Homework questions on DRT (due Thursday)

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Truth

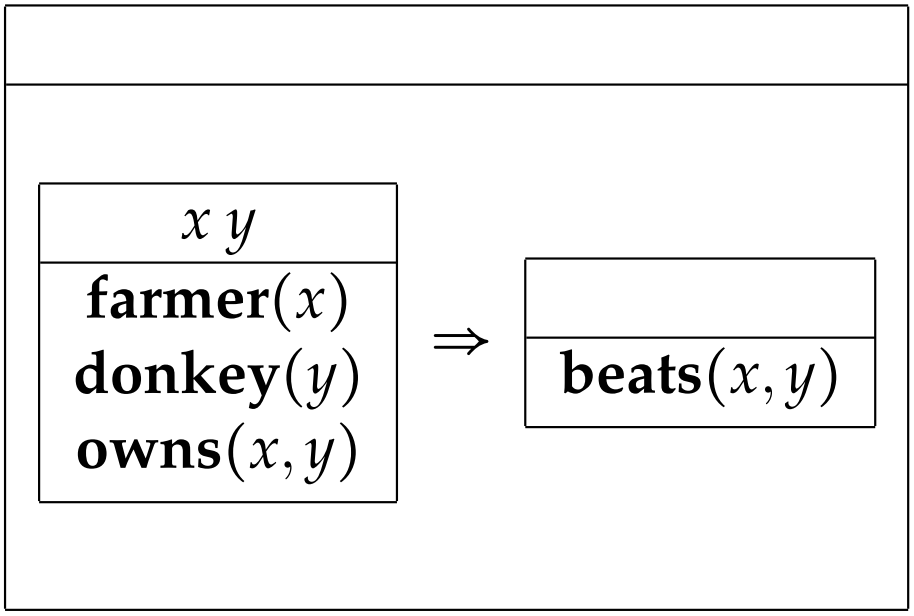
Informally, a DRS K is true in a model M if there is a way of associating individuals in the universe of M with the discourse referents of K so that each of the conditions in K is verified in M.

An embedding is a function that maps discourse referents to individuals (like an assignment or sequence). More formally, a DRS is true in a model if there is an embedding that verifies it.

Semantics of conditionals

f verifies a condition of the form $K \Rightarrow K'$ with respect to model M if and only if:

For all extensions g of f that verify K, there is an extension h of g that verifies K'.



$I(\textbf{Pedro}) = a$
$I(\textbf{farmer}) = \{a, b, c\}$
$I(\textbf{donkey}) = \{d, e, f\}$
$I(\textbf{owns}) = \{\langle a, d\rangle, \langle b, e\rangle, \langle b, f\rangle\}$
$I(\textbf{beats}) = \{\langle a, d\rangle, \langle b, e\rangle, \langle b, f\rangle\}$

$$g_0 = \varnothing$$

$$g_1 = \begin{bmatrix} x & \to & a \end{bmatrix}$$

$$g_2 = \begin{bmatrix} x & \to & b \end{bmatrix}$$

$$g_3 = \begin{bmatrix} x & \to & b \\ y & \to & e \end{bmatrix}$$

$$g_4 = \begin{bmatrix} x & \to & a \\ y & \to & d \end{bmatrix}$$

$$g_4 = \begin{bmatrix} x & \to & a \\ y & \to & e \end{bmatrix}$$

Recall: f verifies $K \Rightarrow K'$ iff for all extensions g of f that verify K, there is an extension h of g that verifies K'.

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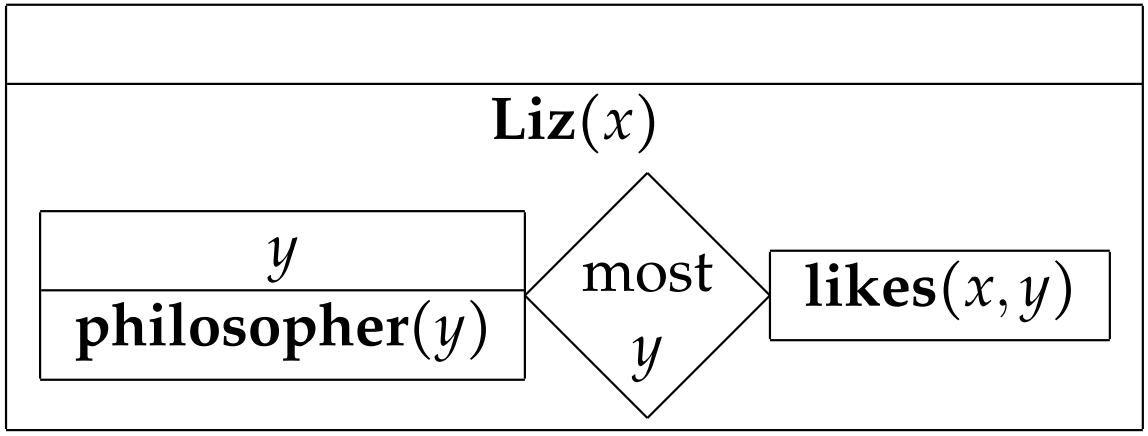
What about quantified donkey sentences?

If Pedro owns a donkey, he beats it.
Every farmer who owns a donkey beats it.

The indefinite in both sentences has universal force.

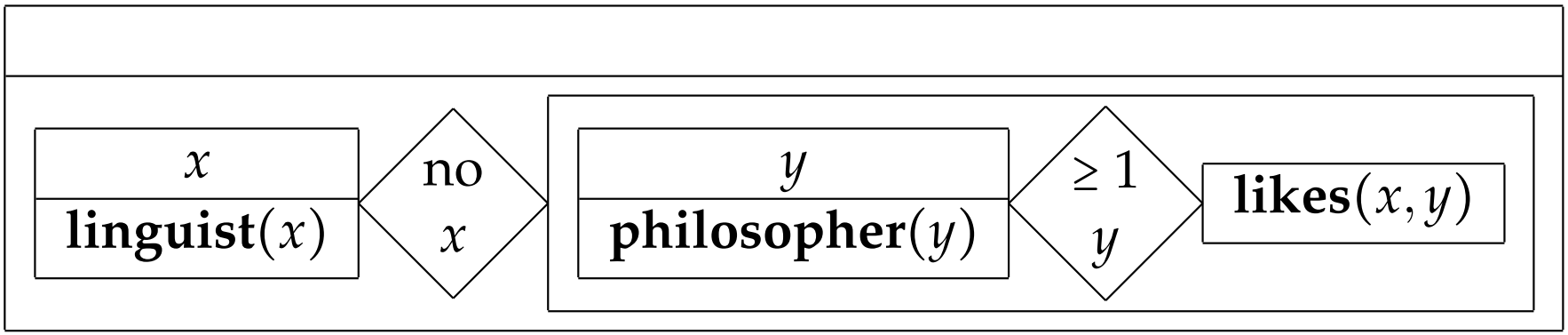
Quantifiers in DRT: Duplex conditions

Liz likes most philosophers



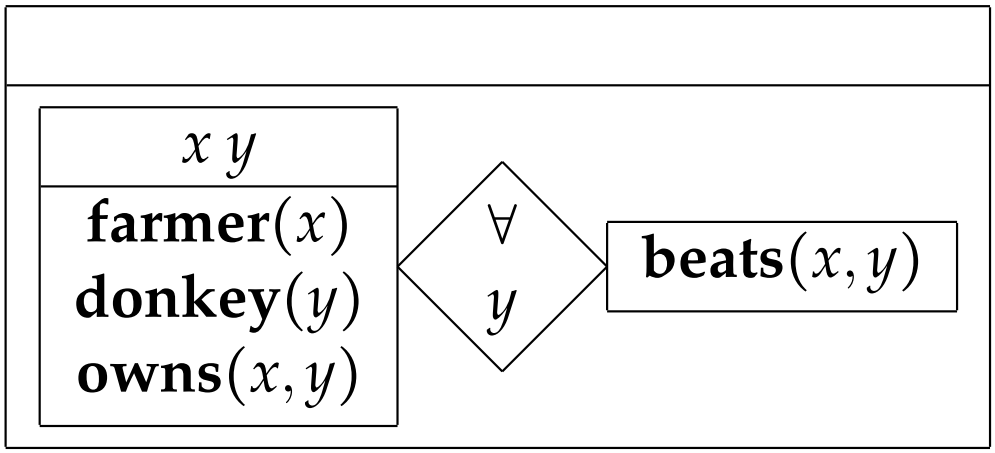
Multiple quantifiers

No linguist likes more than one philosopher.



Quantified donkey sentences

Every farmer who owns a donkey beats it.



How to interpret duplex conditions?

What does "Every farmer who owns a donkey beats it" mean?

- **weak reading**: every farmer who owns a donkey beats at least one of the donkeys he owns.
- **strong reading**: every farmer who owns a donkey beats all of the donkeys he owns.

Good candidate for the weak reading: "Every farmer who owns a tractor uses it to drive to church on Sundays."

To get the strong reading, we interpret universals like conditionals. To get the weak reading, we do something else.

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How do we get the DRSs?

- DRS construction rules + construction algorithm.
- This algorithm consists of instructions saying for each expression of a given fragment of natural language how to build or modify the DRS.

DRS-Construction Algorithm

Kamp & Reyle: 86

Input: a discourse $D = S_1, ..., S_i, S_{i+1}, ...S_n$, the empty DRS K_0

Keep repeating for $i = 1, ..., n$:

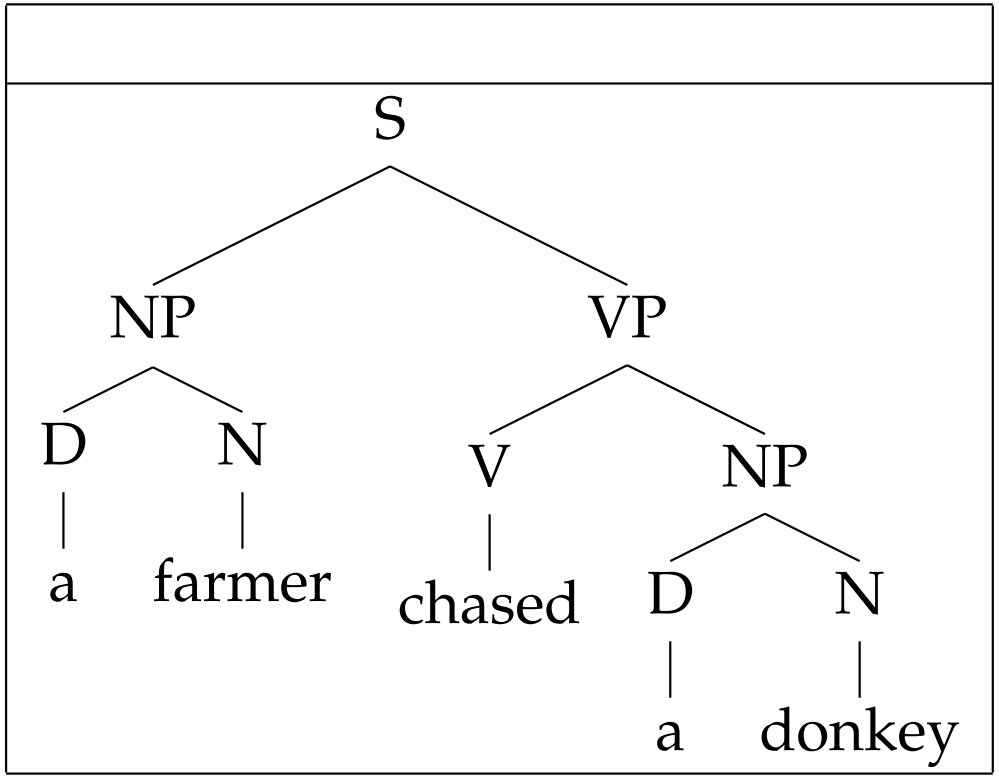
1. add the syntactic analysis $[S_i]$ of (the next) sentence S_i to the conditions of K_{i-1}; call this DRS K_i*. Go to (ii).
2. Input: a set of reducible conditions of K_i*
   Keep on applying construction principles to each reducible condition of K_i* until a DRS K_i is obtained that only contains irreducible conditions. Go to (i).

Example discourse

A farmer chased a donkey. He caught it.

Step 1: Add syntactic analysis of S_1

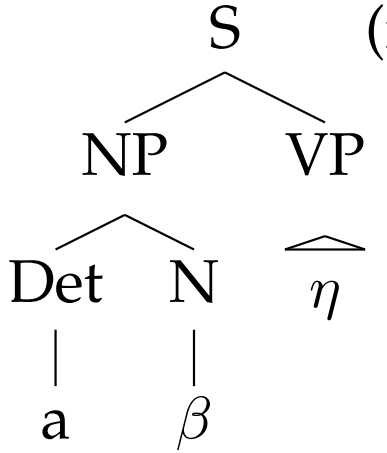
S_1 = A farmer chased a donkey. S_2 = He caught it.



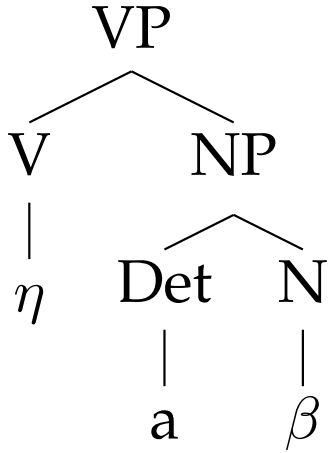
Construction Rule: CR.ID

Triggering configurations

(i)



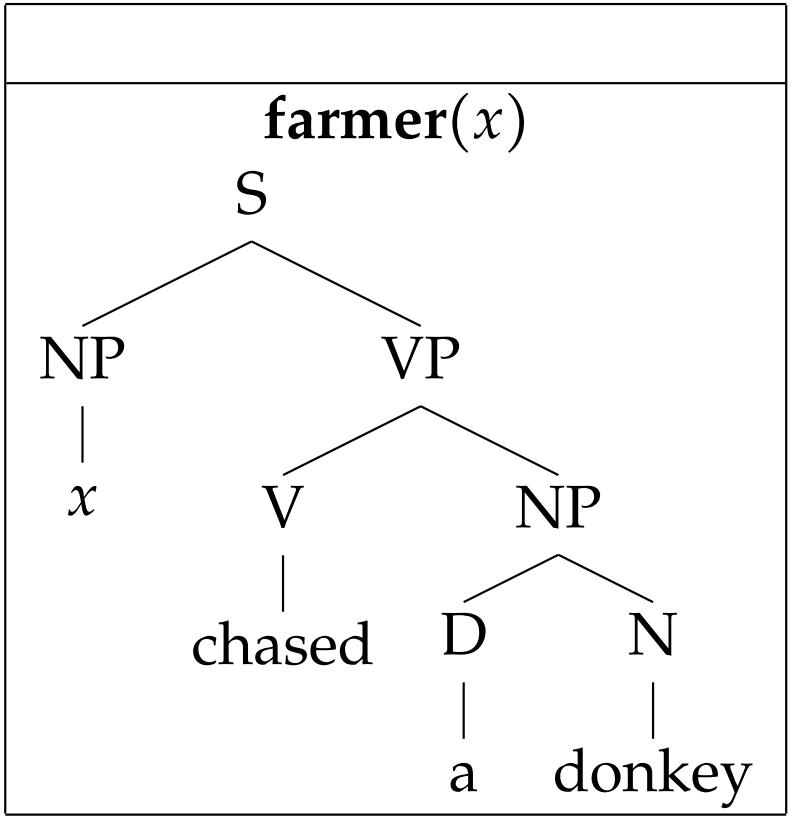
(ii)



Operations: (i) Introduce new referent **u** in the universe.
(ii) introduce a new condition [N](**u**).
(iii) substitute **u** for the NP.

Next step: Reduce indefinite

S_1 = A farmer chased a donkey. S_2 = He caught it.



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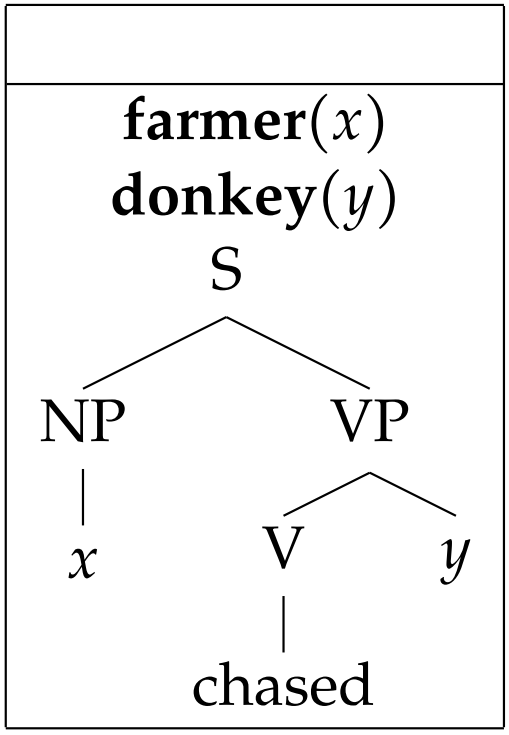


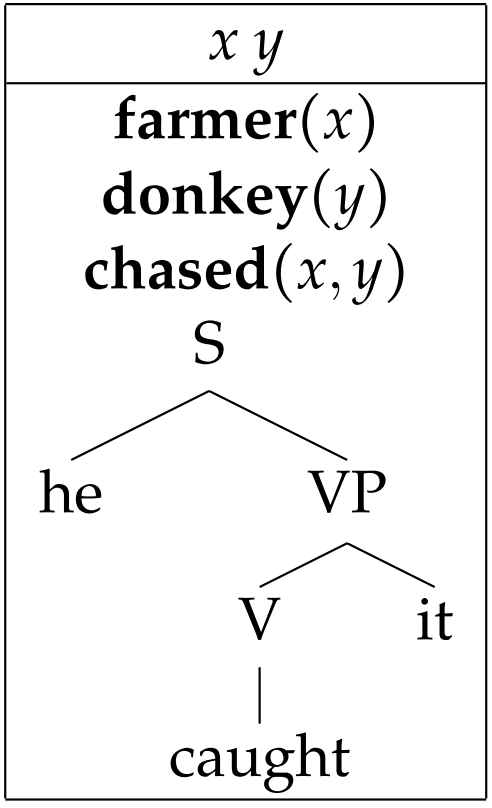
Next step: Reduce verb

S_1 = A farmer chased a donkey. S_2 = He caught it.

$x\ y$
farmer(x)
donkey(y)
chased(x, y)

Next step: Add syntactic analysis of S_2

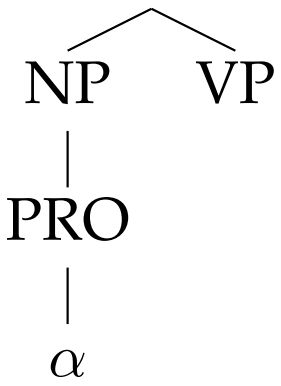
S_1 = A farmer chased a donkey. S_2 = He caught it.



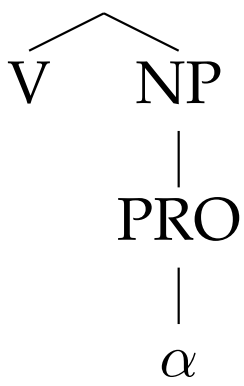
Composition Rule: CR.PRO

Triggering configurations

(i)



(ii)



Operations: (i) Choose a suitable antecedent **v** such that **v** is accessible. (ii) Introduce a new discourse referent **u** into the universe. (iii) Introduce the condition **u** = **v**. (iv) Substitute **u** for the NP.

Choosing an antecedent

CR.PRO: “Choose a suitable antecedent **v** such that **v** is accessible.”

Accessibility is a relation among DRSs. Auxiliary concept: subordination.

Immediate subordination

(Kamp & Reyle 1993: 154)

K_1 is immediately subordinate to K_2 iff either:

1. K_2 contains the condition $\neg K_1$
2. K_2 contains a condition of the form $K_1 \Rightarrow K_3$ or $K_3 \Rightarrow K_1$ for some DRS K_3

Subordination

(Kamp & Reyle 1993: 154)

K_1 is subordinate to K_2 iff either:

1. K_1 is immediately subordinate to K_2; or
2. there is a K_3 such that K_3 is subordinate to K_2 and K_1 is immediately subordinate to K_3.

K_1 is weakly subordinate to K_2 iff either $K_1 = K_2$ or K_1 is subordinate to K_2. We write $K_1 \leq K_2$ for weak subordination.

Accessibility

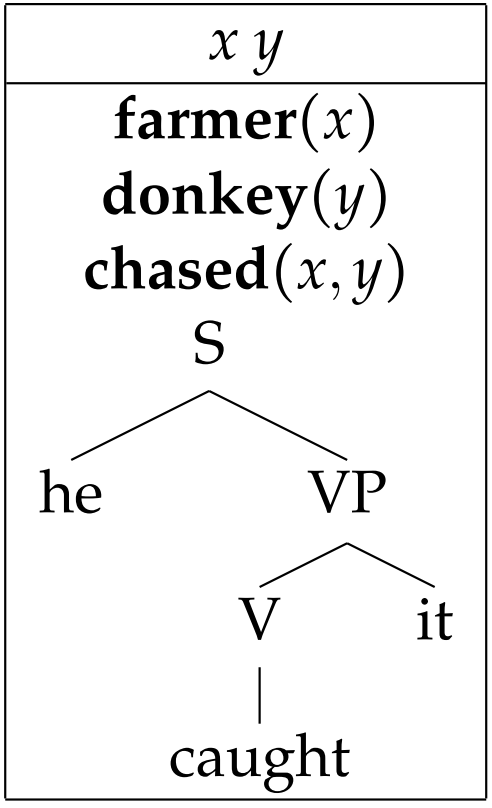
Kamp & Reyle 1993: 155

Let K be a DRS, x a discourse referent and γ a DRS-condition. We say that x is accessible from γ in K if x belongs to the universe of K_1 where:

1. $K_1 \leq K$, and
2. for some K_2, γ is one of the conditions in K_2, and either:
   - 2.1 $K_2 \leq K_1$, or
   - 2.2 there is a DRS K_3 and a DRS K_4 such that $K_1 \Rightarrow K_3$ is among the conditions of K_4, and $K_2 \leq K_3$.
     (In other words, the antecedent DRS is accessible to everything inside the consequent.)

Back to our example

S_1 = A farmer chased a donkey. S_2 = He caught it.



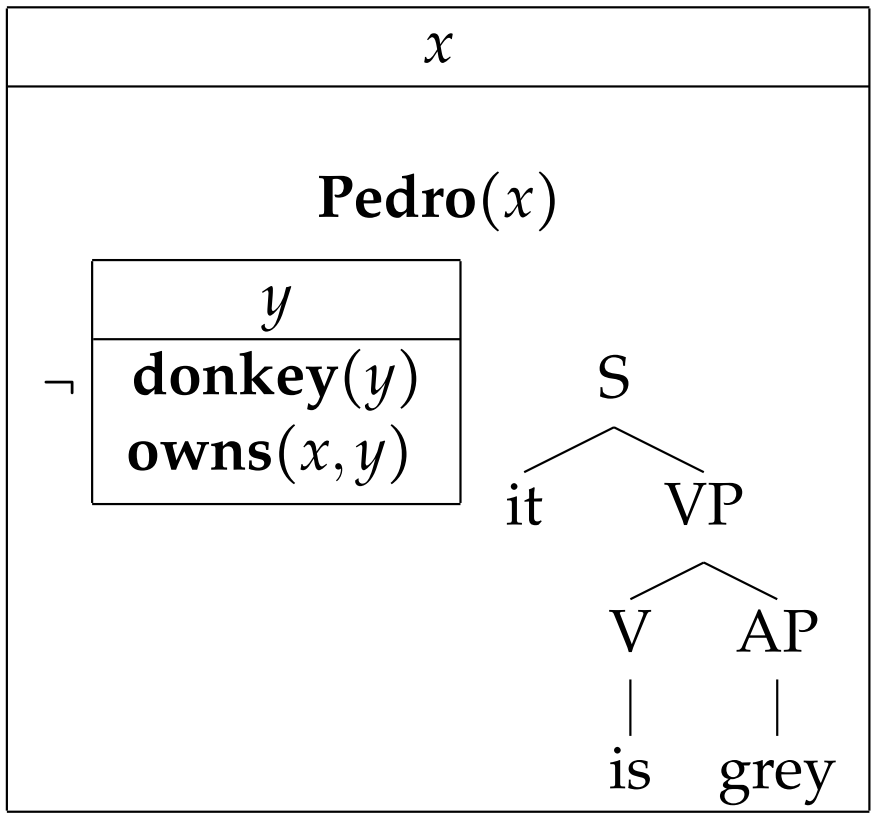
Next step(s): Process the pronoun(s)

S_1 = A farmer chased a donkey. S_2 = He caught it.

$x\ y\ v\ w$
$\mathbf{farmer}(x)$
$\mathbf{donkey}(y)$
$\mathbf{chased}(x, y)$
$\mathbf{caught}(v, w)$
$v = x$
$w = y$

Negation example

S_1 = Pedro doesn't own a donkey. S_2 = It is grey.



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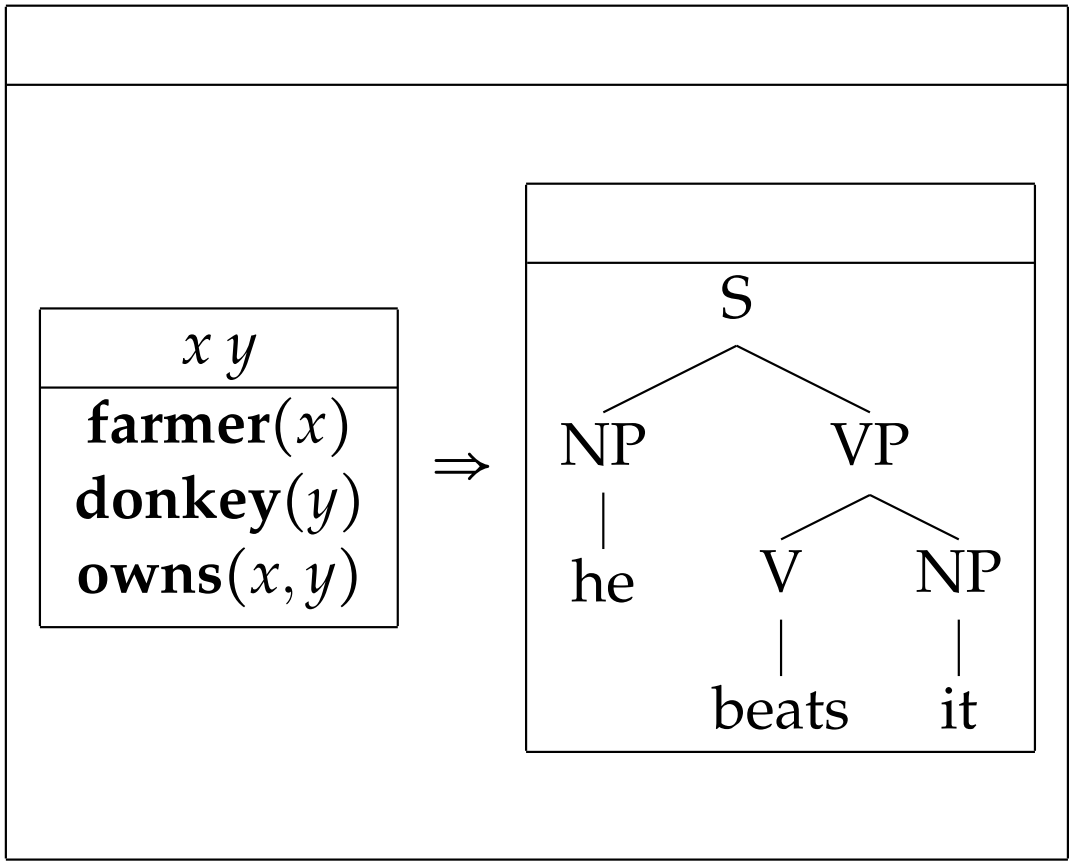
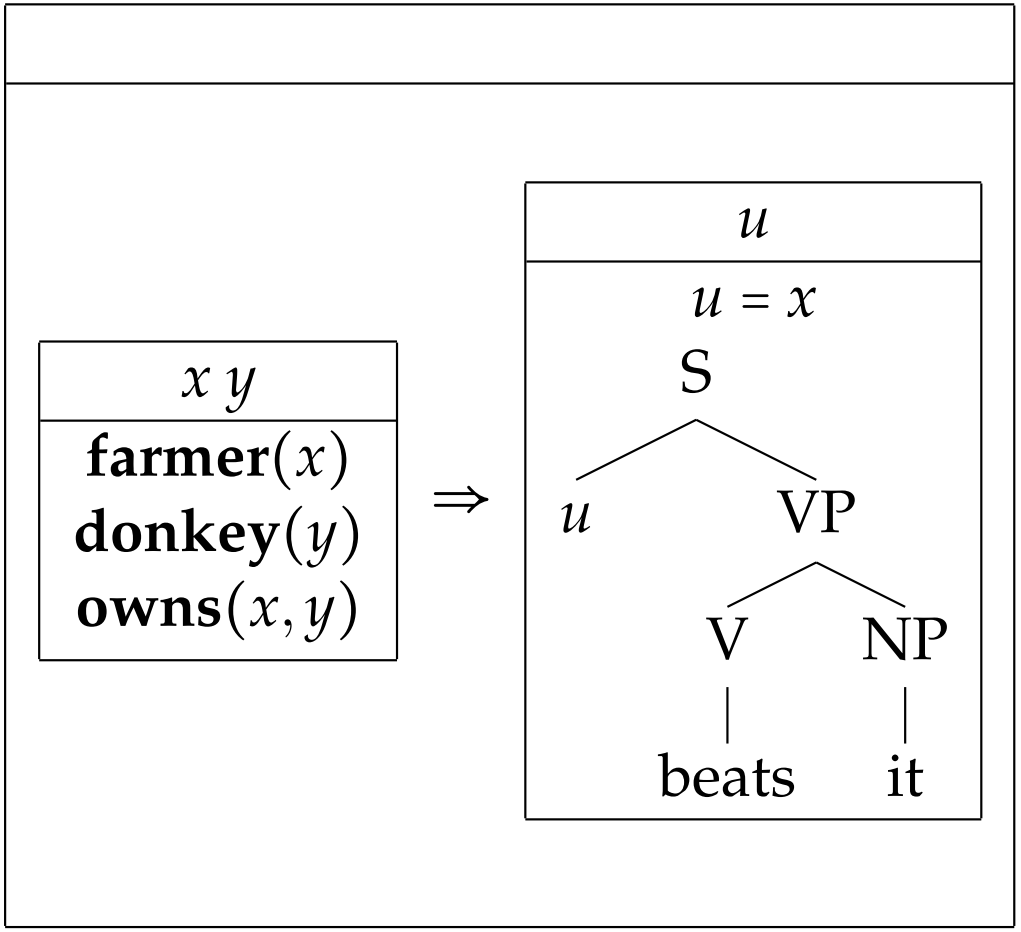
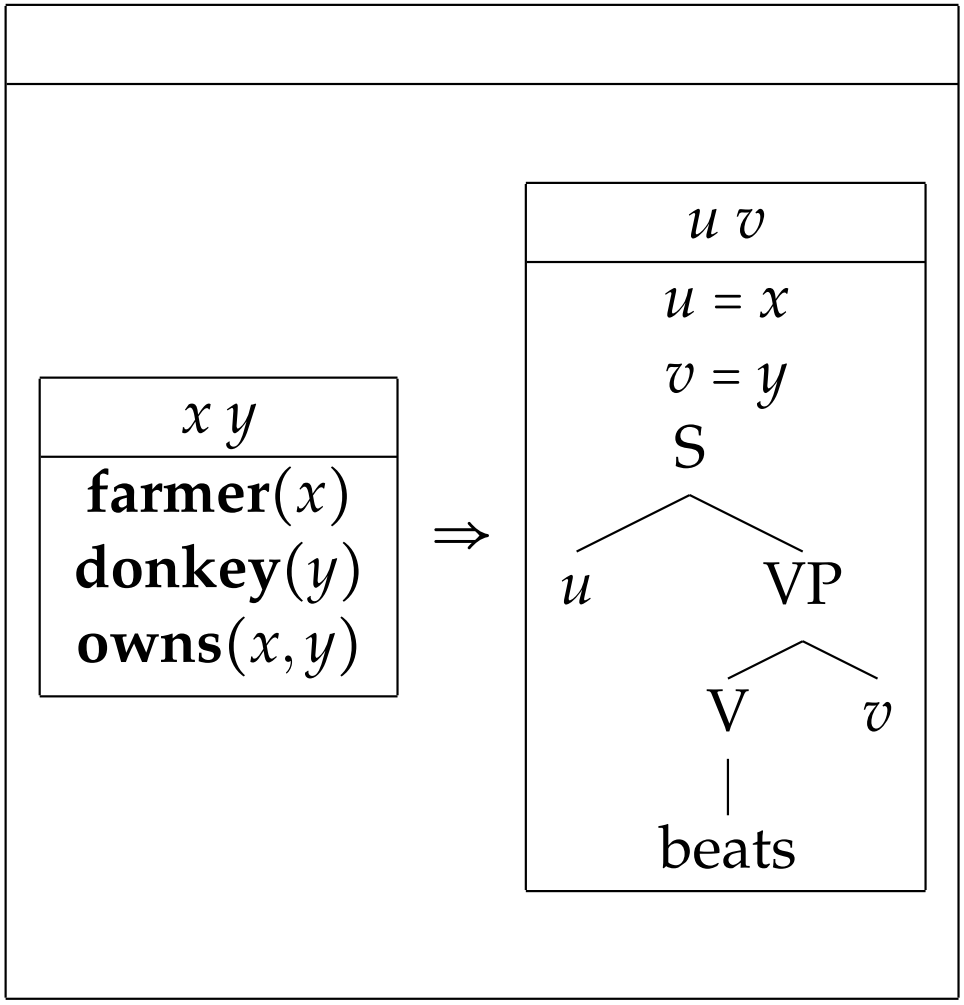
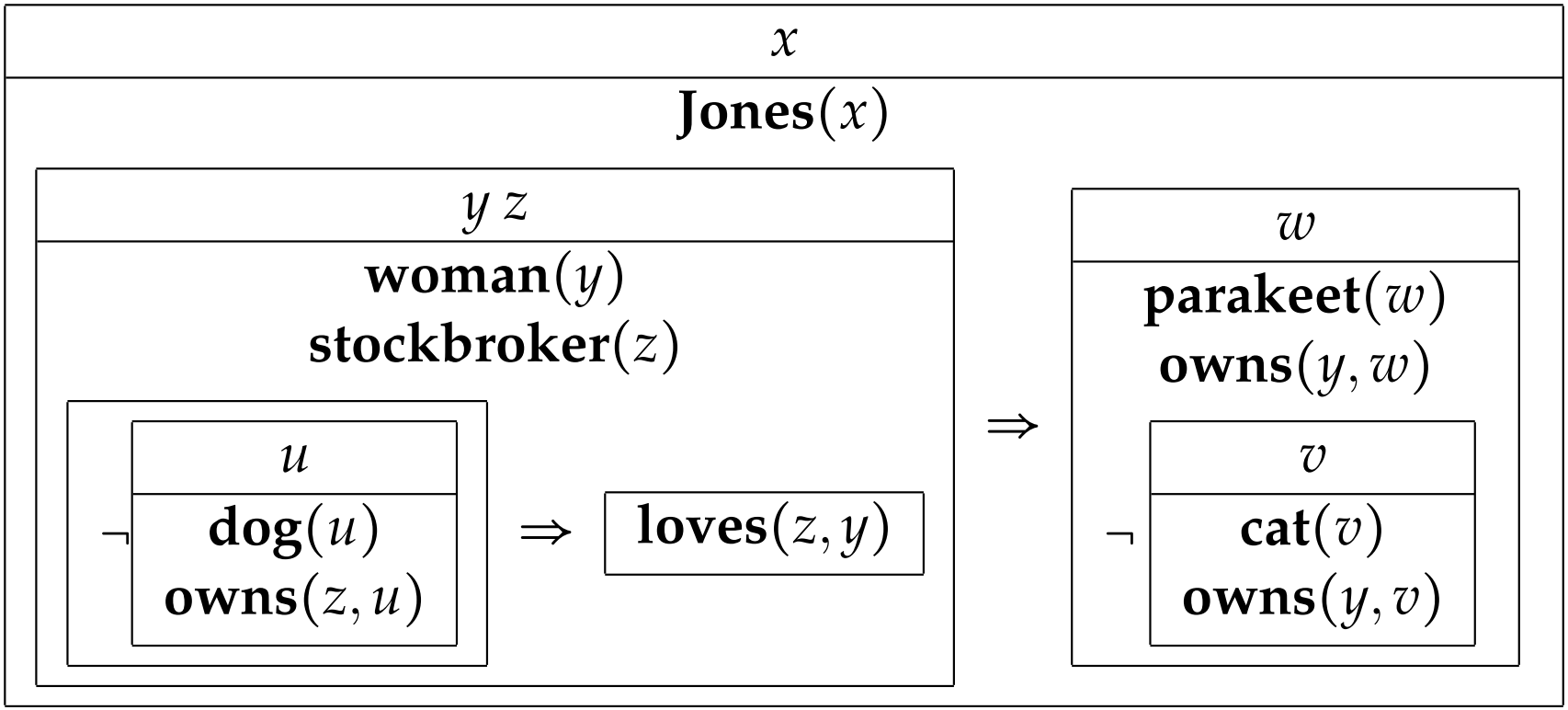
If a farmer owns a donkey, he beats it




x y
farmer(x)
donkey(y)
owns(x, y)
⇒
u
u = x
S
u
VP
V
NP
beats
it


x y
farmer(x)
donkey(y)
owns(x, y)
⇒
u v
u = x
v = y
S
u
VP
V
v
beats

Exercise on accessibility



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