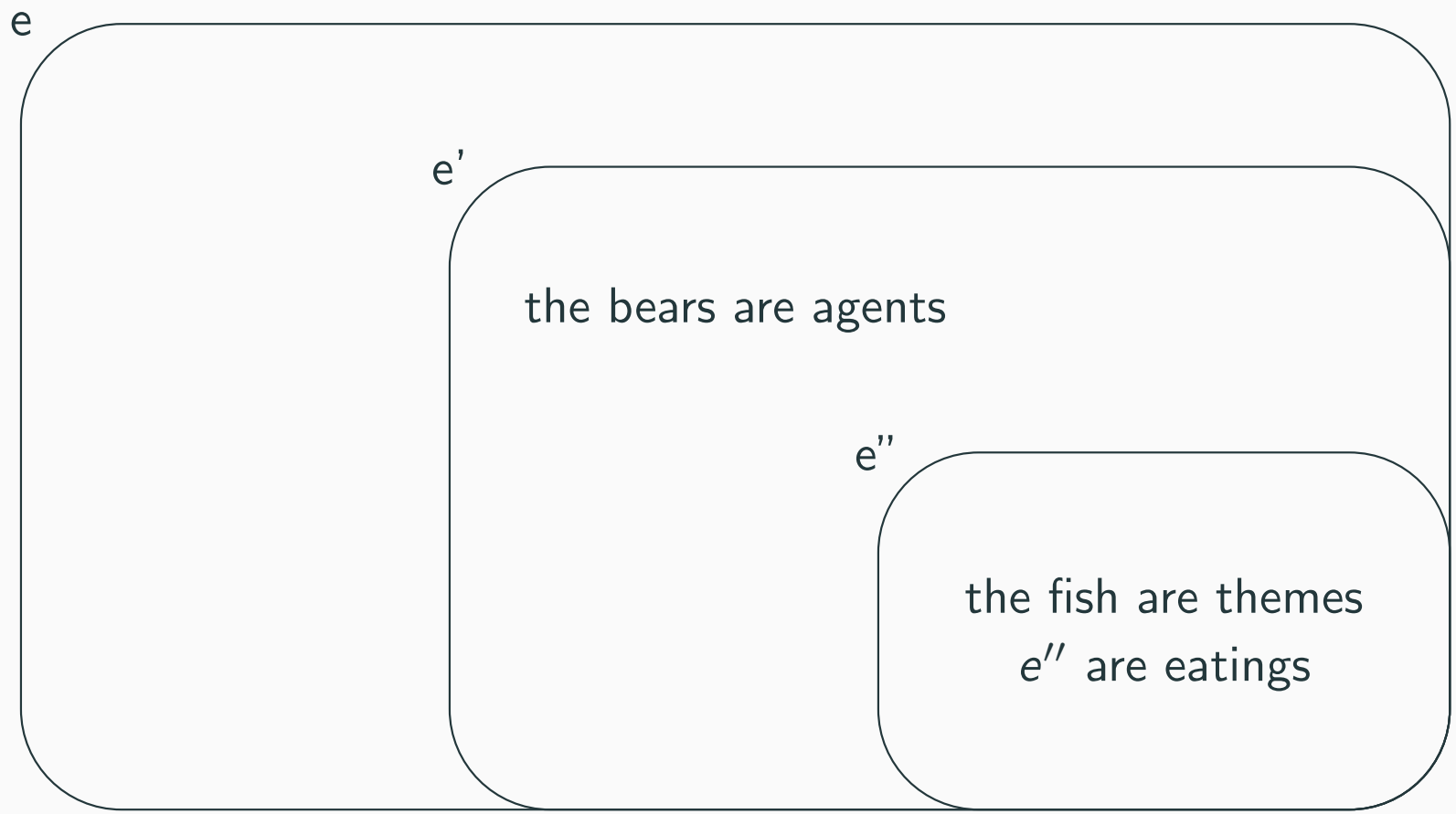
“ The event e has a subevent e' that x is the agent of and that has property p ”

Unsafe event semantics assumption



Unsafe event semantics assumption

There exists an event e,
There exists a sub-event e' of e,
x is the agent of e'
There exists a sub-event e'' of e',
x is the theme of e''
e'' are events of eating



"*All bears are doing something and some of what they are doing is eating all the fish*"

This is almost the weak reading!

This is almost the weak reading!

Ontological stipulation

Things are always doing things.

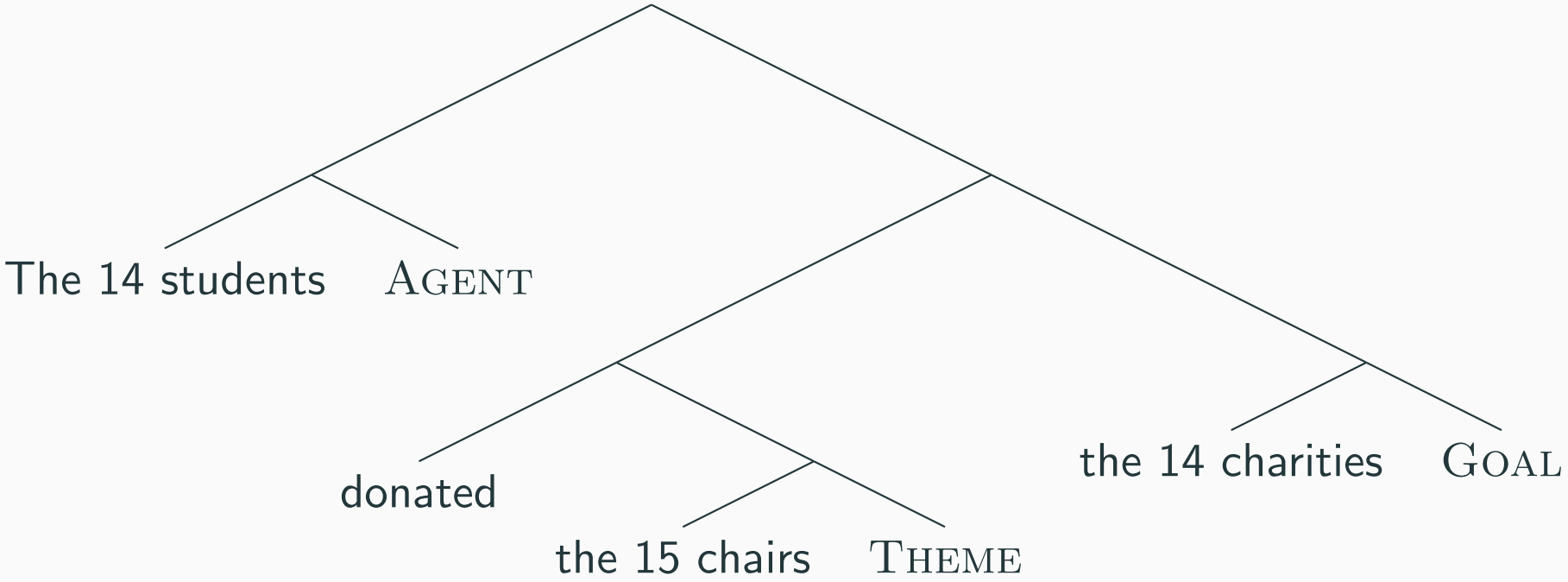
This is almost the weak reading!

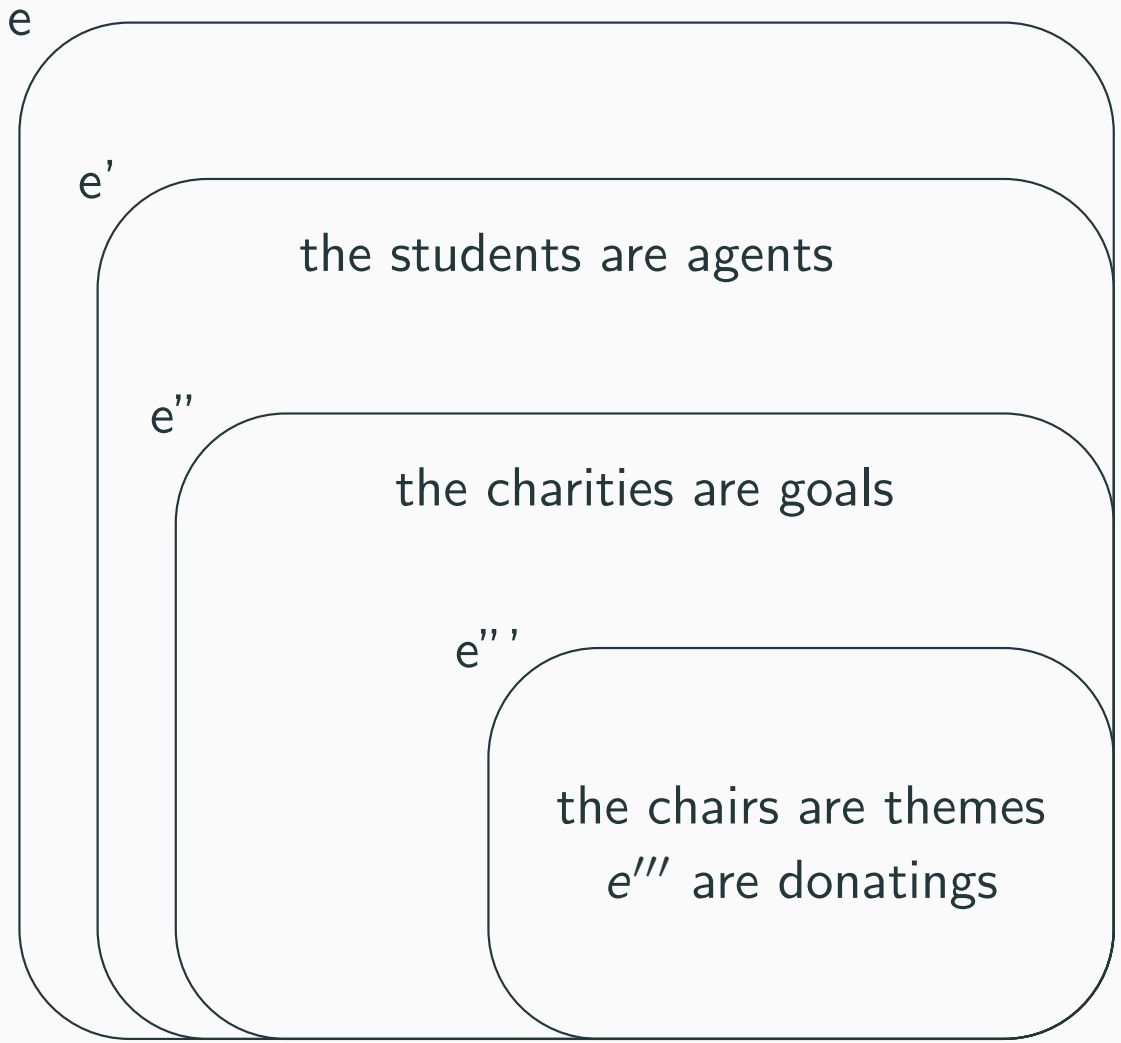
Ontological stipulation

Things are always doing things.

Things are always done things in direction of.

With these LFs, the first thematic role incorporated into the verb will require exhaustive participation.




e
e'
the students are agents
e''
the charities are goals
e'''
the chairs are themes
e''' are donatings

We have derived the right weak readings (hence predicted the logician's inferences). What about *every*?

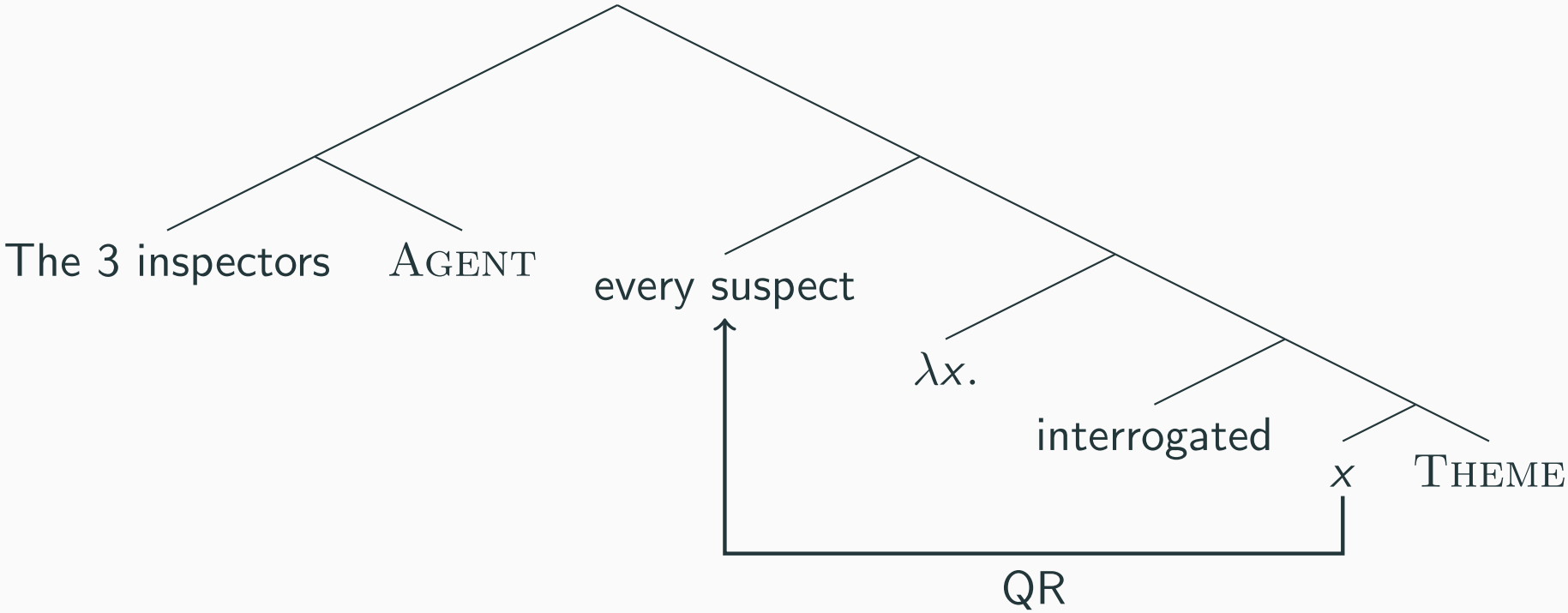
Cumulative readings of every

We need a denotation suitable for scoping at *vt* node.

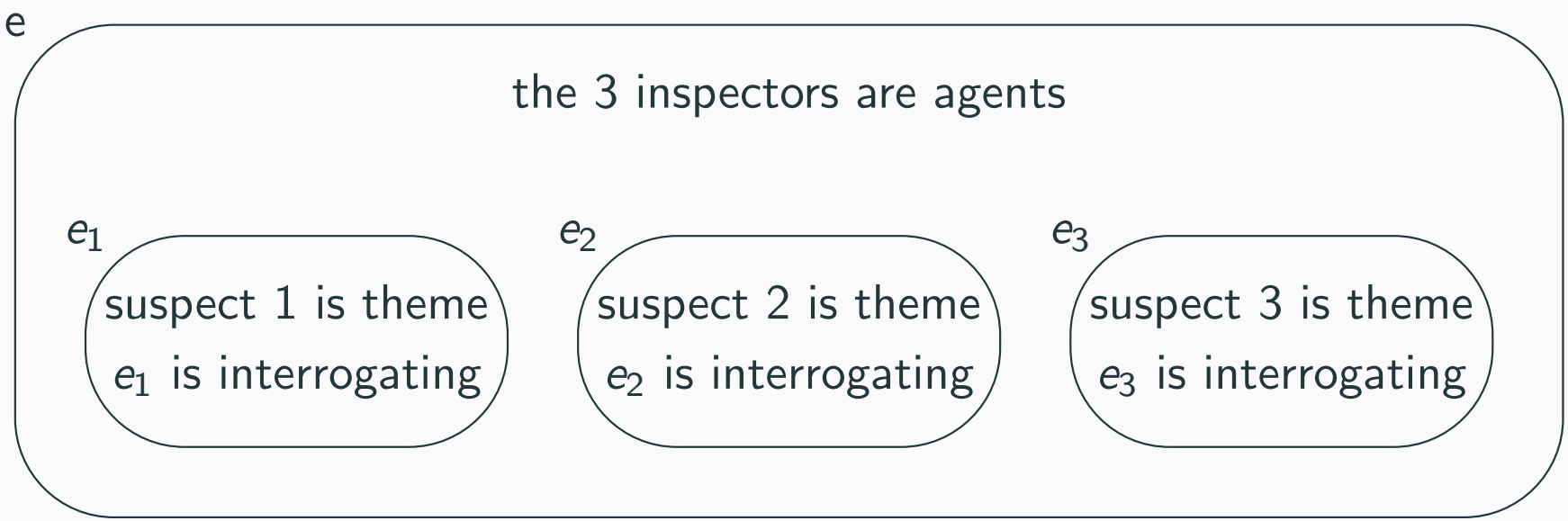
(33) $[\![\text{every NP}]\!] = \lambda p_{evt}.\lambda e_v.\forall x, x \in [\![\text{NP}]\!] \rightarrow p(x)(e)$

Cumulative readings of every

(34) The three inspectors interrogated every suspect.



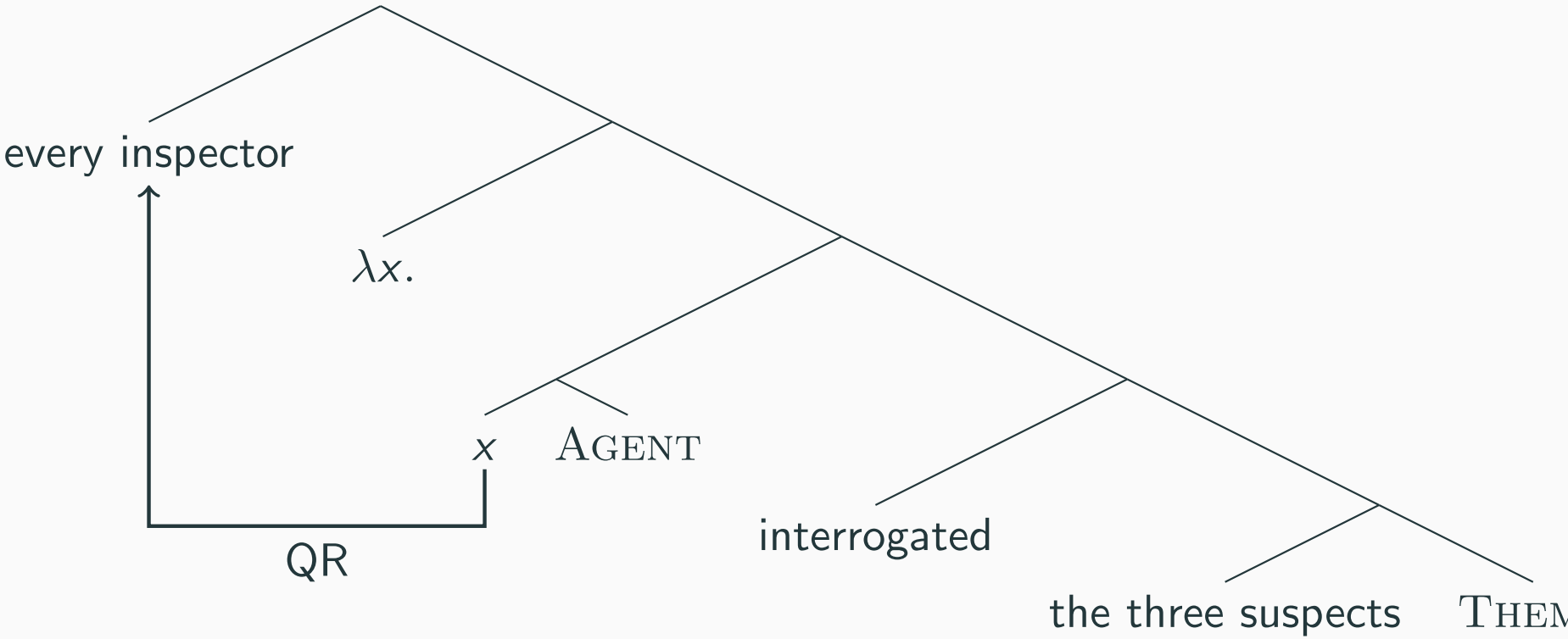
Cumulative readings of every

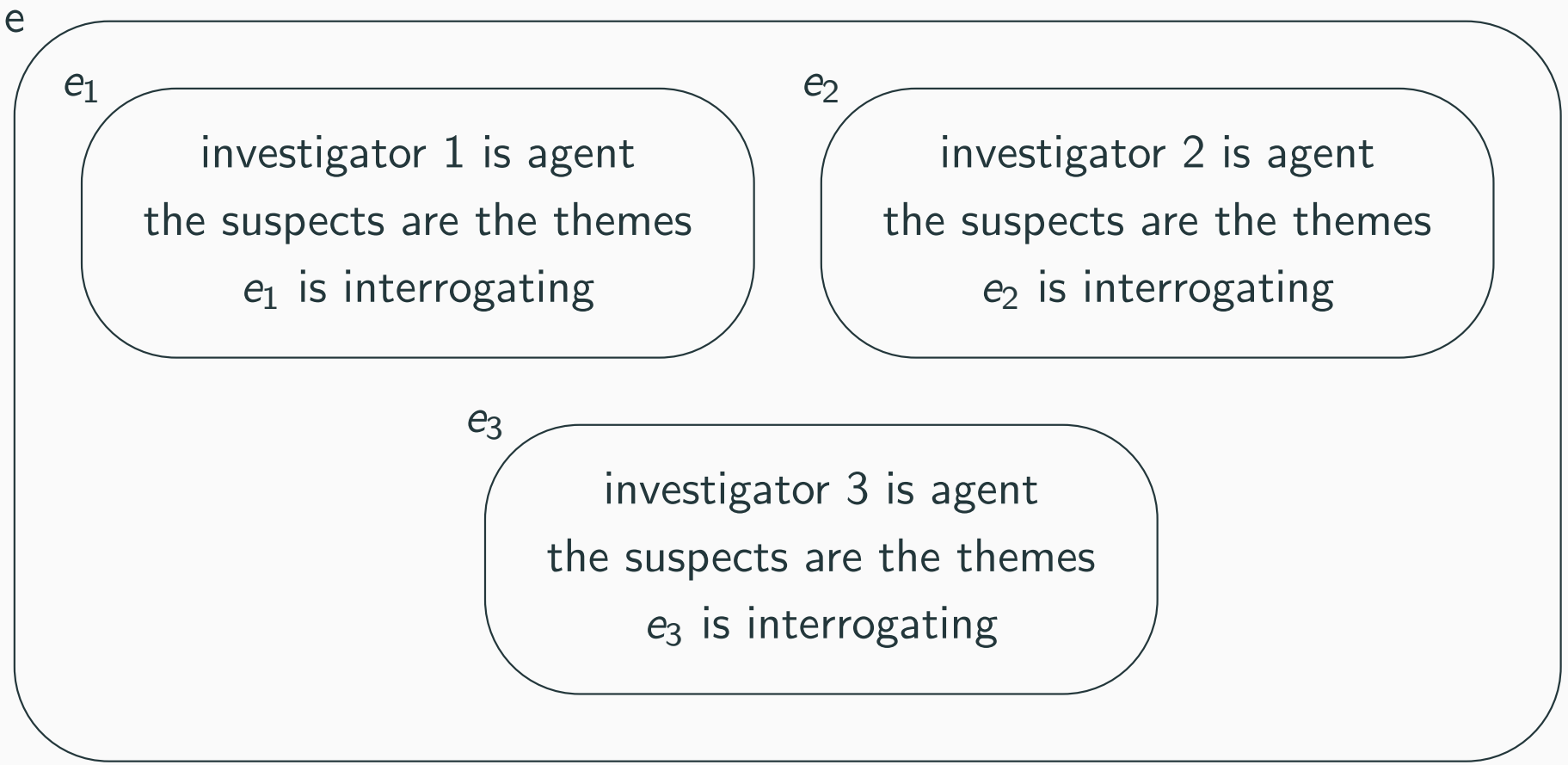


Cumulative readings of every

"The 3 inspectors did something that included an interrogation of every suspect"

(35) Every inspector interrogated the three suspects




e
e_1
investigator 1 is agent
the suspects are the themes
e_1 is interrogating
e_2
investigator 2 is agent
the suspects are the themes
e_2 is interrogating
e_3
investigator 3 is agent
the suspects are the themes
e_3 is interrogating

That is not a cumulative reading.

Do we stand any chance of creating that reading if the object takes scope over the subject?

(36) Every inspector interrogated the three suspects

a. the three suspects λx. every inspector interrogated x

b. the three suspects $\textsc{Dist}$ λx. every inspector interrogated x

(36) Every inspector interrogated the three suspects

a. the three suspects λx. every inspector interrogated x

b. the three suspects $\textsc{Dist}$ λx. every inspector interrogated x

(36a) is vacuous scoping ; doesn't bring much.

(36) Every inspector interrogated the three suspects

a. the three suspects λx. every inspector interrogated x

b. the three suspects $\textsc{Dist}$ λx. every inspector interrogated x

(36a) is vacuous scoping ; doesn't bring much.
(36a) is meaningful but it just creates a distributive reading

What is the key to the success of this account?

$\rightsquigarrow$ you can only create a cumulative reading from a thematic position.

Further puzzlement: predictions, loose ends & co.

In ditransitives, it is believed that the direct object c-commands the indirect object. Here are the tests from Harley and Miyagawa (2017)

(37) a. **Variable binding:**
I gave every book to its rightful owner.
?I gave their paycheck to every worker.

b. **Weak cross-over**
What did you give to its rightful owner?
?Who did you give their book to?

c. **NPI**
I gave nothing to anyone.
*I gave anything to no one

d. **Principle A**
I gave John to himself.
*I gave himself to John.

e. **Idioms** I sent Elvira to the pitchers. *I sent the dogs to Elvira

Variable-binding will yield false positives for c-command.

(38) **Binding into high adjuncts**

I wanted to visit every city[1] before you did want to go to that$_1$ city

It is controversial whether weak cross-over is about c-command or linear order. It is even controversial that it is a grammatical effect.

The data on idioms is partial. [V DO] idioms are attested (e.g. *give the creeps to*), just as much as [V IO] are (Bruening, 2010)

NPI and principle A remain our strongest tests.

(39) The drug was so strong that I started seeing Mary above herself
Why did you put all the blame on Joey I blamed Joey because of himself. It would have been too much to ask for Colton to love her because of herself/her

(40) a. I helped no beggar for anyone's sake but their own.

b. there was no prom for anyone

c. Three students saw no beggars

Bruening, B. (2010). Ditransitive Asymmetries and a Theory of Idiom Formation. *Linguistic Inquiry*, 41:519–562.

Buccola, B. and Spector, B. (2016). Modified numerals and maximality. *Linguistics and philosophy*, 39(3):151–199.

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Scha, R. (1984). Distributive, collective and cumulative quantification. In *Truth, Interpretation and Information; selected papers from the 3rd Amsterdam Colloquium, Dordrecht, Holland*, pages 131–158.