Revisiting donkey sentences

bit.ly/heimfest

7.12.24, Luka Crnič

The study of quantification and anaphoric dependencies has been a major linchpin in the development of semantic theory.

Much of this study in the last 40 years has been propelled by and organized around Heim 1982 and Heim 1990 et al.

Its point of departure have been the numerous challenges to the baseline theory of anaphoric dependencies to indefinites.

The baseline theory

(1) An antecedent NP must c-command a pronoun in order to bind it.

(2) The required c-command relation can be established by movement, which respects islands.

Gal petted every donkey$_x$ before she sold it$_x$.

If Gal petted every donkey$_x$, she sold it$_x$.

(3) Indefinites denote existential quantifiers.

Donkey sentences

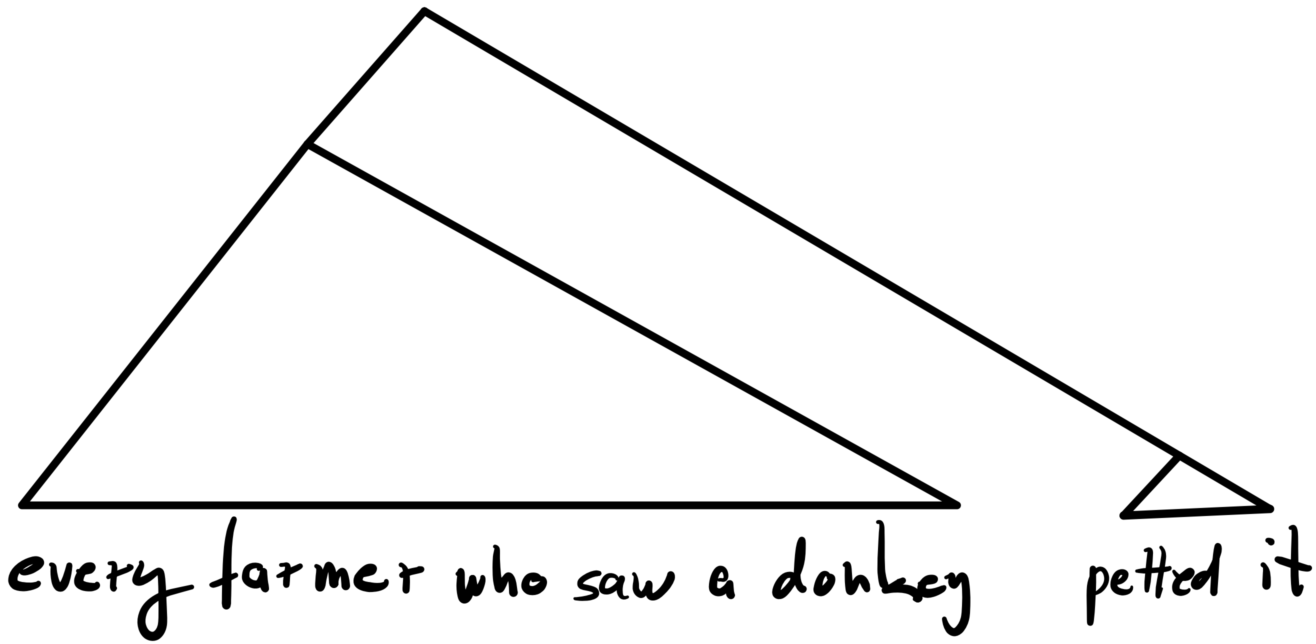
Every farmer who saw a donkey petted it.

$\forall y : \forall x : (\text{farmer } x \text{ saw donkey } y) \to (x \text{ petted } y)$

As we compare our examples of donkey sentences to the logical formulas that paraphrase them, we are led to hypothesize the following generalization: An indefinite that occurs inside an if-clause or relative clause gets interpreted as a universal quantifier whose scope extends beyond this clause. [...]

Heim 1982, p. 38

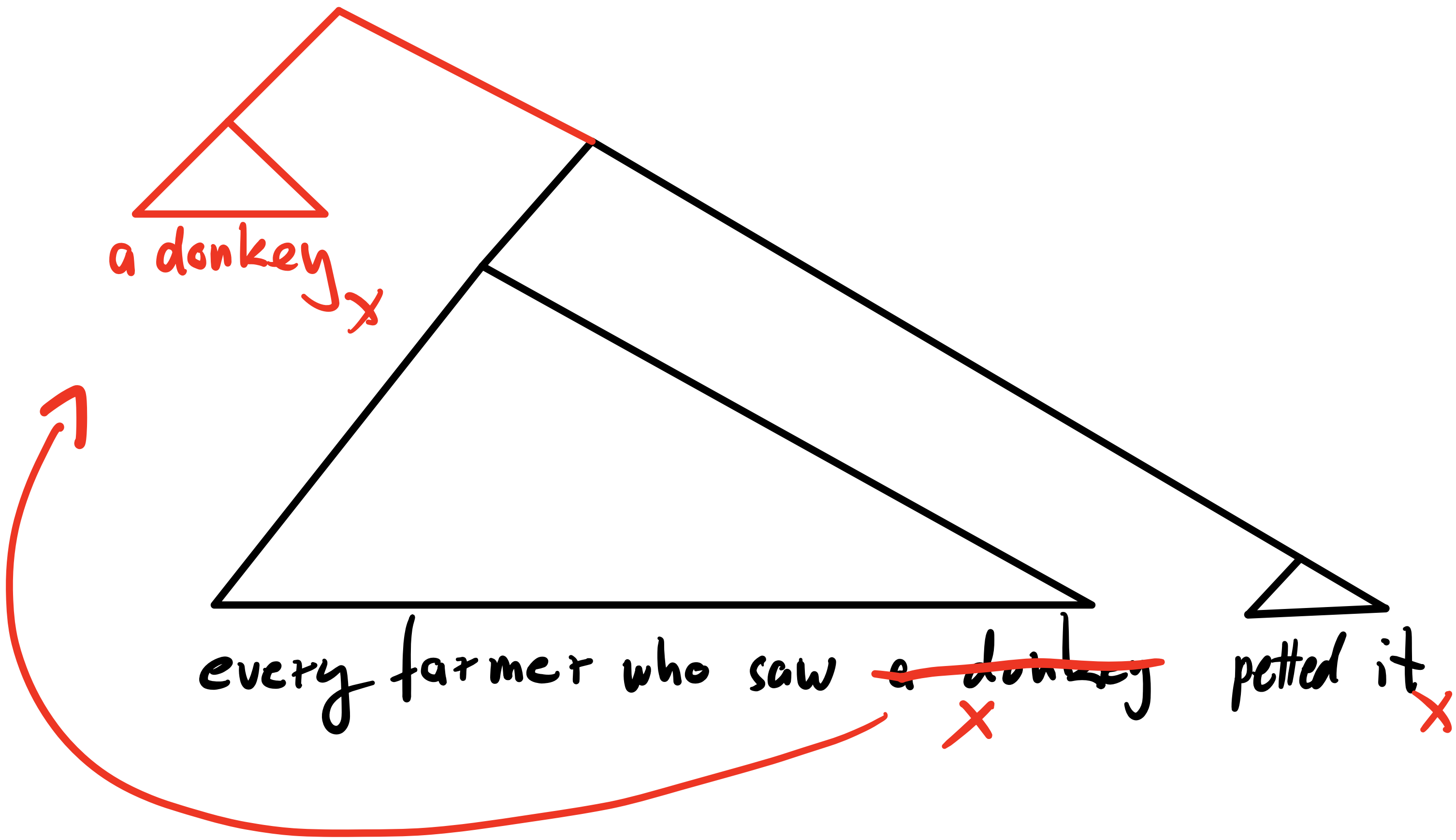
Step 0: Base structure



Current: $\# \forall x: (\exists y: \text{farmer } x \text{ saw donkey } y) \to (x \text{ petted } z)$

Target: $\forall y \, \forall x: (\text{farmer } x \text{ saw donkey } y) \to (x \text{ petted } y)$

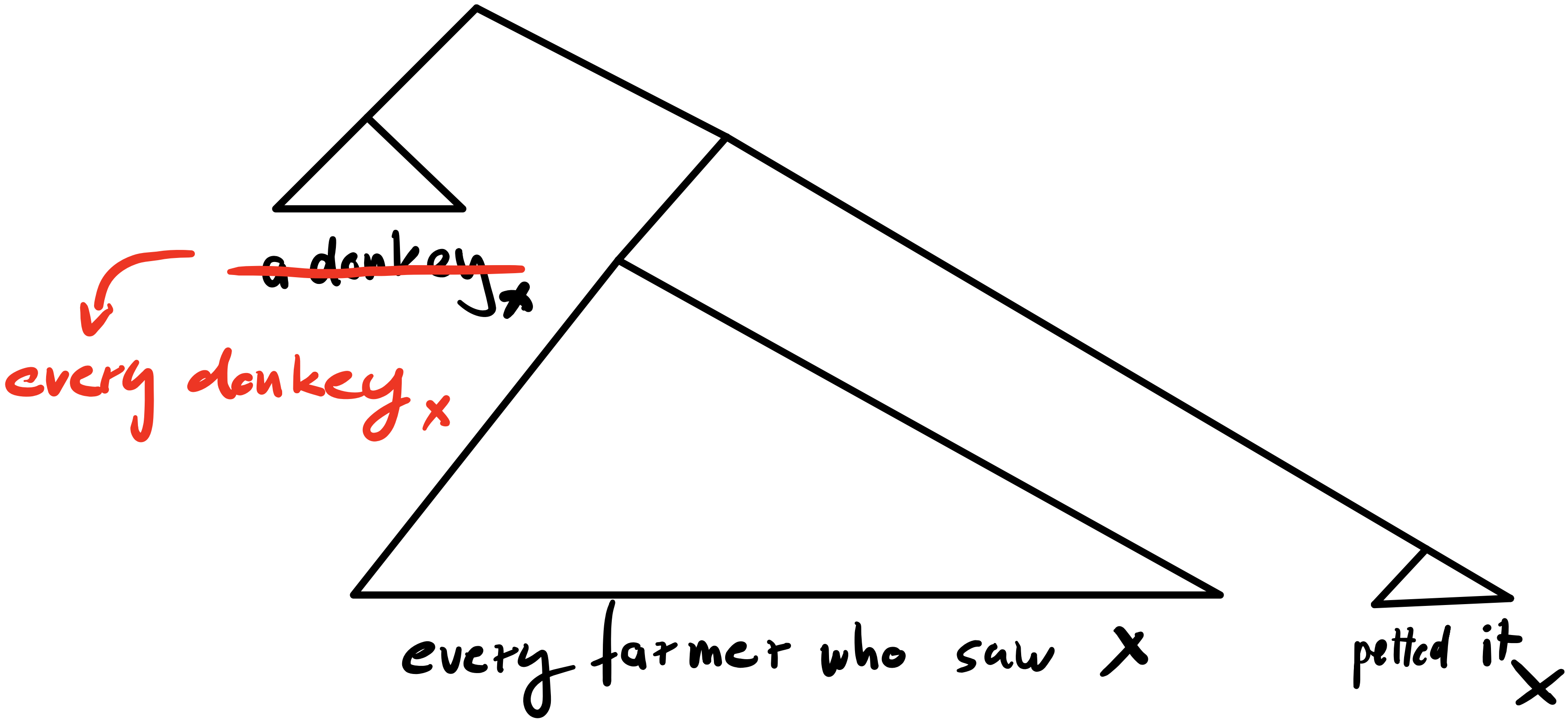
Step 1: Scope out of an island



Current: $\exists y\, \forall x: (\text{farmer } x \text{ saw donkey } y) \rightarrow (x \text{ petted } y)$

Target: $\forall y\, \forall x: (\text{farmer } x \text{ saw donkey } y) \rightarrow (x \text{ petted } y)$

Step 2: Indefinite to universal



Current: $\forall_y \forall x: (\text{farmer } x \text{ saw donkey } y) \to (x \text{ petted } y)$

Target: $\forall_y \forall x: (\text{farmer } x \text{ saw donkey } y) \to (x \text{ petted } y)$

[...] In fact, this generalization was never seriously entertained by anyone. Geach himself refrained from attempting any generalization at all, and it appears to be widely believed that any such attempt is bound to be a rather hopeless enterprise, leading to an unrevealing list of conditions at the very best.

Heim 1982, p. 38

Suggestively similar patterns elsewhere

	sports	
kid 1	S	
kid 2	S	
kid 3	S	B
kid 4	S	B
kid 5	S	B
kid 6		B
kid 7		B

Most kids who play soccer or basketball play both sports.

Most kids who play either sport play both sports.

Most kids who play one sport play both sports.

$$\not\Rightarrow \ \mathrm{most}(\{x \mid x \text{ plays soccer or bball}\})(\{x \mid x \text{ plays both sports}\})$$

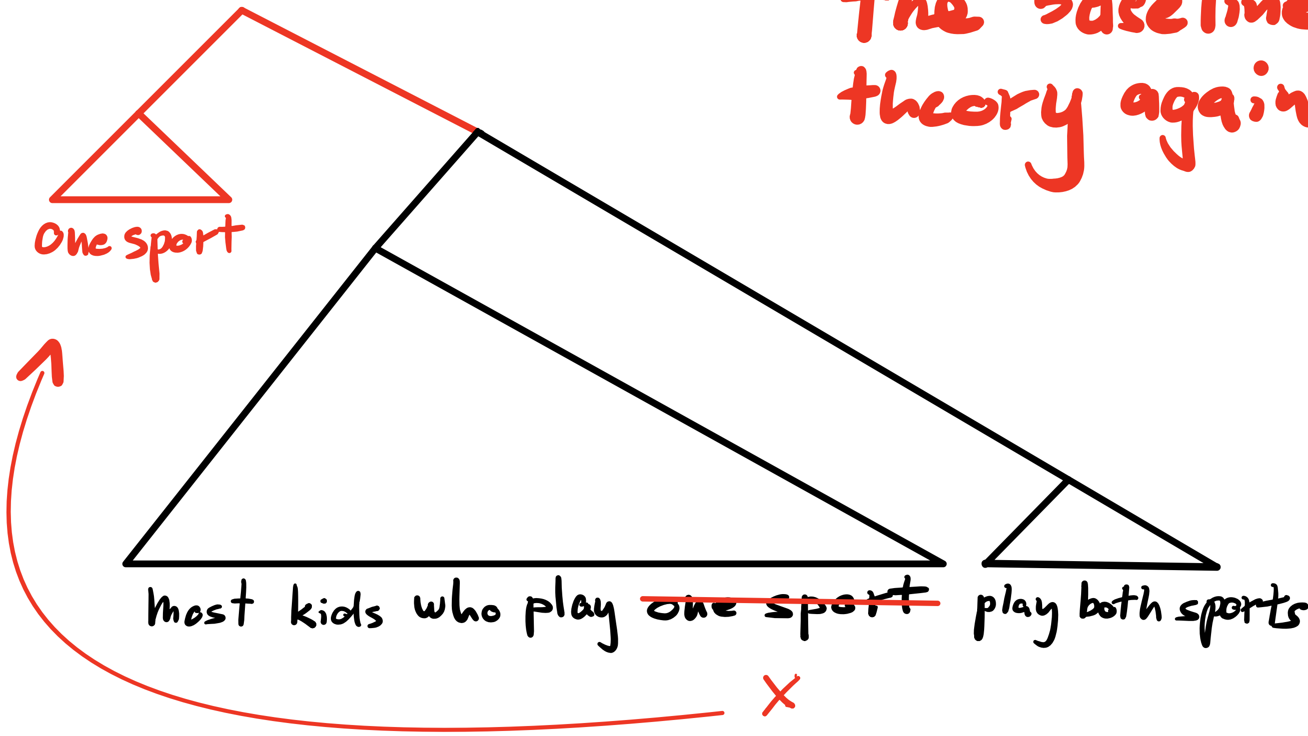
$$\Leftrightarrow \ \mathrm{most}(\{x \mid x \text{ plays soccer}\})(\{x \mid x \text{ plays both sports}\})$$
$$\wedge \ \mathrm{most}(\{x \mid x \text{ plays bball}\})(\{x \mid x \text{ plays both sports}\})$$

Bar-Lev & Fox 2020, fn. 46

Deviance from the baseline theory again

Step 2: Indefinite to universal

every sport



Step 1: scope out of an island

$$\text{most}(\{x \mid x \text{ plays soccer}\})(\{x \mid x \text{ plays both sports}\})$$
$$\wedge\ \text{most}(\{x \mid x \text{ plays bball}\})(\{x \mid x \text{ plays both sports}\})$$

Sarah bought lottery tickets 31–70.

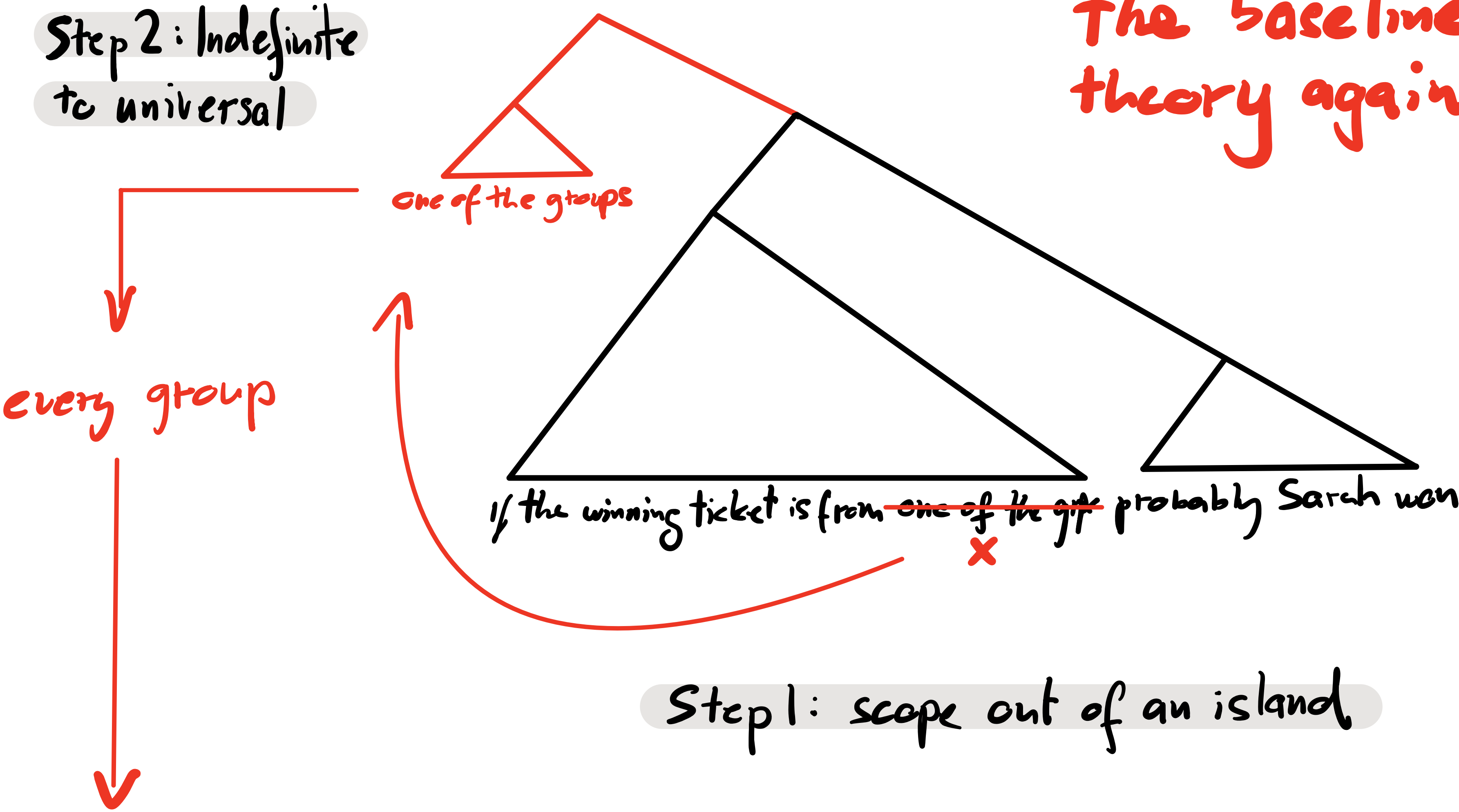
If the winning ticket is between 1–70 or between 31–100 it's more likely than not that Sarah won.

If the winning ticket is from either/one of the two groups it's more likely than not that Sarah won.

$\not\Rightarrow$ Pr(Sarah won | W is between 1–100) > 0.5

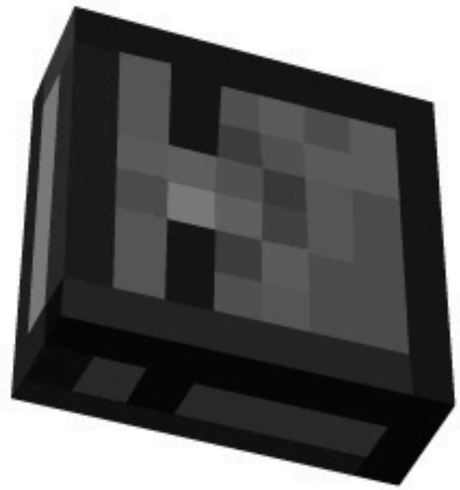
$\Leftrightarrow$ Pr(Sarah won | W is between 1–70) > 0.5
$\wedge$ Pr(Sarah won | W is between 31–100) > 0.5

Deviance from the baseline theory again



$$\Pr(\text{Sarah won} \mid W \text{ is between } 1\text{–}70) > 0.5$$
$$\wedge \Pr(\text{Sarah won} \mid W \text{ is between } 31\text{–}100) > 0.5$$

Deriving the suggestively similar patterns



Step 1: Scope out of islands

Indefinites ✓

Most kids who play one sport play both sports.

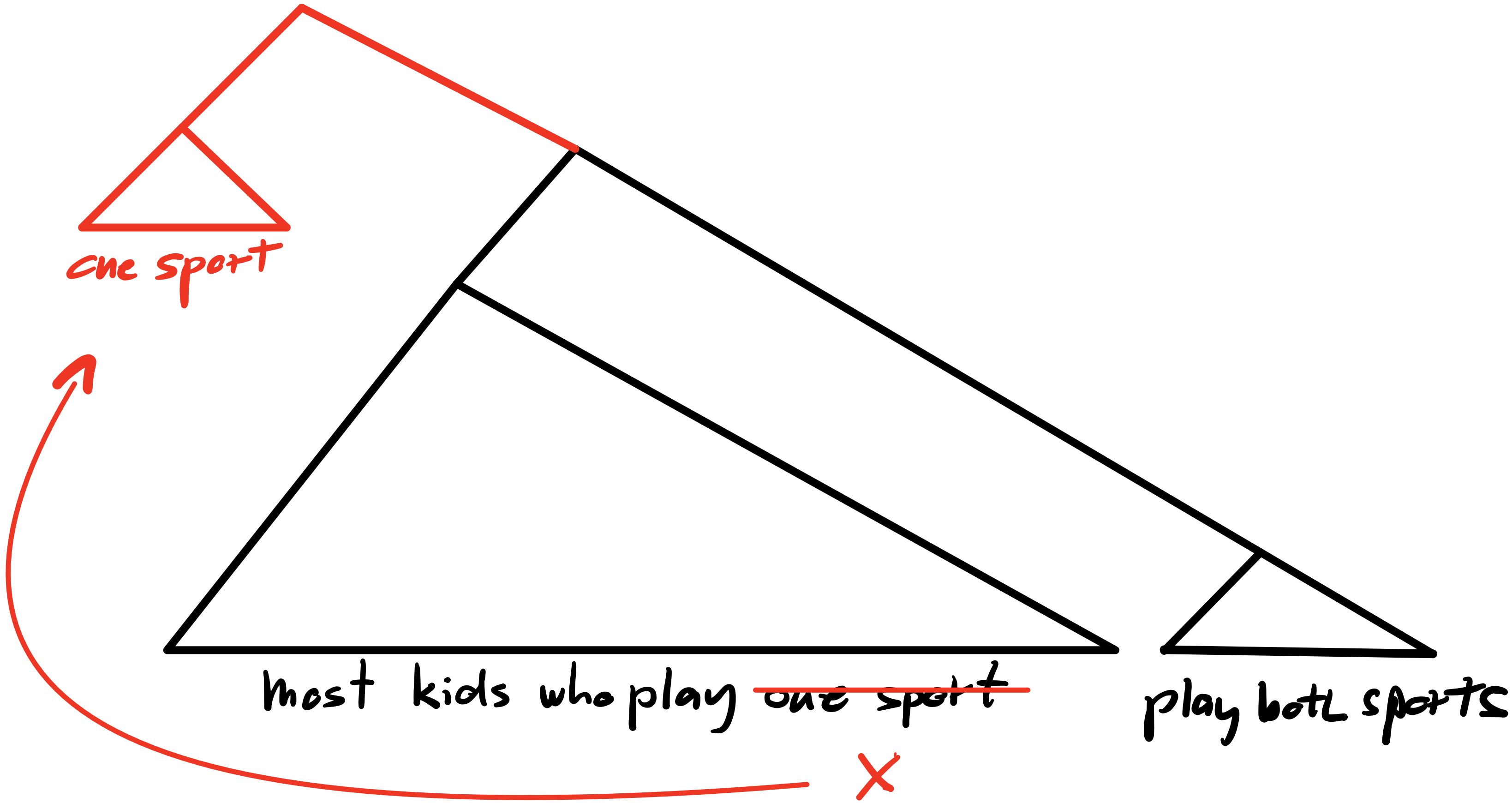
Most kids who play soccer or basketball play both sports.

I don't remember which.

Universal quantifiers ✗

%Most kids who play every sport play just one sport.

eg. Fodor & Sag 82, Rooth & Partee 82, Abusch 93, Reinhart 97



exceptional scope shift, restricted to indefinites

$$\exists x : \text{sport } x \wedge \text{most}(\{z \mid z \text{ plays } x\})(\{z \mid z \text{ plays both sports}\})$$

Step 2: indefinite to universal

you are allowed to play a(ny)/either/one sport.

⇒ every sport x: you are allowed to play x

you are required to play a/either/one sport.

⇏ every sport x: you are required to play x

Condition on universal inferences

Alternatives to sentences are grammatical objects that are at most as complex as the sentences.

A universal inference can be generated for an indefinite sentence iff it is not equivalent to a universal quantifier alternative.

cf. Fox 07, Katzir 07

sentence: [You are allowed [to play a sport]]

alternative: [you are allowed [to play every sport]] $\not\Leftrightarrow$

inference: every sport x: you are allowed to play x

the universal inference is **not equivalent** to a univ. quantifier alt.

$\rightsquigarrow$ the universal inference **can** be generated

sentence: [You are required [to play a sport]]

alternative: [you are required [to play every sport]] $\Leftrightarrow$

inference: every sport x: you are required to play x

the universal inference is **equivalent** to a univ. quantifier alt.

$\rightsquigarrow$ the universal inference **cannot** be generated

Missing alternatives

a consequence of the condition on universal inferences is that if a universal alternative to an indefinite sentence cannot be generated in grammar, the sentence should give rise to a universal inference.

Missing lexical alternatives

e.g. Singh et al. 12/16, Davidson 13, Bowler 14, Bar-Lev & Margulis 14, Bassi & Bar-Lev 16, Tieu et al. 16, 17, Bar-Lev 18, Staniszewski 21, Jeretič 21, etc.

Missing alternatives simpliciter

Universal quantifier alternatives to indefinite sentences can be missing also if universal quantifiers cannot be targeted by the same grammatical operations as indefinites...

Putting the pieces together

Step 1

$[\text{one sport}]_x\,[\text{most kids who play } x \text{ play both sports}]$

$\exists x: \text{sport } x \wedge \text{most}(\{z \mid z \text{ plays } x\})(z \mid z \text{ plays both sports}\})$

Step 2

$\#\,[\text{every sport}]_x\,[\text{most kids who play } x \text{ play both sports}]$

the universal inference is not equivalent to a univ. quantifier alt.

$\rightsquigarrow$ the universal inference can be generated

$\forall x: \text{sport } x \rightarrow \text{most}(\{z \mid z \text{ plays } x\})(z \mid z \text{ plays both sports}\})$

A further prediction

scope shifting of universal quantifiers/conj. can be curtailed by means other than islands. for example, the scope of universal quantifiers (but not of indefinites) seems to be trapped by downward-monotone operators.

Fewer than 1000 students got into an Ivy League school.

fewer than 1000 > an
an > fewer than 1000

Fewer than 1000 students got into every Ivy League school.

	fewer than 1000 > every
#	every > fewer than 1000

Beghelli 1995, Mayr & Spector 12, esp. Fleisher 15, fn. 25

every Ivy league school accepts fewer than 1000 students. together they accept many more than 1000.

Fewer than 1000 students got into Brown or Columbia or...

Fewer than 1000 students got into any Ivy League school.

Step 1 [any IL school]$_x$ [fewer than 1000 st got into x]

Step 2 # [every IL school]$_x$ [fewer than 1000 st got into x]

$\rightsquigarrow$ $\forall x$: x is an IL school $\rightarrow$ fewer than 1000 st got into x

Circling back to donkey sentences

Every farmer who saw a donkey petted it.

Step 1 [a donkey]$_x$ [every farmer who saw x petted x]

$$\exists y : \forall x : (\text{farmer } x \text{ saw donkey } y) \rightarrow (x \text{ petted } y)$$

Step 2 # [every donkey]$_x$ [every farmer who saw x petted x]

the universal inference is not equivalent to a univ. quantifier alt.

⇝ the universal inference can be generated

$$\forall y : \forall x : (\text{farmer } x \text{ sees donkey } y) \rightarrow (x \text{ pets } y)$$

One consequence

if a universal quantifier alternative to a donkey sentence is available, the universal inference should be blocked.

Gal saw every donkey$_x$ and petted it$_x$.

[every donkey]$_x$ [Gal saw x and petted it$_x$]

Ruys 93, Fox 00

One consequence

Gal saw a donkey$_x$ and petted it$_x$.

sentence: $[\text{a donkey}]_x\ [\text{Gal saw } x \text{ and petted } x]$

alternative: $[\text{every donkey}]_x\ [\text{Gal saw } x \text{ and petted } x]$ $\Updownarrow$

inference: every donkey x : Gal saw x $\wedge$ Gal petted x

the universal inference is equivalent to a univ. quantifier alt.

$\rightsquigarrow$ the universal inference cannot be generated

$$\exists x: \text{Gal saw donkey } x \wedge \text{Gal petted } x$$

Further consequences

- donkey anaphora require indefinite antecedents

  Every man who has a wife sits next to her.

  #Every married man sits next to her.

- there is no uniqueness requirement due to binding

  If someone buys a sage plant, she buys 8 others along with it.

  If a bishop meets a man, he blesses him.

Summary

indefinites admit exceptional scope shift and their import can be strengthened to a universal inference.

the two features of indefinites conspire to yield the suggestively similar patterns.

at least some donkey sentences fall out immediately from these same assumptions.

it is worth exploring whether a general theory of donkey sentences can be developed on this basis, where it would fail, and why.

Towards a more realistic theory: Alternatives

Negation of universal inferences

Every farmer who saw a donkey was lucky.

$\leadsto_W \neg\forall y : \forall x : (\text{farmer } x \text{ saw donkey } y) \to (x \text{ was lucky})$

$\leadsto_S \exists!y : \forall x : (\text{farmer } x \text{ saw donkey } y) \to (x \text{ was lucky})$

Charlow 19

Condition and alternatives

more sophisticated assumptions are needed about strengthening and alternatives (anyway)

A universal inference can be derived for an indefinite sentence iff it is not equivalent to any alternative to the sentence.

$[a_D \text{ donkey}]_x [\text{every farmer who saw } x \text{ was lucky}]$

~~$[\text{every}_D \text{ donkey}]_x [\text{every farmer who saw } x \text{ was lucky}]$~~

$[\text{every farmer who saw } a_D \text{ donkey was lucky}]$

$[\text{every farmer who saw every}_D \text{ donkey was lucky}]$

cf. Fox07, Katzir07

Universal inference is blocked

the universal inference is equivalent to an alternative!

sentence: [a donkey]$_x$ [every farmer who saw x was lucky]

alternative: [every farmer who saw a donkey was lucky]

$\forall x: (\exists y: \text{farmer } x \text{ saw donkey } y) \rightarrow (x \text{ was lucky})$

$\Updownarrow$

inference: $\forall y: \forall x: (\text{farmer } x \text{ saw donkey } y) \rightarrow (x \text{ was lucky})$

universal strengthening is thus blocked.

- What about the corresponding donkey sentences?
  - What about the sentence's implicatures?

Donkey sentences unaffected

Every farmer who saw a donkey petted it.

[a donkey]$_x$ [every farmer who saw x petted x]

~~[every donkey]$_x$ [every farmer who saw x petted x]~~

[every farmer who saw a donkey petted it]

[every farmer who saw every donkey petted it]

the universal inference is not equivalent to any alternative

$\rightsquigarrow$ the universal inference can be generated

Scalar implicatures

Every farmer who saw a donkey was lucky.

$[a_D \text{ donkey}]_x$ [every farmer who saw x was lucky]

[every farmer who saw a_D donkey was lucky]

[every farmer who saw every_D donkey was lucky]

negation of the simple alternative:

$$\rightsquigarrow_W \neg \forall y: \forall x: (\text{farmer } x \text{ saw donkey } y) \to (x \text{ was lucky})$$

negation of subdomain alternatives:

$$\rightsquigarrow_S \exists! y: \forall x: (\text{farmer } x \text{ saw donkey } y) \to (x \text{ was lucky})$$

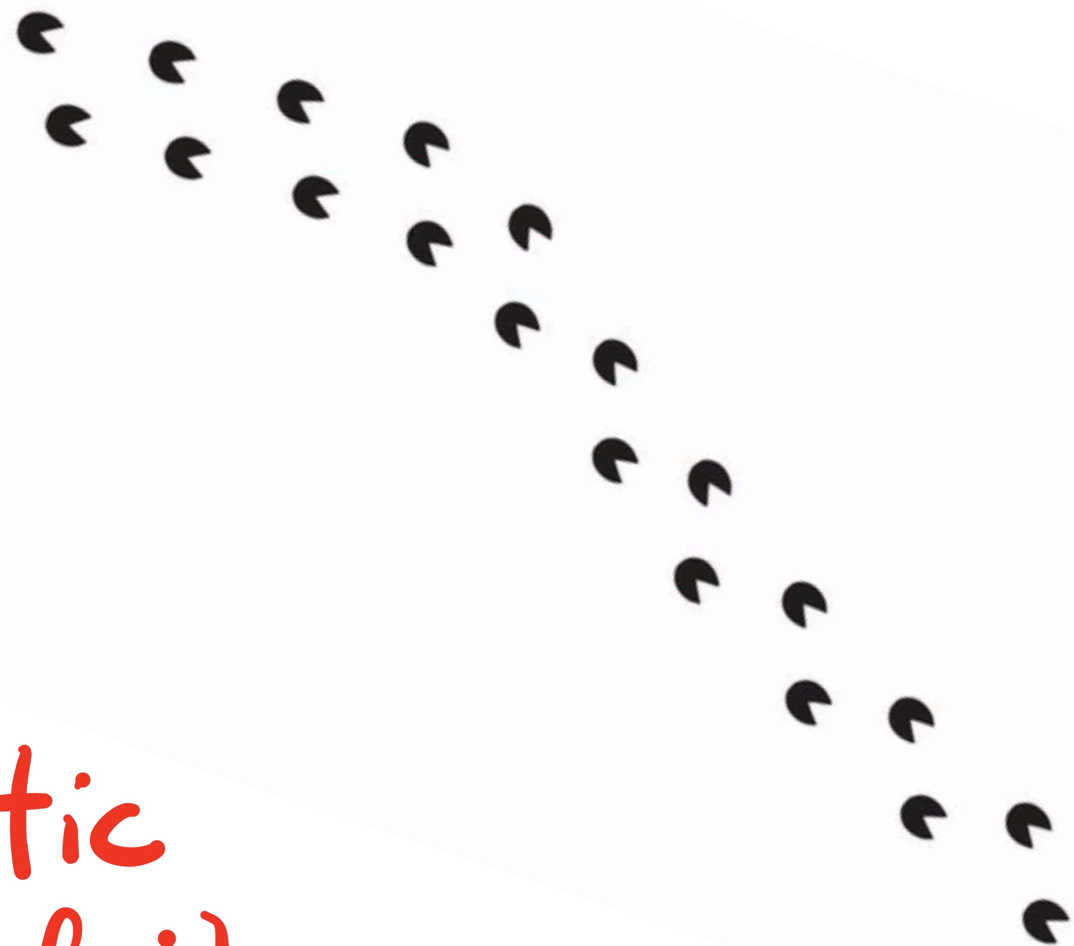
A further consequence

we discussed inhibition of universal inferences in conjoined sentences. something similar may hold for juxtaposed ones (if we would treat such sentences analogously to conjoined sentences, admitting text-level scope)

Gal owns a donkey. she pets it.

alternative: Gal owns every donkey. she pets every donkey.

⇝ universal inference is blocked



Towards a more realistic theory: Indefinites

Binding and scope trapping

Every$_x$ farmer who saw a donkey of his$_x$ petted it.

\# [a donkey of his$_x$]$_z$ [every$_x$ farmer who saw z petted z]

An analysis of indefinites is needed that would allow their nominal content to be interpreted in situ, and their existential quantification at the exceptional scope site...

Choice function (in)definites

This can be achieved by employing choice functions and accordingly by treating pronouns as choice function definite descriptions.

$$[\exists_f\,[\text{every}_x\ \text{farmer who saw}\ f_x\text{ donkey of his}_x\ \text{petted}\ f_x\text{ donkey of his}_x]]$$

this update does not affect our derivations ...

eg. Winter 97, 02, Schlenker 06; Schlenker 04, Chierchia 05

Weak vs. strong readings

$[\exists_f\, [\text{every}_x \text{ farmer who saw } f_x \text{ donkey of his}_x \text{ petted } f_x \text{ donkey of his}_x]]$

$$\exists f \in SCH: \forall x\, (\text{farmer } x \text{ saw } f(x)(\text{donkey of } x) \rightarrow x \text{ petted } f(x)(\text{donkey of } x))$$

= Every farmer who saw a donkey of his petted a donkey of his he saw

⇝ weak reading of donkey anaphora

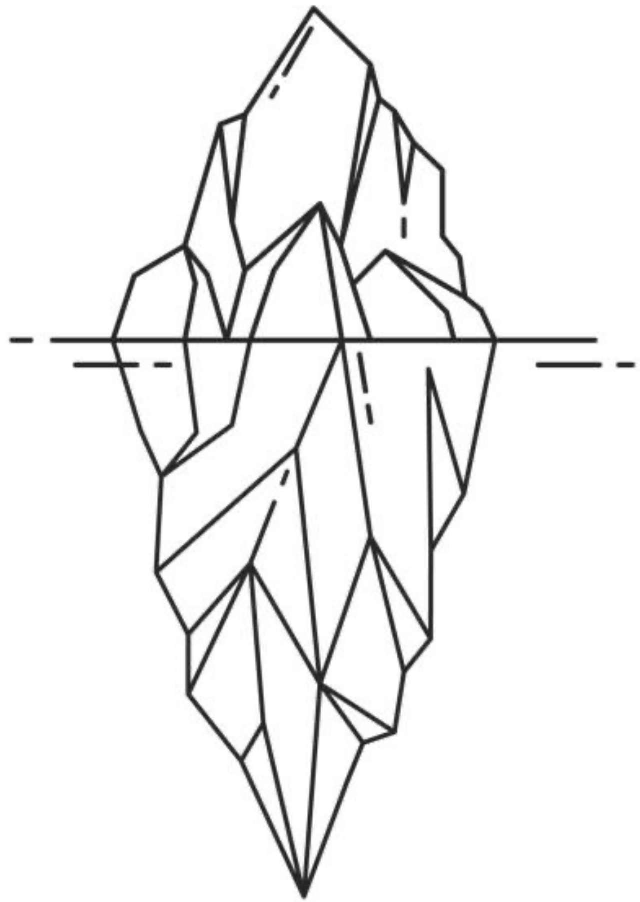
$\Big\Downarrow$ strengthening

$$\forall f \in SCH: \forall x\, (\text{farmer } x \text{ saw } f(x)(\text{donkey of } x) \rightarrow x \text{ petted } f(x)(\text{donkey of } x))$$

= Every farmer who saw a donkey of his petted every donkey of his he saw

⇝ strong reading of donkey anaphora

Outlook



we studied the nature of exceptional scope construals of indefinites and their strengthening. the patterns we discussed follow on the grammatical theory of strengthening and alternatives + the assumption that indefinites alone take exceptional scope.

We said nothing about

- non-universally quantified donkey sentences
- donkey sentences with plural anaphora
- and many other challenges ...