# Semantics

## Quantifiers and scope ambiguity

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Recitation #12
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# Quantifiers

So far, the NPs that we focused on mostly were either proper names (1a) or definite descriptions (1b):

(1) a. [$_{NP}$ Taylor] thinks that at most one leopard ate their pizza.

b. [$_{NP}$ The leopard that's crouching behind the lectern right now] looks hungry.

- These NPs refer to particular individuals in the world.
- But what about other NPs?

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- But what about other NPs?

- Today's recitation: an investigation into NPs with determiners like *at most*, *every*, *some*, *no*, etc.
- This is a special type of determiner called **quantifier**.
  - Question we're going to explore: **what is the semantics of NPs with quantifiers?**

- Today's recitation: an investigation into NPs with determiners like *at most*, *every*, *some*, *no*, etc.
- This is a special type of determiner called **quantifier**.
  - Question we're going to explore: **what is the semantics of NPs with quantifiers?**

- **A simple hypothesis:** NPs with quantifiers have the same behavior as proper names and definite descriptions.
- Let's test this hypothesis.

# Diagnostic #1

(2) *Proper name*

*S1* John came yesterday morning.

*S2* John came yesterday.

- If *S1* is true, then *S2* is necessarily true.
  - In other words . . .

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(2′) *Quantifier*

*S1* At most one letter came yesterday morning.

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- If *S1* is true, then *S2* is necessarily true.
- Consider the following situation: yesterday, only one letter came in in the morning, but two more in the afternoon.
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- Consider the following situation: yesterday, only one letter came in in the morning, but two more in the afternoon.
  - *S1*: true
  - *S2*: false

# Diagnostic #2

(3) *Proper name*

*S1* Mount Rainier is on this side of the border, and

*S2* Mount Rainier is on the other side of the border.

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  - In other words ***S1* and *S2* contradict each other.**

(3′) *Quantifier*

*S1* More than two mountains are on this side of the border, and

*S2* more than two mountains are on the other side of the border.

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*S1* Either Socrates is mortal, or

*S2* it is not the case that Socrates is mortal.

- The overall sentence *S1* + *S2* (= negation of *S1*) is necessarily true.
  - **Tautology**: a statement that is necessarily true.

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(4′) *Quantifiers*

*S1* Every philosopher is mortal, or

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*negation of* S1

- The overall sentence *S1* + *S2* (= negation of *S1*) is necessarily true.

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- The overall sentence *S1* + *S2* (= negation of *S1*) is necessarily true. **Wrong!**
  - The overall sentence *S1* + *S2* is not a tautology.

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- We're trying to understand the difference between *e.g.* [$_{\text{NP}}$ Jaimie] and [$_{\text{NP}}$ at most one dog].
- First-pass hypothesis: they have the same behavior.
- Three diagnostics that show that this hypothesis is incorrect:

  #1 Entailment
  #2 Contradiction
  #3 Tautology

- We can't say that NPs with quantifiers refer to individuals in the world, like proper names or definite descriptions.
- But what *is* their semantics?

## Proposal

Quantifiers express relationships between sets.

- Here we will focus on *every*, *some*, and *no*.
- **Assumption:** VPs refer to sets of entities.
  - [$_{\text{VP}}$ is asleep] refers to the set of entities who are asleep.
  - The sentence *Fido is asleep* is true if Fido belongs to the set of entities who are asleep.

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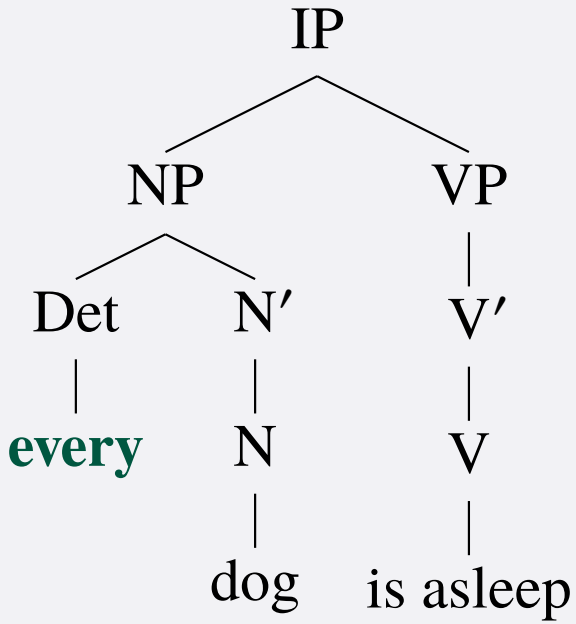
# Universal quantifier *every*

(5) a. Every dog is asleep.

b.




- This sentence is true if and only the set of dogs is a subset of the entities who are asleep.

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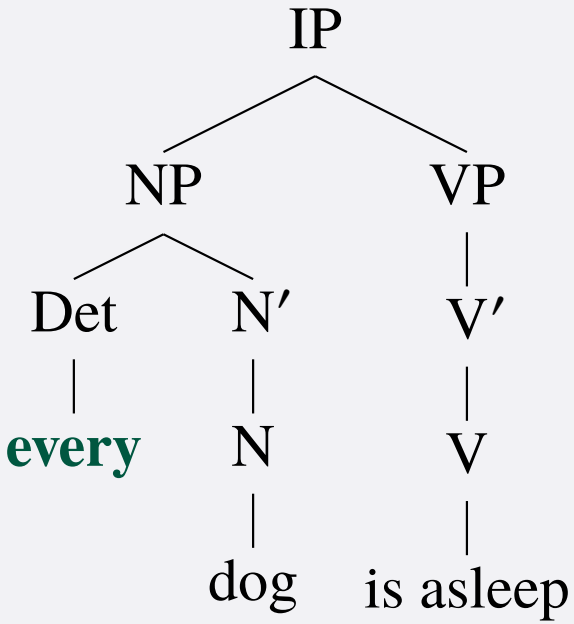
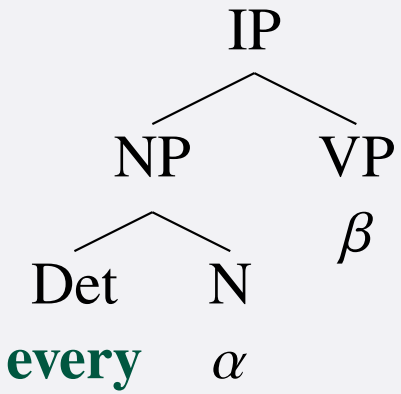



- This sentence is true if and only the set of dogs is a subset of the entities who are asleep.

$\Rightarrow$ Generalizing:

A sentence of the form




is true if and only if $\alpha \subseteq \beta$

# Existential quantifier *a*, *some*

(6) a. Some dog is asleep.

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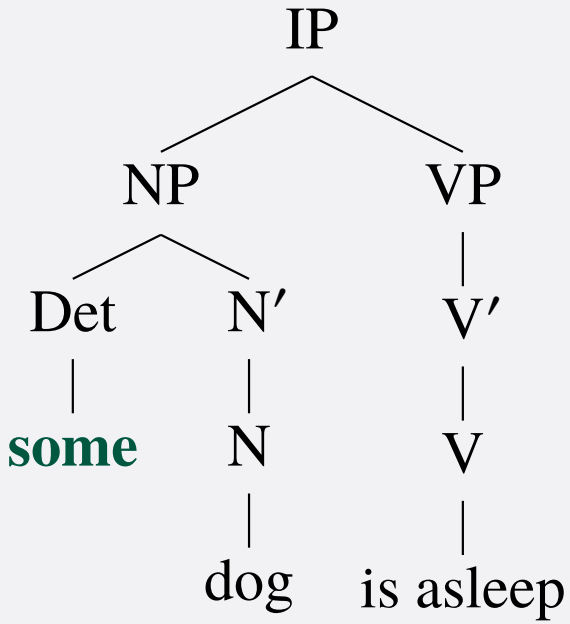


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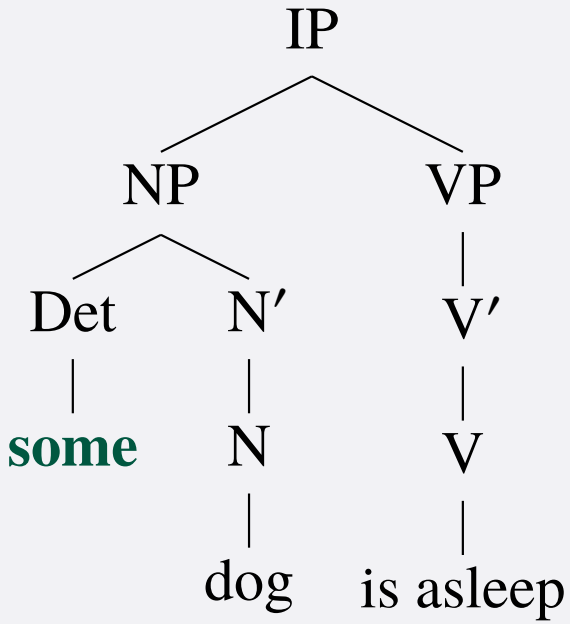


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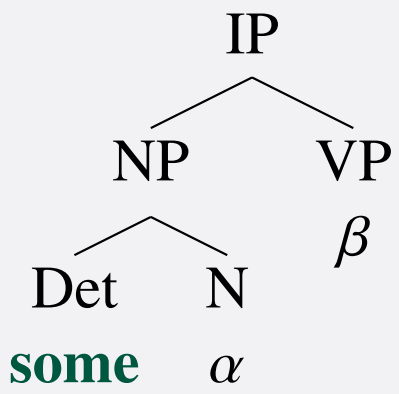


is true if and only if $\alpha \cap \beta \neq \emptyset$.

# Negative quantifier *no*

(7) a. No dog is asleep.

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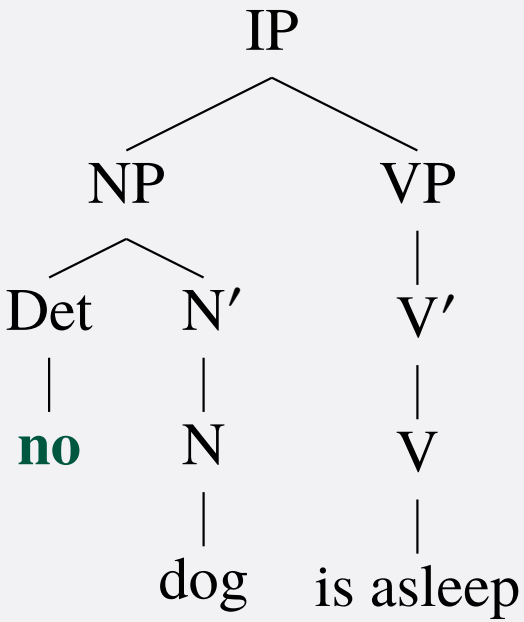


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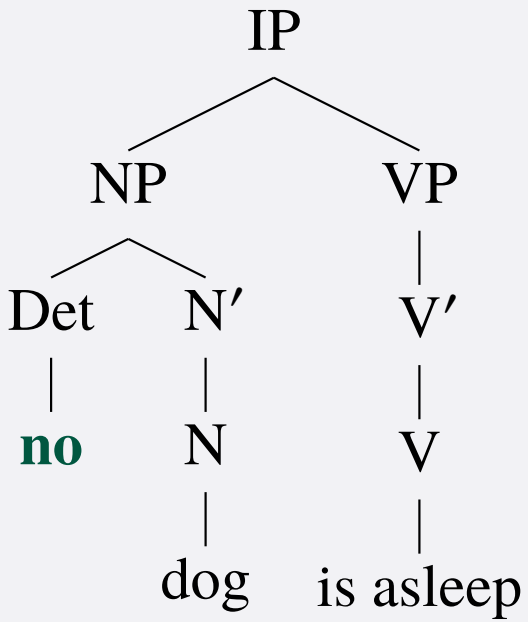


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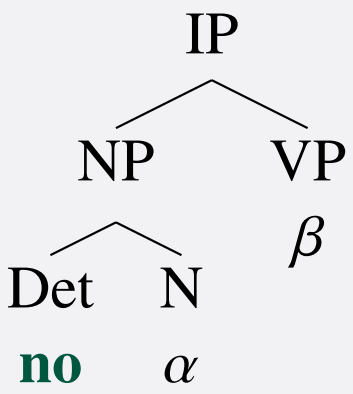


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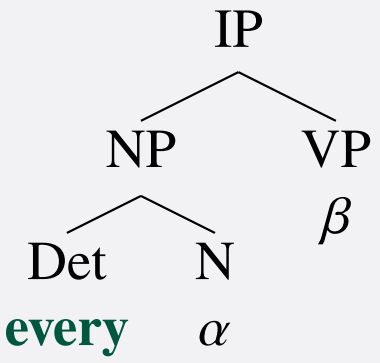
# Summary

(8) a.

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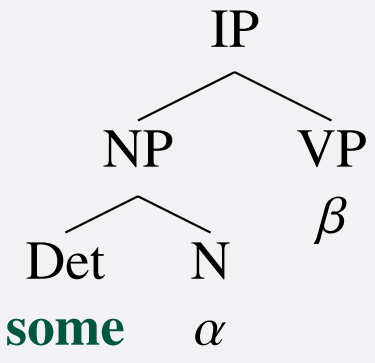


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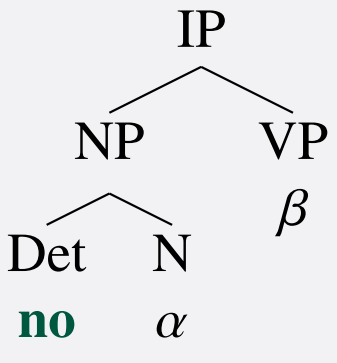
c.

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# Scope ambiguity

(9) A man is robbed every five minutes in Boston.

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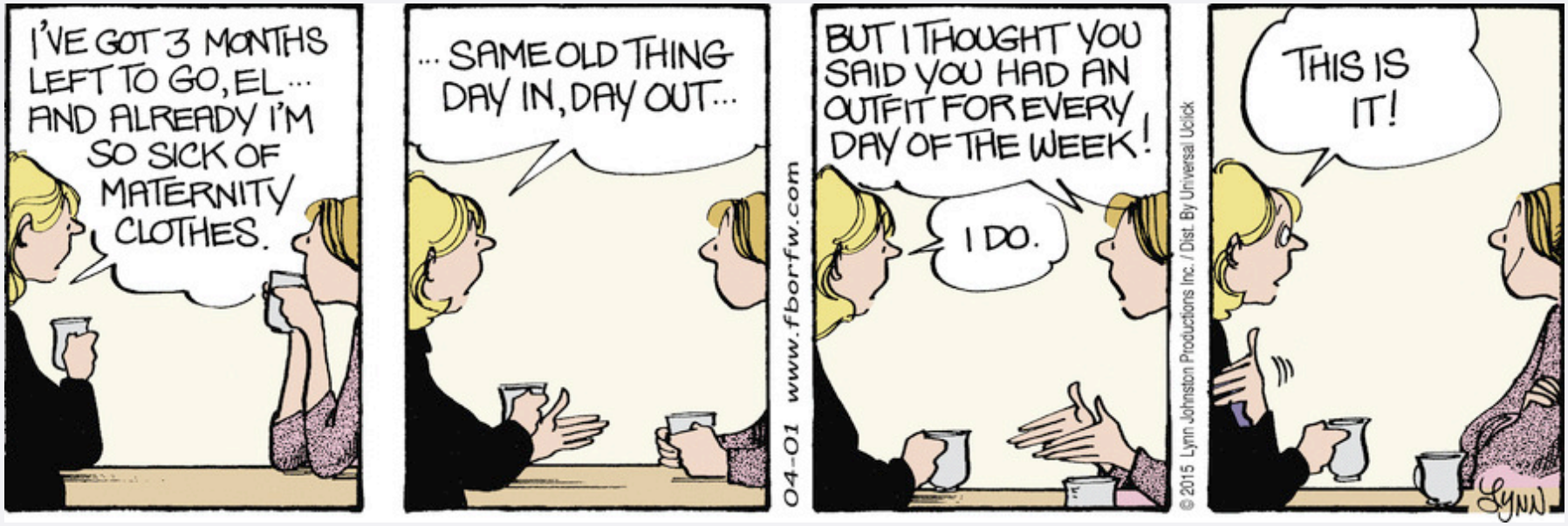
- Explaining the joke:
  - The intended reading is one where, every five minutes, a *different* man is robbed in Boston.
  - But the addition of *Poor guy* picks out a reading it is the *same* man that is robbed every five minutes.

The same type of joke can be seen in the following comic strip:




*For Better or For Worse* by Lynn Johnston, 2015 <LINK>, via **Language Log**.

But what is the source of the humor in the comic strip and in (9)?

(9) A man is robbed every five minutes in Boston. Poor guy...

(10) a. A man is robbed in Boston. Poor guy...

b. The man is robbed every five minutes in Boston. Poor guy...

But what is the source of the humor in the comic strip and in (9)?

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- It seems that the joke is based on the presence of two quantifiers (*a* and *every*), which interact with each other.
- This 'interaction' is called **scope ambiguity**.

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i. *There is a student who petted every dog.*

ii. *For every dog, a (potentially different) student petted him/her.*

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i. *There is a student who petted every dog.*

ii. *For every dog, a (potentially different) student petted him/her.*

- The second reading (*a potentially different student for every dog*) is usually more difficult to get.
- But we can construct examples where the first reading (*the same student pets every dog*) is implausible.

(12) A guard is standing in front of every building.

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ii. *For every building a (different) guard is standing in front of it.*

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i. # *There is guard who is standing in front of every building.*

ii. *For every building a (different) guard is standing in front of it.*

- The first reading is a logical possibility, but nonsensical according to how our world works.

- **How** does a sentence like (11) come to have two readings?

  (11) A student petted every dog.

- Consider a minimally different sentence:

  (13) A student petted every dog and the cat.

  - Is this sentence still ambiguous?

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- Consider now a minimally different sentence:

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- In order to understand the lack of ambiguity in (13) and (14), let's consider (15b):

(15) a. Taylor petted the cat and **the brown dog**.

b. **Which dog** did Taylor pet the cat and ___?

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  - Portions of a sentence we can't move from: **islands**
  - Coordination is a type of island.

# Taking stock

- We want to know how *A student petted every dog* is scopally ambiguous.
- If an NP with a quantifier (*every dog*) is inside an island (coordination), the sentence is no longer ambiguous.
- We can now formulate a hypothesis about scope ambiguity.

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- We can now formulate a hypothesis about scope ambiguity.
  - Scope ambiguity is generated by **movement**.
  - And therefore blocked by islands.

# References


- A 24.900 handout by Itai Bassi.
- Kratzer, Angelika & Irene Heim. *Semantics in generative grammar*. Oxford: Blackwell, 1998.
- Schwarzschild, Roger & Altshuler, Daniel. *Language and meaning*. Ms. of textbook, 2015.

# Linguistics undergraduate classes next semester

You can find the course schedule here:
**http://linguistics.mit.edu/courses_sp19/**

- Semantics and pragmatics (Prof. Luka Crnič)
- Historical linguistics and sociolinguistics (Prof. Edward Flemming)

In the Fall: phonology, syntax, and field methods!

Thank you!

Muito obrigado!
[ˈmũj̃tʊ obɾiˈgadʊ]