Semantics lab class (Course 2)

Lecture 6, assignment 6

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Session 5

December 6, 2023

Our agenda today

- Recap: Empty expressions, modification, presupposition
- Assignment 5
- Something new:
  Presupposition failure, (Un)definedness, definite article
- Some exercise to help you with assignment 6

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Semantically vacuous expressions

Some expressions have only syntactic but no semantic contribution:

(1) a. Snowball is a cat.

b. [[Snowball is a cat]]

= [[cat]] ([[Snowball]])

= [$\lambda x : x \in D_e$. x is a cat] (Snowball)

= 1 iff Snowball is a cat

Empty expressions: A list

Unary non-verbal predicates:

Common noun: [[~~is a~~ cat]]= $\lambda x : x \in D_e$. x is a cat

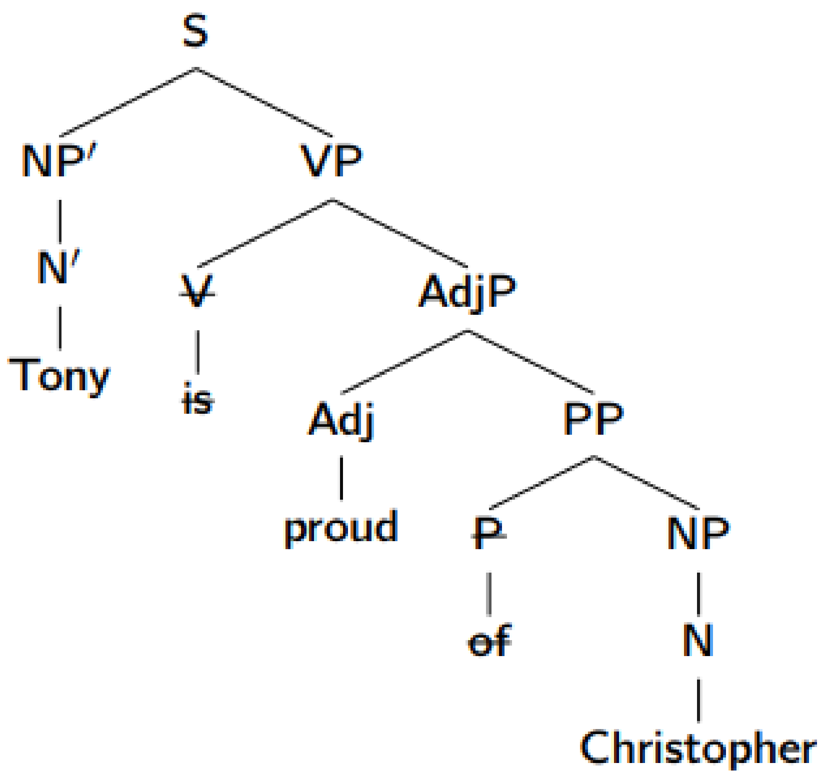
Predicative ADJ: [[~~is~~ rich]]= $\lambda x : x \in D_e$. x is rich

Binary non-verbal predicates:

[[~~is~~ the father ~~of~~]]= $\lambda x \in D_e$. [$\lambda y \in D_e$. y is the father of x]

[[~~is~~ from]]= $\lambda x \in D_e$. [$\lambda y \in D_e$. y is from x]

Semantic invisibility



In the assignments and exams, the empty expressions will be deleted in the tree.

Modification as parts of set

(2) a. a city in Texas

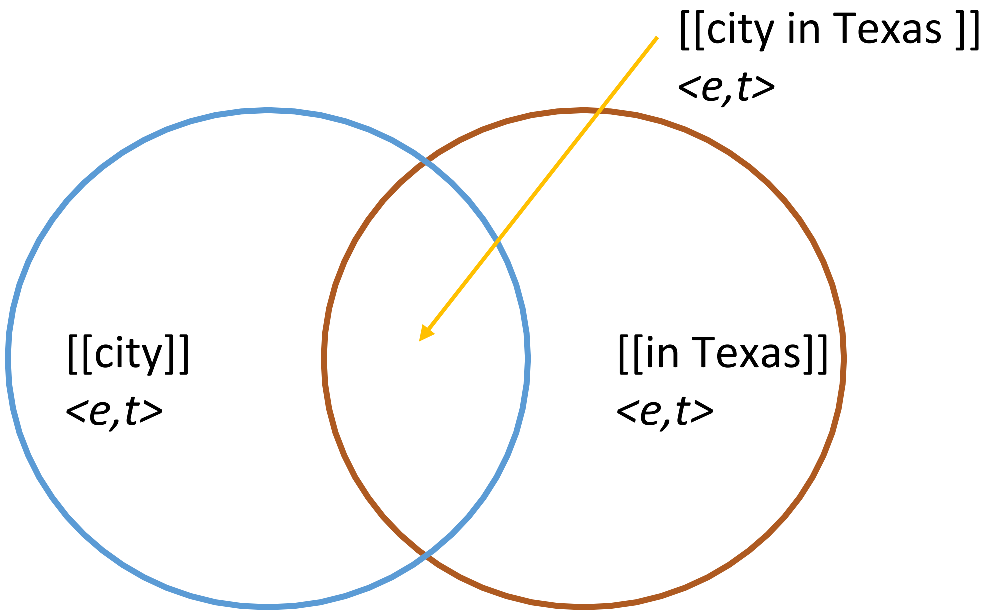
b. Snowball is a white cat.

Modifiers are characteristic functions of the type *<e,t>*.

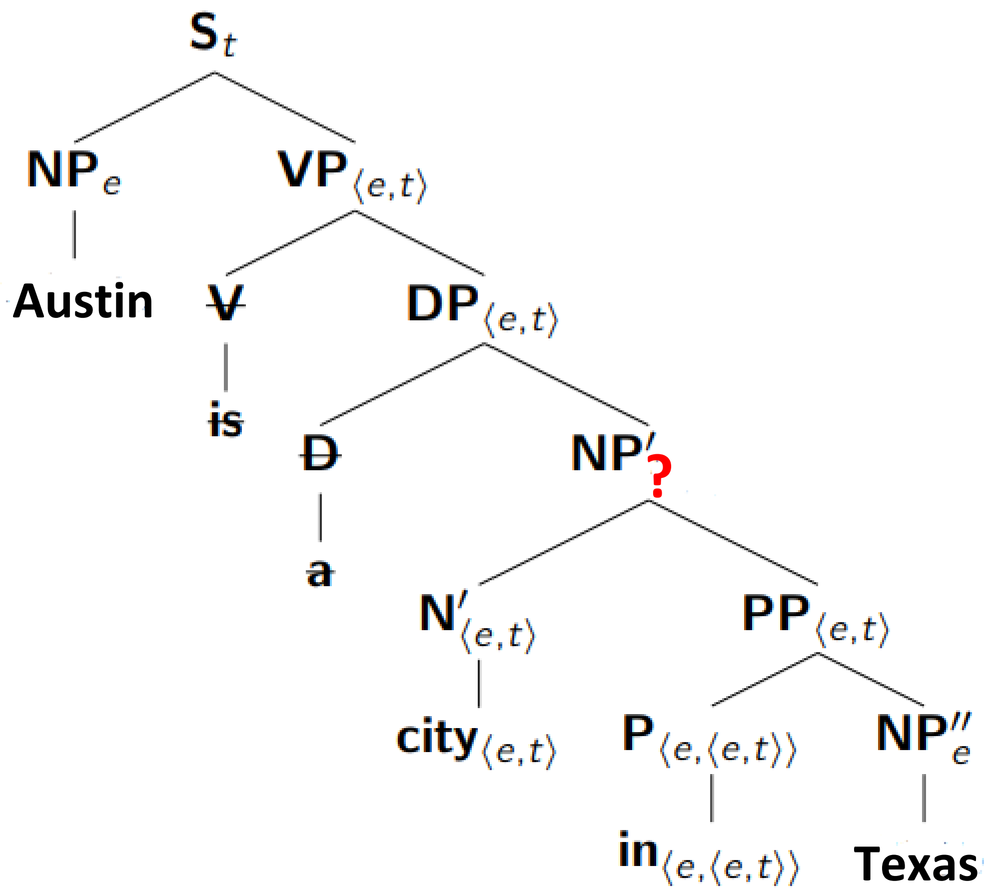
(3) Austin is a city in Texas. *entails*

a. Austin is a city.

b. Austin is in Texas.



How to combine <*e,t*> with <*e,t*>?

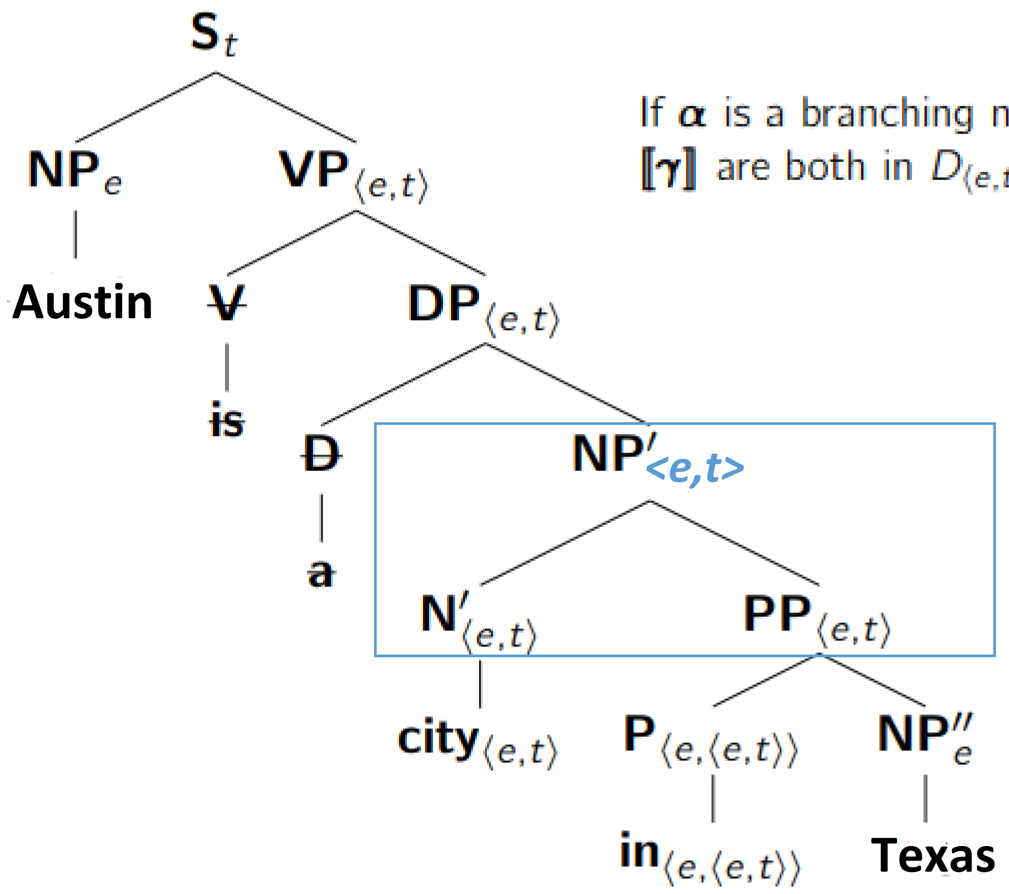


FA: One node is a function that takes its sister as argument.

Problem: Both N' and PP denote functions of type <e,t>,

Maybe FA is not suitable here.

New Rule: Predicate modification (PM)



If α is a branching node, $\{\beta, \gamma\}$ is the set of α's daughters, and $[\![\beta]\!]$ and $[\![\gamma]\!]$ are both in $D_{\langle e,t \rangle}$, then $[\![\alpha]\!] = \lambda x \in D_e \,.\, [\![\beta]\!](x) = [\![\gamma]\!](x) = 1$.

Semantic rules: A list

TN If $\boldsymbol{\alpha}$ is a terminal node, $[\![\boldsymbol{\alpha}]\!]$ is specified in the lexicon.

NN If $\boldsymbol{\alpha}$ is a non-branching node, and $\boldsymbol{\beta}$ is $\boldsymbol{\alpha}$'s daughter, then $[\![\boldsymbol{\alpha}]\!] = [\![\boldsymbol{\beta}]\!]$.

FA If $\boldsymbol{\alpha}$ is a branching node, $\{\boldsymbol{\beta}, \boldsymbol{\gamma}\}$ is the set of $\boldsymbol{\alpha}$'s daughters, and $[\![\boldsymbol{\beta}]\!]$ is a function whose domain contains $[\![\boldsymbol{\gamma}]\!]$, $[\![\boldsymbol{\alpha}]\!] = [\![\boldsymbol{\beta}]\!]([\![\boldsymbol{\gamma}]\!])$.

PM If $\boldsymbol{\alpha}$ is a branching node, $\{\boldsymbol{\beta}, \boldsymbol{\gamma}\}$ is the set of $\boldsymbol{\alpha}$'s daughters, and $[\![\boldsymbol{\beta}]\!]$ and $[\![\boldsymbol{\gamma}]\!]$ are both in $D_{\langle e,t\rangle}$, then
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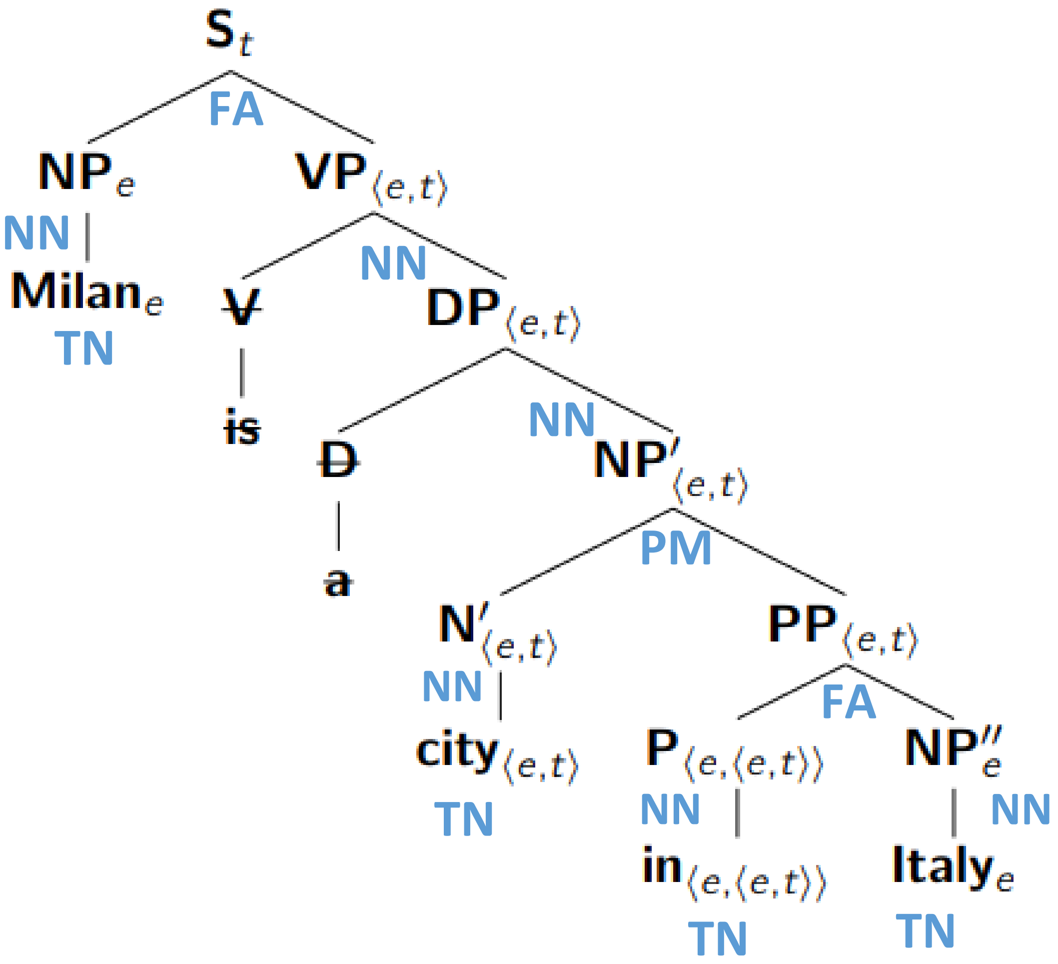
The most important skill: semantic types and rules



Recap: Entailment and literal meaning

The **literal meaning** of a sentence is its **truth-conditional meaning.**

Truth-conditions are composed by **lexical meanings** of each part of a sentence.

Entailments come from **lexical meanings,** thus are part of **the truth-conditional meaning.**

(4) a. I have a white cat. *entails* b. I have an animal.

because a white cat is an animal.

Negation and truth-conditions

Negation "reverses" the truth-conditions of a sentence.
So the conjunction of a sentence and its entailments leads to ***contradiction***.

(5) # I have a white cat but I don't have an animal.

Unlike entailments, **presuppositions** "survive" under negation.

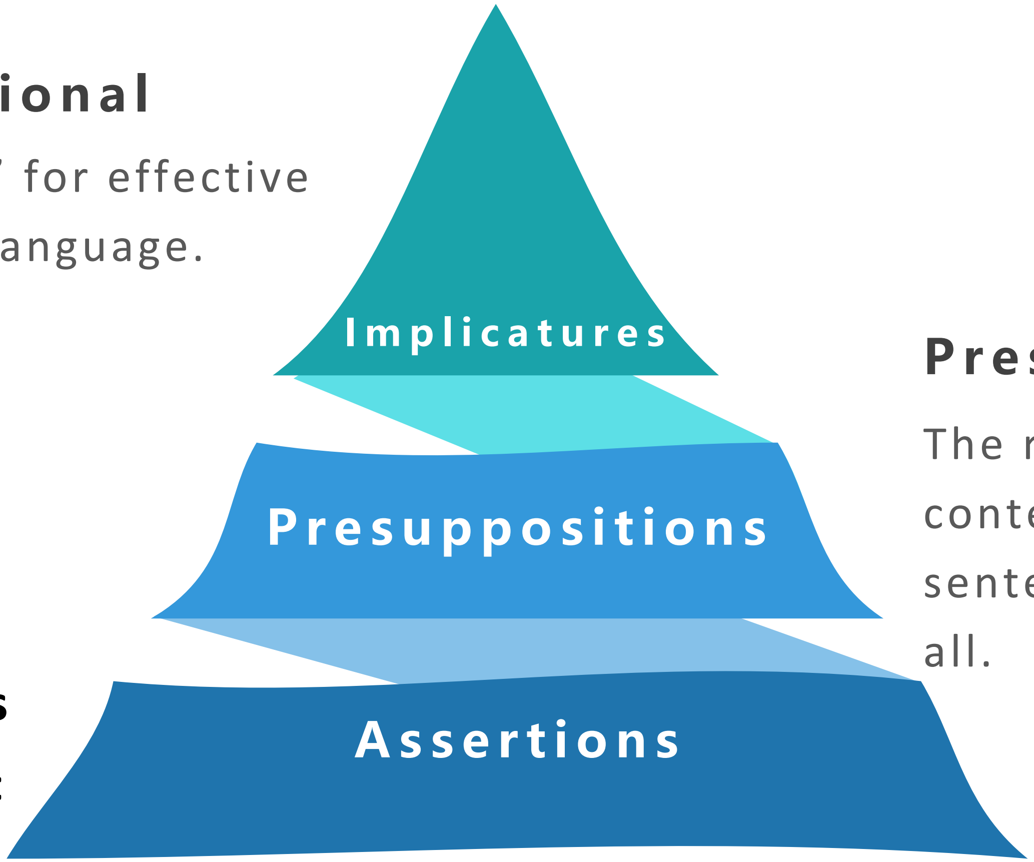
(6) a. I played with my cat today. *presupposes* b. I have a cat.

(7) b. I didn't play with my cat today. *presupposes* b. I have a cat.

Three levels of meaning

Conversational

A set of “guidelines” for effective and rational use of language.



Presuppositional

The requirements that the context must satisfy for the sentence to be interpretable at all.

Truth-conditions

Entailment

Some presupposition triggers

In English, presuppositions are usually triggered by lexical items.

- **Definite noun phrases**

  Mary loves / doesn't love her cat

  ≫ Mary has a cat.

- **Verbs like know, forget**

  I forgot/ didn't forget Mary is a vegetarian.

  ≫ Mary is a vegetarian.

- **Aspect: Stop, quit, again**

  John stopped/ hasn't stop smoking

  ≫ John used to smoke

Tests for Entailment and Presupposition

(8) a. Jane loves her husband.

b. Jane is married.

<u>Entailment test:</u>

Contradiction with negation: # Jane loves her husband and she is not married.

<u>Presupposition tests:</u>

Negation: Jane doesn't love her husband. *(8b) still holds.*

Conditional: If Jane loves her husband, then she will stay. *(8b) still holds.*

Question: - Does Jane love her husband? - No idea. *(8b) still holds.*

Conclusion: (15a) entails and presupposes (8b).

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Assignment 5: Exercise 1

- Any questions?

(2) Mary knows she won the prize. *entails*

b. Mary believes she won the prize.

Entailment thesis: for people to know that *p* is true, they must have something like a belief that *p* is true.

Assignment 5: Exercise 1

Note that there has been constant debates about the two theses due to obvious counter-examples.

(2') Mary knows the rumor that she won the prize, but she doesn't believe the rumor that she won the prize.

(2'') # Mary knows for a fact that it is raining outside (because she feels the raindrops), but she doesn't believe that it is raining outside.

It seems knowledge of *p* only entail **justifiable** beliefs of *p*.

Assignment 5: Exercise 2

- Any questions?
- (5a-d) differ in the order of PM and empty expressions.

Assignment 5

(4) Anna is a smart student from Ukraine.

(4) entails:

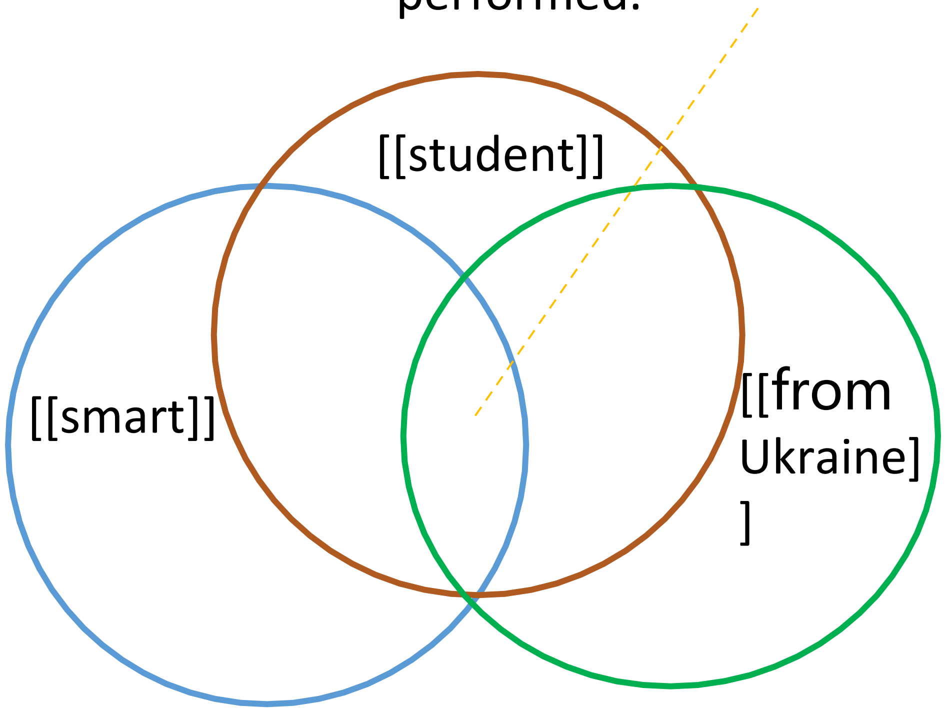
b. Anna is smart.

c. Anna is a student .

d. Tony is from Ukraine.

Intersective modification

Since intersection is symmetric
it does not matter in which order it is performed.



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Presupposition failure

(1) The king of France is bald.

What is the truth value of sentence (1) in the real world (in the world we live in)?

Presupposition failure

It hard to say the sentence is either true or false, since there is no king of France in reality.

(1) The king of France is bald. *presupposes* *There is a king of France.*

We say there is a **presupposition failure**.

The Russell-Strawson debate

(1) The king of France is bald.

Does (1) have a truth value?

Russell: (1) is false, because there is no king of France and so the king of France is not bald.

Strawson: (1) is neither true nor false, i.e. **undefined**. Because we cannot check whether the statement is true or false.

We follow Strawson in this class

(1) The king of France is bald.

Does (1) have a truth value?

Russell: (1) is false, because there is no king of France and so the king of France is not bald.

Strawson: (1) is neither true nor false, i.e. undefined. Because we cannot check whether the statement is true or false. ✓

Semantic rules with no (un-)definedness projection

Only FA encodes definedness because functions are only defined for its domain.

TN If $\boldsymbol{\alpha}$ is a terminal node, $[\![\boldsymbol{\alpha}]\!]$ is specified in the lexicon.

NN If $\boldsymbol{\alpha}$ is a non-branching node, and $\boldsymbol{\beta}$ is $\boldsymbol{\alpha}$'s daughter, then $[\![\boldsymbol{\alpha}]\!] = [\![\boldsymbol{\beta}]\!]$.

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$[\![\boldsymbol{\alpha}]\!] = \lambda x \in D_e \,.\, [\![\boldsymbol{\beta}]\!](x) = [\![\boldsymbol{\gamma}]\!](x) = 1$.

Definedness for interpretation functions [[ ]]

Interpretation functions **[[ ]]** are also functions that encode definedness.

Recall that *win* triggers ***p*****resuppositions.** John won the game presupposes John took part in the game.

win is only in the domain of **[[ ]]** if the presuppositions trigger by *win* is satisfied.

In other words: *win* can only have an interpretation if for some individual to win a game, this individual has to first take part in this game.

Interpretation rules projecting (un-)definedness

The mother nodes are in the domain of **[[ ]]** only if its daughters are in the domain of **[[ ]]**

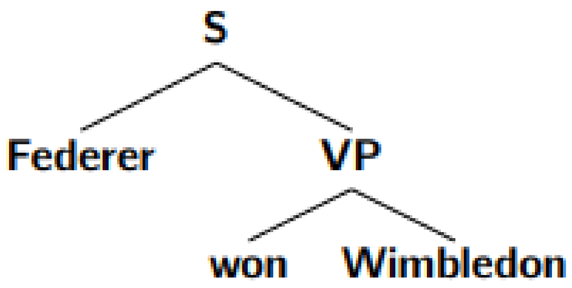
FA If $\boldsymbol{\alpha}$ is a branching node, $\{\boldsymbol{\beta}, \boldsymbol{\gamma}\}$ is the set of $\boldsymbol{\alpha}$'s daughters, then $\boldsymbol{\alpha}$ is in the domain of $[\![\ ]\!]$ if $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are in the domain of $[\![\ ]\!]$ and $[\![\boldsymbol{\gamma}]\!]$ is in the domain of $[\![\boldsymbol{\beta}]\!]$. Then $[\![\boldsymbol{\alpha}]\!] = [\![\boldsymbol{\beta}]\!]([\![\boldsymbol{\gamma}]\!])$.

NN If $\boldsymbol{\alpha}$ is a non-branching node, and $\boldsymbol{\beta}$ is $\boldsymbol{\alpha}$'s daughter, then $\boldsymbol{\alpha}$ is in the domain of $[\![\ ]\!]$ if $\boldsymbol{\beta}$ is in the domain of $[\![\ ]\!]$. Then $[\![\boldsymbol{\alpha}]\!] = [\![\boldsymbol{\beta}]\!]$.

PM If $\boldsymbol{\alpha}$ is a branching node, $\{\boldsymbol{\beta}, \boldsymbol{\gamma}\}$ is the set of $\boldsymbol{\alpha}$'s daughters, then $\boldsymbol{\alpha}$ is in the domain of $[\![\ ]\!]$ if $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are in the domain of $[\![\ ]\!]$ and $[\![\boldsymbol{\beta}]\!]$ and $[\![\boldsymbol{\gamma}]\!]$ are both in $D_{\langle e,t \rangle}$. Then $[\![\boldsymbol{\alpha}]\!] = \lambda x \in D_e$. $[\![\boldsymbol{\beta}]\!](x) = [\![\boldsymbol{\gamma}]\!](x) = 1$.

TN If $\boldsymbol{\alpha}$ is a terminal node, then $\boldsymbol{\alpha}$ is in the domain of $[\![\ ]\!]$ if $[\![\boldsymbol{\alpha}]\!]$ is specified in the lexicon.

Truth-conditions and definedness



$$[\![\text{S}]\!] = [\![\text{VP}]\!]([\![\text{Federerer}]\!]) \qquad \text{(FA)}$$

$$= [\![\text{won}]\!]([\![\text{Wimbledon}]\!])([\![\text{Federerer}]\!]) \qquad \text{(FA)}$$

$$= [\lambda x \in D_e \ . \ [\lambda y : y \in D_e \text{ and } y \text{ took part in } x \ . \ y \text{ came first in } x]] (\text{Wimbledon})(\text{Federerer}) \qquad (3{\times}\text{TN})$$

$$= [\lambda y : y \in D_e \text{ and } y \text{ took part in Wimbledon} \ . \ y \text{ came first in Wimbledon}] (\text{Federerer})$$

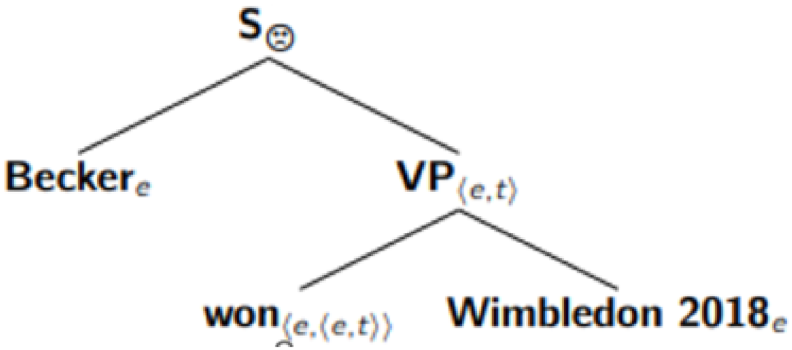
$$= 1 \text{ iff Federerer came first in Wimbledon} \qquad \text{(FA)}$$

defined only if Federerer is an individual who took part in Wimbledon

Undefined semantic value and negation

In a situation where Becker didn't even take part in Wimbledon 2018:

(3) Becker won Wimbledon 2018.



[[S]]= # (undefined)

Exercise 1: Truth-values and undefinedness

Let the situation S_1 be:

D_e={John, Jane, Sue}. John and Sue used to smoke. John is the only one who stops smoking. Jane never smokes.

Which results do our semantic rules give for (4a-e) in S_1?

(4) a. Jane stops smoking.

b. John stops smoking.

c. It is not the case that John stops smoking.

d. It is not the case that Jane stops smoking.

e. Sue stops smoking.

Solution: Exercise 1

(4) a. [[Jane stops smoking]]= #

b. [[John stops smoking]]= 1

c. [[It is not the case that John stops smoking]]= 0

d. [[It is not the case that Jane stops smoking]]= #

e. [[Sue stops smoking]]= 0

Exercise 2: Truth-values and undefinedness

Let the situation S_2 be:

D_e*={John, Jane, Sue}. None of John, Jane and Sue ever smoked in their life.*

Which results do our semantic rules give for (4’a-e) in S_2?

(4’) a. Jane stops smoking.

b. John stops smoking.

c. It is not the case that John stops smoking.

d. It is not the case that Jane stops smoking.

e. Sue stops smoking.

Solution: Exercise 2

(4’) a. [[Jane stops smoking]]= #

b. [[John stops smoking]]= #

c. [[It is not the case that John stops smoking]]= #

d. [[It is not the case that Jane stops smoking]]= #

e. [[Sue stops smoking]]= #

Intuitions about definite expressions

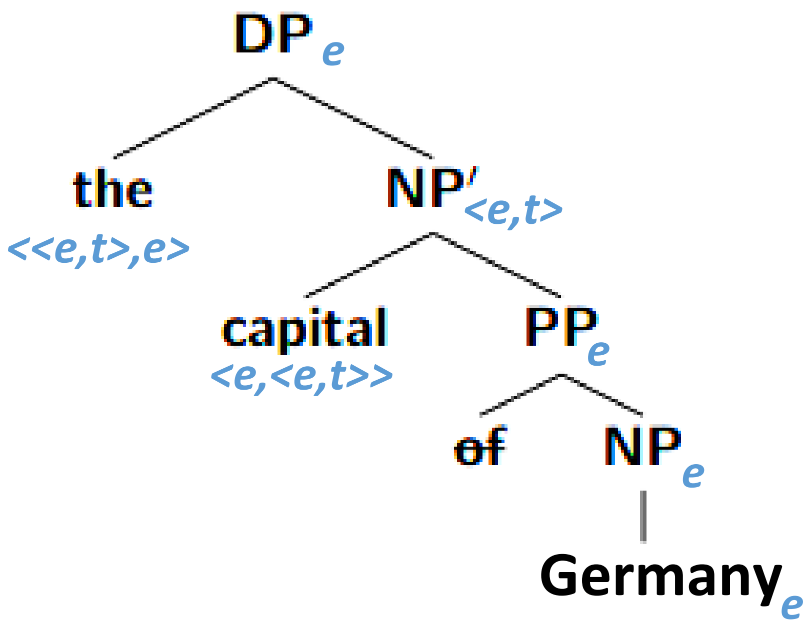
What is the difference between (a) and (b) in the following sentence?

(5) a. A white cat.
    b. The white cat.

(6) a. A city in Germany
    b. The capital of Germany
    c. #A capital of Germany

Our Intuitions tell us, **uniqueness** seems to be encoded in [[the]].

Which semantic type?



Lexical entry for [[the]]

$[\![\textbf{the}]\!] = \lambda f : f \in D_{\langle e,t \rangle}$ and there is exactly one x such that $f(x) = 1$.
the unique y such that $f(y) = 1$.

This can be abbreviated as:

$[\![\textbf{the}]\!] = \lambda f : f \in D_{\langle e,t \rangle}$ and $\exists! x[f(x) = 1]$. $\iota y[f(y) = 1]$.

"$\exists! x[\phi]$" = "there is exactly one x such that ϕ"

"$\iota x[\phi]$" = "the unique x such that ϕ"

Uniqueness and undefinedness

Definite expressions are only defined for characteristic functions that picks out a **singleton set** in a world**.**

(7) a. [[The king of the USA]]= #
because [[king of the USA]]=Ø.

b. [[The airport in Göttingen is big]]= #
because [[airport in Göttingen]]=Ø.

c. [[The student in Göttingen is happy]]= ?

Uniqueness and undefinedness

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(7) a. [[The king of the USA]]= #
because [[king of the USA]]=Ø.

b. [[The airport in Göttingen is big]]= #
because [[airport in Göttingen]]=Ø.

c. [[The student in Göttingen is happy]]= #
because [[student in Göttingen]] is not a **singleton set;**
there are many students in Göttingen.

Exercise 3: Construct situations

(7) c. The student in Göttingen is happy.

[[(7c)]]= 1

[[(7c)]]= 0

[[(7c)]]= #

Solution: Exercise 3

Assume a situation S_1 in which [[student in Göttingen]]= {John}. John is happy.

In S_1, [[(7c)]]= 1

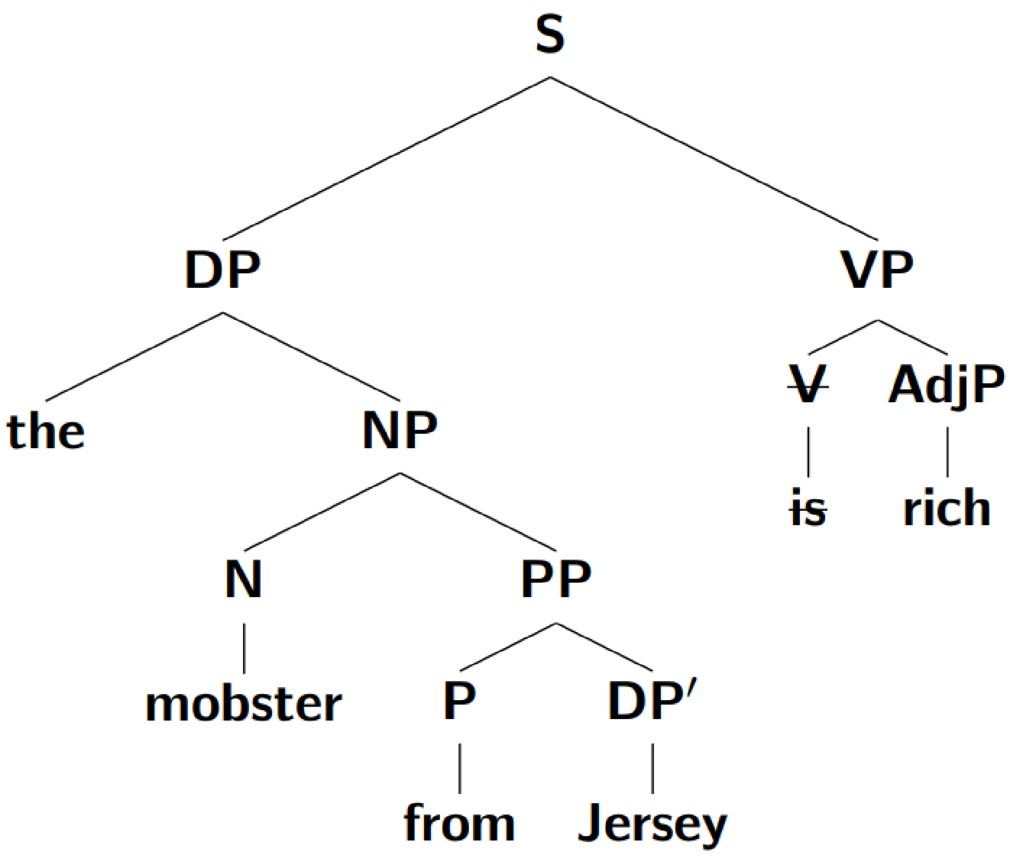
Assume a situation S_2 in which [[student in Göttingen]]= {Jane}. Jane is not happy.

In S_2, [[(7c)]]= 0

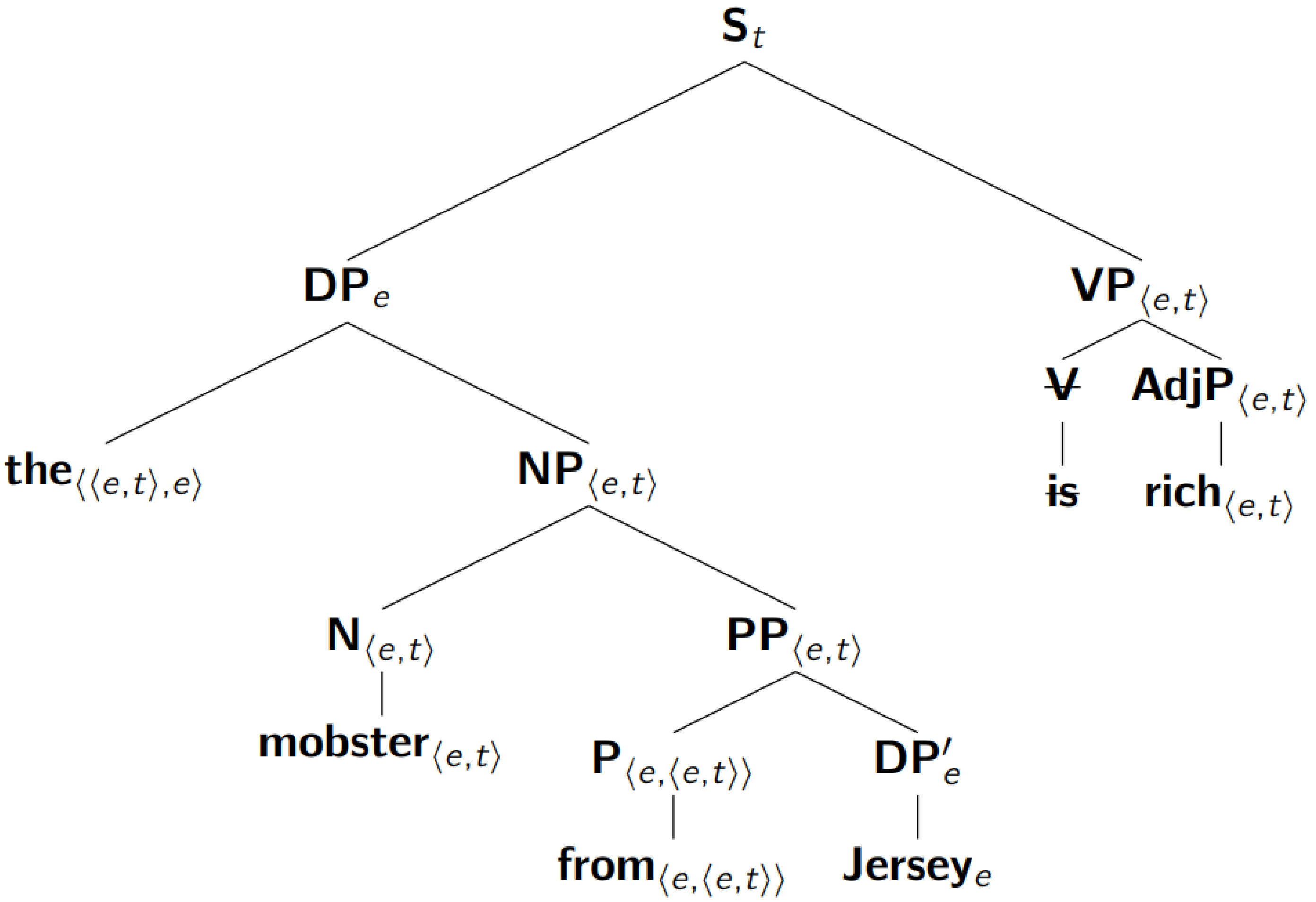
Assume a situation S_3 in which [[student in Göttingen]]= {Jane, John}. Jane and John are not happy.

In S_3, [[(7c)]]= #

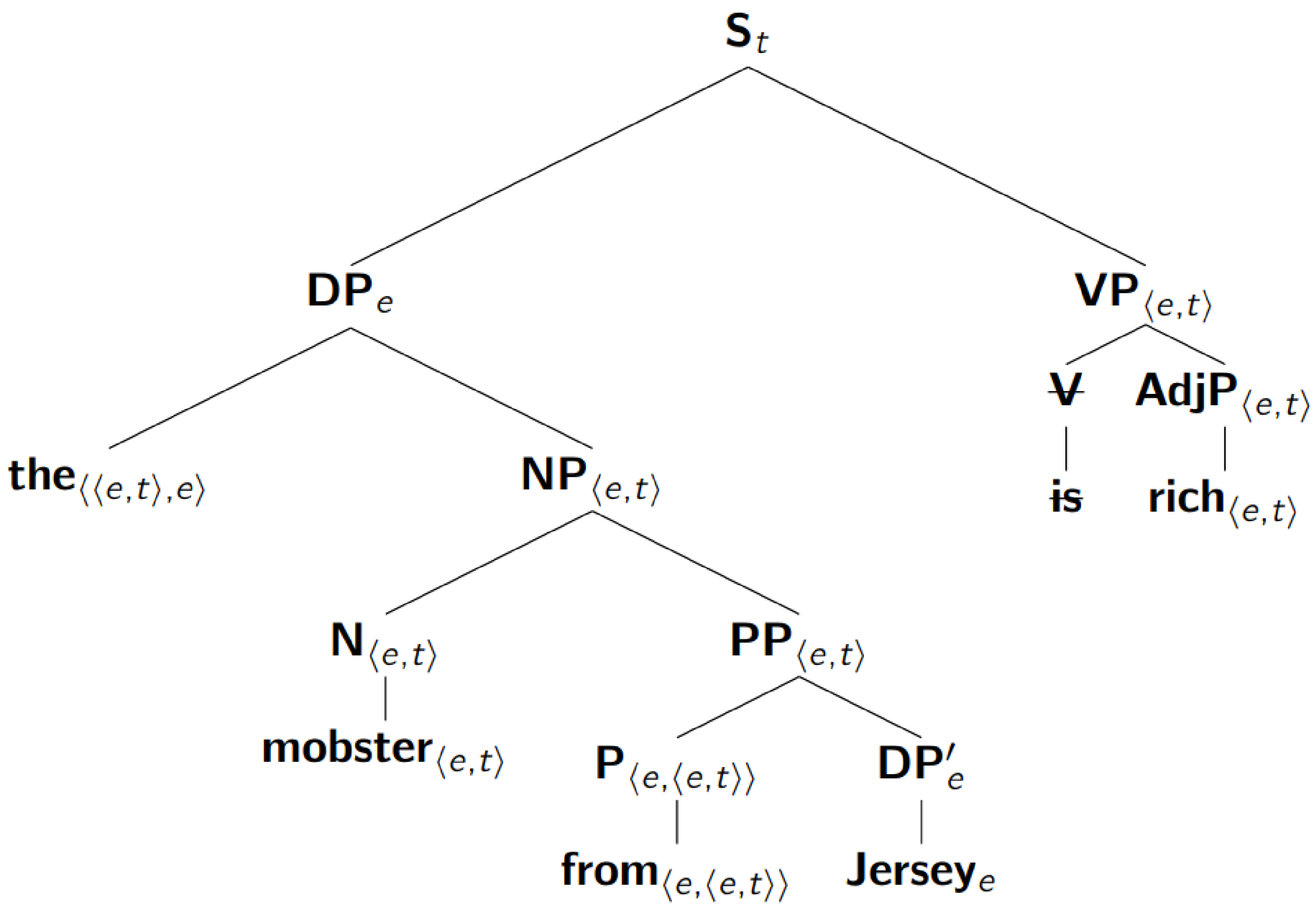
Exercise 4: Annotate the tree with semantic types



Solution: Exercise 4



Exercise 5: Compute the truth-conditions and definedness conditions



Solution: Exercise 5

$$[\![\textbf{from}]\!] = [\lambda x \in D_e \,.\, [\lambda y \in D_e \,.\, y \text{ is from } x]] \qquad \text{(TN)}$$

$$\begin{aligned}[\![\textbf{P}]\!] &= [\![\textbf{from}]\!] && \text{(NN)}\\ &= [\lambda x \in D_e \,.\, [\lambda y \in D_e \,.\, y \text{ is from } x]] && ([\![\textbf{from}]\!])\end{aligned}$$

$$[\![\textbf{Jersey}]\!] = \text{Jersey} \qquad \text{(TN)}$$

$$\begin{aligned}[\![\textbf{DP}']\!] &= [\![\textbf{Jersey}]\!] && \text{(NN)}\\ &= \text{Jersey} && ([\![\textbf{Jersey}]\!])\end{aligned}$$

$$\begin{aligned}[\![\textbf{PP}]\!] &= [\![\textbf{P}]\!]([\![\textbf{DP}']\!]) && \text{(FA)}\\ &= [\lambda x \in D_e \,.\, [\lambda y \in D_e \,.\, y \text{ is from } x]](\text{Jersey}) && ([\![\textbf{P}]\!],[\![\textbf{DP}']\!])\\ &= [\lambda y \in D_e \,.\, y \text{ is from Jersey}]\end{aligned}$$

$$[\![\textbf{mobster}]\!] = \lambda x \in D_e \,.\, x \text{ is a mobster} \qquad \text{(TN)}$$

$$\begin{aligned}[\![\textbf{N}]\!] &= [\![\textbf{mobster}]\!] && \text{(NN)}\\ &= \lambda x \in D_e \,.\, x \text{ is a mobster} && ([\![\textbf{mobster}]\!])\end{aligned}$$

Solution: Exercise 5

$$
\begin{aligned}
[\![\mathbf{NP}]\!] &= \lambda x \in D_e \;.\; [\![\mathbf{N}]\!](x) = [\![\mathbf{PP}]\!](x) = 1 && \text{(PM)}\\
&= \lambda x \in D_e \;.\; [\lambda y \in D_e \;.\; y \text{ is a mobster}](x) = [\lambda y \in D_e \;.\; y \text{ is from Jersey}](x) = 1 && ([\![\mathbf{N}]\!], [\![\mathbf{PP}]\!])\\
&= \lambda x \in D_e \;.\; x \text{ is a mobster and } x \text{ is from Jersey}
\end{aligned}
$$

$$
[\![\mathbf{the}]\!] = \lambda f : f \in D_{\langle e,t\rangle} \text{ and } \exists! x[f(x) = 1] \;.\; \iota y[f(y) = 1] \qquad \text{(TN)}
$$

$$
\begin{aligned}
[\![\mathbf{DP}]\!] &= [\![\mathbf{the}]\!]([\![\mathbf{NP}]\!]) && \text{(FA)}\\
&= [\lambda f : f \in D_{\langle e,t\rangle} \text{ and } \exists! x[f(x) = 1] \;.\; \iota y[f(y) = 1]]([\lambda y \in D_e \;.\; y \text{ is a mobster and } y \text{ is from Jersey}]) && ([\![\mathbf{the}]\!]), [\![\mathbf{NP}]\!])\\
&= \iota y[y \text{ is a mobster and } y \text{ is from Jersey}]\\
&\quad \text{defined only if } \exists! x[x \text{ is a mobster and } x \text{ is from Jersey}]
\end{aligned}
$$

Solution: Exercise 5

$$[\![\textbf{rich}]\!] = \lambda x \in D_e \; . \; x \text{ is rich} \qquad \text{(TN)}$$

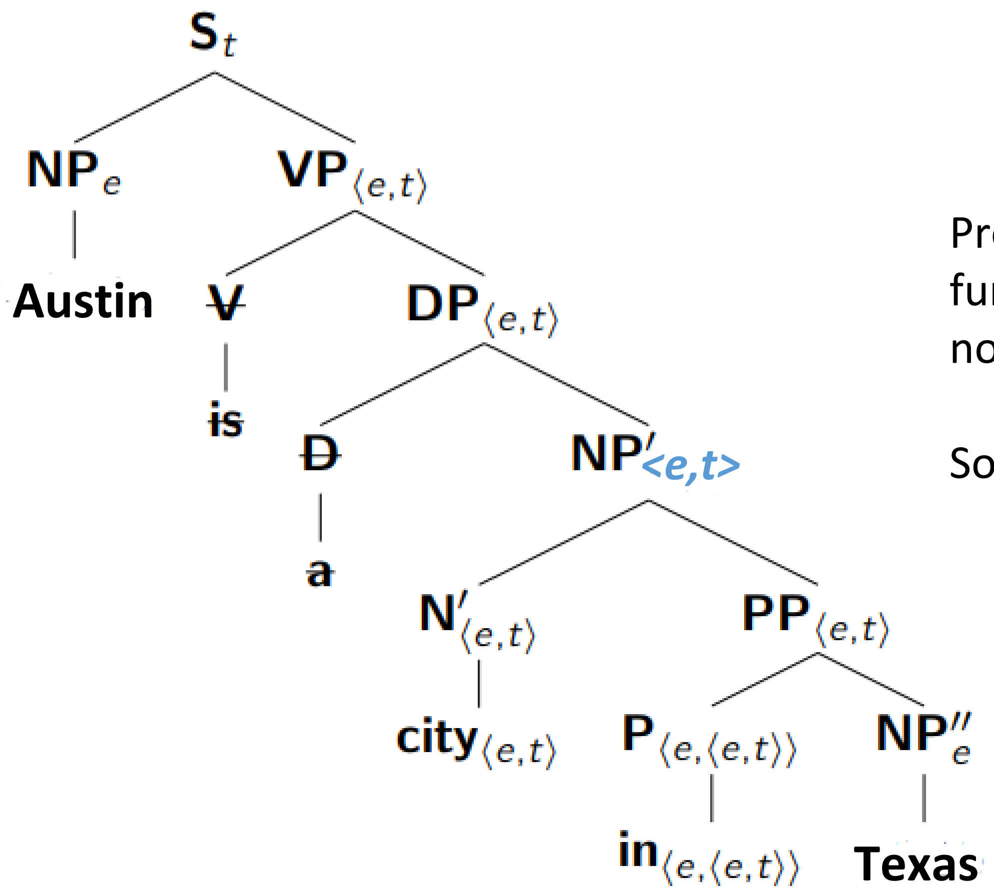
$$\begin{aligned} [\![\textbf{AdjP}]\!] &= [\![\textbf{rich}]\!] && \text{(NN)} \\ &= \lambda x \in D_e \; . \; x \text{ is rich} && ([\![\textbf{rich}]\!]) \end{aligned}$$

$$\begin{aligned} [\![\textbf{VP}]\!] &= [\![\textbf{AdjP}]\!] && \text{(NN)} \\ &= \lambda x \in D_e \; . \; x \text{ is rich} && ([\![\textbf{AdjP}]\!]) \end{aligned}$$

$$\begin{aligned} [\![\textbf{S}]\!] &= [\![\textbf{VP}]\!]([\![\textbf{DP}]\!]) && \text{(FA)} \\ &= [\lambda x \in D_e \; . \; x \text{ is rich}](\iota y[y \text{ is a mobster and } y \text{ is from Jersey}]) \\ &\quad \text{defined only if } \exists! x[x \text{ is a mobster and } x \text{ is from Jersey}] \\ &= 1 \text{ iff } \iota y[y \text{ is a mobster and } y \text{ is from Jersey}] \text{ is rich} \\ &\quad \text{defined only if } \exists! x[x \text{ is a mobster and } x \text{ is from Jersey}] \end{aligned}$$

Hint for assignment 6: Exercise 2

New rules vs. new type?



Problem: Both N' and PP denote functions of type <e,t>. Maybe FA is not suitable here.

So we impose a new rule **PM**.

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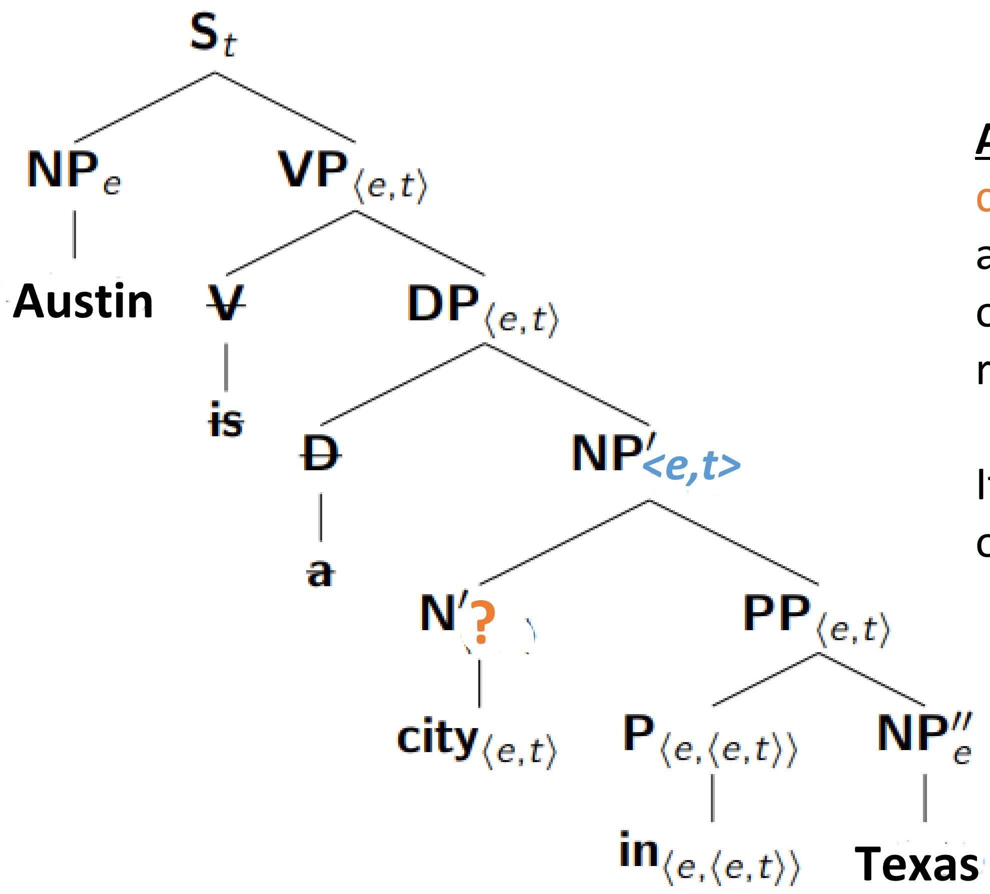
New rules vs. new type?



<u>Another option:</u> Keep FA and change the type of [[city]] so it is a function that take its sister PP of type *<e,t>* as an argument and return NP' of type *<e,t>*.

If so, what type would [[city]] be of?

Thank you and see you next time!