

Presupposition in DRT

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Ling391:
Advanced Computational Semantics

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PRESUPPOSITION

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Presupposition

- ❑ Presupposition vs. Entailment
- ❑ Look at some examples of presupposition
- ❑ Look at the typical problems associated with presuppositions
- ❑ Concentrate on a DRT based approach due to Rob van der Sandt

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What is presupposition?

- ❑ It is hard to pin down precisely what presuppositions are or how they behave
- ❑ Presuppositions are a bit like entailment but not quite...

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Entailment

- ❑ Consider:

Vincent has a car.
A car is a vehicle.

- ❑ This entails:

Vincent has a vehicle.

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Entailment

- ❑ Consider:

Vincent has a red car.

- ❑ This entails:

Vincent has a car.

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Entailment and negation

- Entailments are typically not preserved under negation.

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Entailment

- Consider:

Vincent has no car.
A car is a vehicle.

- This does not entail:

Vincent has a vehicle.

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Entailment

- Consider:

Vincent does not have a red car.

- This does not entail:

Vincent has a car.

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Presupposition

- Consider:

Vincent cleaned his car.

- This entails:

Vincent has a car.

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Presupposition

- Consider:

Vincent did not clean his car.

- This entails:

Vincent has a car.

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Entailment or presupposition

- We call implications preserved under negation **presuppositions**
- We call implications not preserved under negation **entailments**

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Presupposition triggers

- In English, presuppositions are usually triggered by lexical items
- There are several tricks to find out whether a lexical item is a presupposition trigger or not
- These tests are:
 - The negation test
 - The conditional test
 - The question test

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Presupposition trigger test

- Consider the sentence:

Alex is a bachelor.

- This sentence implies that Alex is male.
- But are we dealing with a presupposition or entailment?

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Presupposition test

- Alex is a bachelor.
Does this presuppose: Alex is male?

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Presupposition test

- Alex is a bachelor.
Does this presuppose: Alex is male?
- Negation: Alex is not a bachelor.
Implies: Alex is male? YES

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Presupposition test

- Alex is a bachelor.
Does this presuppose: Alex is male?
- Negation: Alex is not a bachelor.
Implies: Alex is male? YES
- Conditional: If Alex is a bachelor, then ...
Implies: Alex is male? YES

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Presupposition test

- Alex is a bachelor.
Does this presuppose: Alex is male?
- Negation: Alex is not a bachelor.
Implies: Alex is male? YES
- Conditional: If Alex is a bachelor, then ...
Implies: Alex is male? YES
- Question: Is Alex is a bachelor?
Implies: Alex is male? YES

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Presupposition test

- Alex is a bachelor.
Does this presuppose: Alex is male?
- Negation: Alex is not a bachelor.
Implies: Alex is male? YES
- Conditional: If Alex is a bachelor, then ...
Implies: Alex is male? YES
- Question: Is Alex is a bachelor?
Implies: Alex is male? YES
- Conclusion:
being a bachelor presupposes being male.

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Presupposition trigger test

- Consider the sentence:

Alex is a man.

- This sentence implies that Alex is male.
- But are we dealing with a presupposition or entailment?

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Presupposition test

- Alex is a man.
Does this presuppose: Alex is male?

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Presupposition test

- Alex is a man.
Does this presuppose: Alex is male?
- Negation: Alex is not a man.
Implies: Alex is male? NO

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Presupposition test

- Alex is a man.
Does this presuppose: Alex is male?
- Negation: Alex is not a man.
Implies: Alex is male? NO
- Conditional: If Alex is a man, then ...
Implies: Alex is male? NO

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Presupposition test

- Alex is a man.
Does this presuppose: Alex is male?
- Negation: Alex is not a man.
Implies: Alex is male? NO
- Conditional: If Alex is a man, then ...
Implies: Alex is male? NO
- Question: Is Alex is a man?
Implies: Alex is male? NO

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Presupposition test

- Alex is a man.
Does this presuppose: Alex is male?
- Negation: Alex is not a man.
Implies: Alex is male? NO
- Conditional: If Alex is a man, then ...
Implies: Alex is male? NO
- Question: Is Alex a man?
Implies: Alex is male? NO
- Conclusion:
being a man does not presuppose being male. 25

Presupposition trigger test

- Consider the sentence:

Butch knows that Zed is dead.
- This sentence implies Zed is dead.
- But are we dealing with a presupposition or entailment?

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Presupposition test

- Butch knows that Zed is dead.
Does this presuppose: Zed is dead?

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Presupposition test

- Butch knows that Zed is dead.
Does this presuppose: Zed is dead?
- Negation: Butch does not know that Zed is dead.
Implies: Zed is dead? YES

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Presupposition test

- Butch knows that Zed is dead.
Does this presuppose: Zed is dead?
- Negation: Butch does not know that Zed is dead.
Implies: Zed is dead? YES
- Conditional: If Butch knows that Zed is dead, then ...
Implies: Zed is dead? YES

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Presupposition test

- Butch knows that Zed is dead.
Does this presuppose: Zed is dead?
- Negation: Butch does not know that Zed is dead.
Implies: Zed is dead? YES
- Conditional: If Butch knows that Zed is dead, then ...
Implies: Zed is dead? YES
- Question: Does Butch know that Zed is dead?
Implies: Zed is dead? YES

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Presupposition test

- ❑ Butch knows that Zed is dead.
Does this presuppose: Zed is dead?
- ❑ Negation: Butch does not know that Zed is dead.
Implies: Zed is dead? YES
- ❑ Conditional: If Butch knows that Zed is dead, then ...
Implies: Zed is dead? YES
- ❑ Question: Does Butch know that Zed is dead?
Implies: Zed is dead? YES
- ❑ Conclusion:
knowing P presupposes P.

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Presupposition triggers

- ❑ Presupposition triggers are not rare
- ❑ English comes with a large variety of presupposition triggers

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Possessives

- ❑ Example:

Mia likes her husband.
Mia does not like her husband.

- ❑ Presupposition:

Mia has a husband.

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To regret

- ❑ Example:

Vincent regrets that he left Mia alone.
Vincent does not regret that he left Mia alone.

- ❑ Presupposition:

Vincent left Mia alone.

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To like

- ❑ Example:

Mia likes Vincent.
Mia does not like Vincent.

- ❑ Presupposition:

Mia knows Vincent.

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To answer

- ❑ Example:

Butch answered the phone.
Butch did not answer the phone.

- ❑ Presupposition:

The phone was ringing.

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Only

Example:

Only Jules likes big kahuna burgers.
Not only Jules likes big kahuna burgers.

Presupposition:

Jules likes big kahuna burgers.

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Again

Example:

Butch escaped again.
Butch did not escape again.

Presupposition:

Butch escaped once before.

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To manage

Example:

Butch manage to start the chopper.
Butch did not manage to start the chopper.

Presupposition:

Butch had difficulties starting the chopper.

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Third

Example:

Butch lost for the third time.
Butch did not loose for the third time.

Presupposition:

Butch lost twice before.

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Continue

Example:

Butch continued his race.
Butch did not continue his race.

Presupposition:

Butch interrupted his race.

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To win

Example:

Germany won the world cup.
Germany did not win the world cup.

Presupposition:

Germany participated in the world cup.

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Another

□ Example:

Peter wants another beer.
Peter does not want another beer.

□ Presupposition:

Peter had at least one beer.

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To lie

□ Example:

Butch lied to Marsellus.
Butch did not lie to Marsellus.

□ Presupposition:

Butch told something to Marsellus.

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Cleft construction

□ Example:

It was Butch who killed Vincent.
It was not Butch who killed Vincent.

□ Presupposition:

Someone killed Vincent.

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Proper names

□ Example:

Butch talked to Marsellus.
Butch did not talk to Marsellus.

□ Presupposition:

There is someone named Marsellus.

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Definite NP

□ Example:

Butch talked to the boss.
Butch did not talk to the boss.

□ Presupposition:

There is a boss.

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Dealing with Presupposition

- OK, so presuppositions are fairly common. But what's the big deal?
- Problems related to presupposition:
 - The Binding Problem
 - The Denial Problem
 - The Projection Problem
- Presupposition may convey new information
 - Accommodation

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The Binding Problem

□ Example:

Butch nearly escaped from his apartment.

- Trigger “his apartment” presupposes that Butch has an apartment.

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The Binding Problem

□ Example:

A boxer nearly escaped from his apartment.

- Trigger “his apartment” presupposes that a boxer has an apartment.
□ But which boxer? A boxer? Any boxer?

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The Denial Problem

- Vincent does not like his wife.

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The Denial Problem

- Vincent does not like his wife.
□ Vincent does not like his wife, because Vincent does not have a wife!

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The Denial Problem

- Vincent does not regret killing Zed, because he did not kill Zed!

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The Denial Problem

- Vincent does not regret killing Zed, because he did not kill Zed!
□ Alex is not a bachelor, because she is a woman!

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The Denial Problem

- ❑ Vincent does not regret killing Zed, because he did not kill Zed!
- ❑ Alex is not a bachelor, because she is a woman!
- ❑ Butch did not lie to Marsellus, because he did not tell him anything!

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The Projection Problem

- ❑ Consider:
Mia's husband is out of town.
- ❑ Presupposes that Mia is married.

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The Projection Problem

- ❑ Consider:
If Mia has a husband, then Mia's husband is out of town.
- ❑ Does NOT presuppose that Mia is married.

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The Projection Problem

- ❑ Consider:
If Mia is married, then Mia's husband is out of town.
- ❑ Does NOT presuppose that Mia is married.

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The Projection Problem

- ❑ Consider:
If Mia dates Vincent, then Mia's husband is out of town.
- ❑ Does presuppose that Mia is married.

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The Projection Problem_{MR}

- ❑ Consider:
John's donkey is eating quietly in the stable.
- ❑ Presupposes that John has a donkey.

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The Projection Problem^{MR}

- Consider:

Either John has no donkey or John's donkey is eating quietly in the stable.

- Does NOT presuppose that John has a donkey.

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The Projection Problem^{MR}

- Consider:

Either John is not a donkey-owner or John's donkey is eating quietly in the stable

- Does NOT presuppose that John has a donkey.

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The Projection Problem^{MR}

- Consider:

Either John is out of hay or John's donkey is eating quietly in the stable.

- Does presuppose that John has a donkey.

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The Projection Problem

- Complex sentences sometimes neutralise presuppositions
- `Complex` meaning here sentences with conditionals, negation, or disjunction, modals
- These sentences make it difficult to predict whether a presupposition projects or not

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Accommodation

- Example:

Vincent informed his boss.

- Presupposition: *Vincent has a boss.*
- What if we don't have a clue whether Vincent has a boss or not?
- Accommodation: incorporating missed information as long as this is not conflicting with other information

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Solutions

- There is a rich literature on presupposition
- There are many different attempts to solve the problems related to presupposition
 - Many-valued logics
 - Default logics
 - Pragmatic theories
 - Non-monotonic reasoning

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Van der Sandt's Theory

- Presuppositions are essentially extremely rich anaphoric pronouns
- Presuppositions introduce new DRSs that need to be incorporated in the discourse context
- It is a good way of dealing with the binding, projection, and denial problems

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Van der Sandt's Theory

- Presuppositions introduce new DRSs that need to be incorporated in the discourse context
- There are two ways to resolve presuppositional DRSs:
 - By **binding**
 - By **accommodation**

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Two birds with one stone

- The presupposition as anaphora theory handles anaphoric pronouns and presuppositions in essentially the same way

Presupposition = Anaphora
Anaphora = Presupposition

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Two birds with one stone^{MR}

- Idea: In the same way that we find antecedents to bind pronouns and anaphora (1), we find antecedents to "bind" presuppositions (2):
 - (1) If a farmer owns a donkey, **he** beats **it**.
 - (2) If Mia has a husband, then **Mia's husband** is out of town.
- Note that the antecedents of anaphora and presupposition need not be individuals, but can be VP-properties, propositions, etc.
 - (3) Sue likes movies, and **so** does Joan.
 - (4) Ana stopped smoking.

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One mechanism

- Essentially one mechanism to deal with pronouns, proper names, definite descriptions, etc.
- The differences are accounted for in the way they can accommodate and bind
 - Pronouns do not accommodate
 - Proper names always accommodate globally
 - Definite descriptions can accommodate anywhere

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Presuppositions in DRT

- We need to carry out two tasks:
 - Select presupposition triggers in the lexicon
 - Indicate what they presuppose
- We will use a new operator, the alpha-operator, α .
- If B1 and B2 are DRSs, the so is $B1\alpha B2$
- B1 is the presupposition of B2

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Preliminary DRSs

- She dances $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{female}(x) \\ \hline \end{array} \alpha \begin{array}{|c|} \hline \text{dance}(x) \\ \hline \end{array}$
- Mia dances $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{mia}(x) \\ \hline \end{array} \alpha \begin{array}{|c|} \hline \text{dance}(x) \\ \hline \end{array}$
- The woman dances $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{woman}(x) \\ \hline \end{array} \alpha \begin{array}{|c|} \hline \text{dance}(x) \\ \hline \end{array}$

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Presupposition in the lexicon

- She $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{female}(x) \\ \hline \end{array} \alpha p@x$
- Mia $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{mia}(x) \\ \hline \end{array} \alpha p@x$
- The woman $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{woman}(x) \\ \hline \end{array} \alpha p@x$

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Indefinite vs. Definite NP

- A woman $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{woman}(x) \\ \hline \end{array} ; p@x$
- The woman $\lambda p. \begin{array}{|c|} \hline x \\ \hline \text{woman}(x) \\ \hline \end{array} \alpha p@x$

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The algorithm

- After constructing a preliminary DRS for an input sentence, we still have to resolve the presuppositions
- After resolution we will have an ordinary DRS that we can use for our inference tasks
- Resulting DRS needs to be consistent and informative

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Binding Presuppositions

- Example:
Vincent danced with a woman.

x y e
vincent(x)
dance(e)
agent(e,x)
with(e,y)
woman(y)

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Binding Presuppositions

- Example:
*Vincent danced with a woman.
The woman collapsed.*

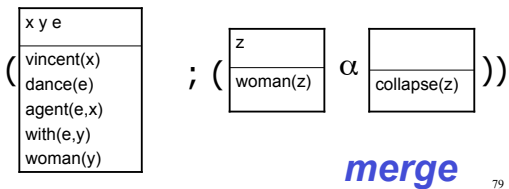
x y e
vincent(x)
dance(e)
agent(e,x)
with(e,y)
woman(y)

 $\left(\begin{array}{|c|} \hline z \\ \hline \text{woman}(z) \\ \hline \end{array} \alpha \begin{array}{|c|} \hline \text{collapse}(z) \\ \hline \end{array} \right)$

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Binding Presuppositions

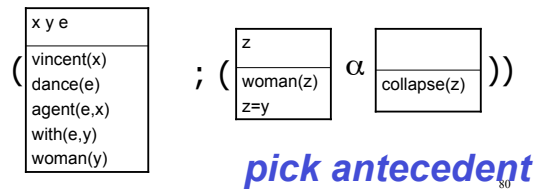
- Example:
Vincent danced with a woman.
The woman collapsed.



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Binding Presuppositions

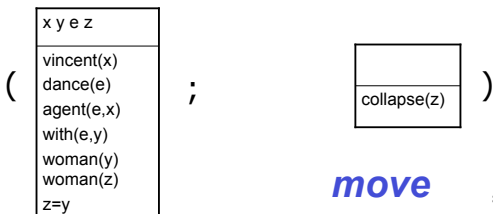
- Example:
Vincent danced with a woman.
The woman collapsed.



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Binding Presuppositions

- Example:
Vincent danced with a woman.
The woman collapsed.



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Binding Presuppositions

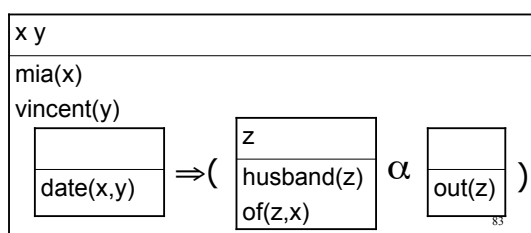
- Example:
Vincent danced with a woman.
The woman collapsed.



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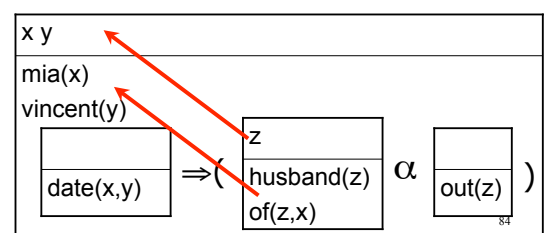
Accommodating Presuppositions

- Example:
If Mia dates Vincent, then her husband is out of town



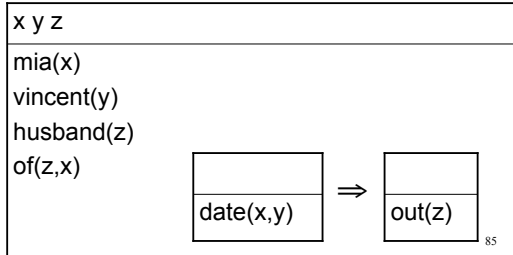
Global accommodation

- Example:
If Mia dates Vincent, then her husband is out of town



Global Accommodation

- Example:
If Mia dates Vincent, then her husband is out of town



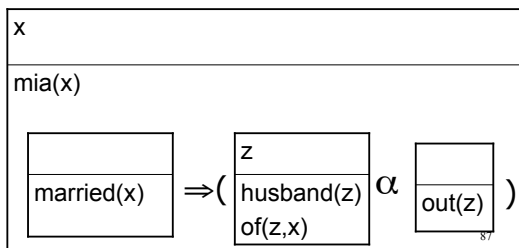
Non-global accommodation

- Performing global accommodation is saying that something is presupposed.
- But recall the projection problem.
- Presuppositions can be neutralised by binding and non-global accommodation.

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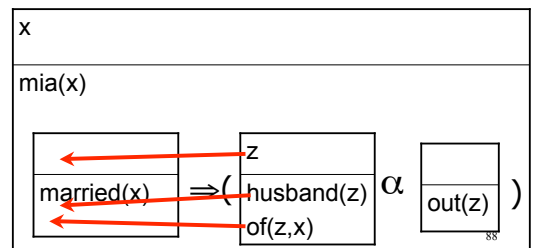
Non-global Accommodation

- Example:
If Mia is married, then her husband is out of town



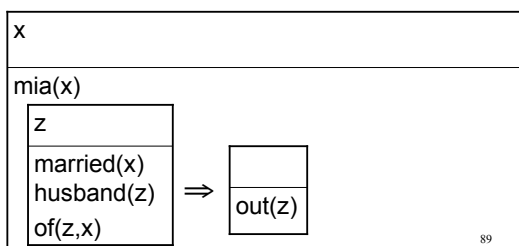
Non-global Accommodation

- Example:
If Mia is married, then her husband is out of town



Non-global Accommodation

- Example:
If Mia is married, then her husband is out of town



Preferences

- Binding is preferred to accommodation
- Global accommodation is preferred to local accommodation

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Van der Sandt's Algorithm

1. Generate a DRS for the input sentence, with all elementary presuppositions marked by α
2. Merge this DRS with the DRS of the discourse so far processed
3. Traverse the DRS, and on encountering an α -DRS try to:
 1. Link (MR) or bind the presupposed information to an accessible antecedent, or
 2. Accommodate the information to a superordinated level of DRS
4. Remove those DRSs from the set of potential readings that violate the acceptability constraints

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Accessibility and Subordination^{MR}

- A DRS B_1 is **accessible** from DRS B_2 when B_1 equals B_2 , or when B_1 subordinates B_2
- A DRS B_1 **subordinates** B_2 iff:
 - B_1 immediately subordinates B_2
 - There is a DRS B such that B_1 subordinates B and B subordinates B_2
- B_1 **immediately subordinates** B_2 iff:
 - B_1 contains a condition $\neg B_2$
 - B_1 contains a condition $B_2 \vee B$ or $B \vee B_2$
 - B_1 contains a condition $B_2 \Rightarrow B$
 - $B_1 \Rightarrow B_2$ is a condition in some DRS B

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The acceptability constraints

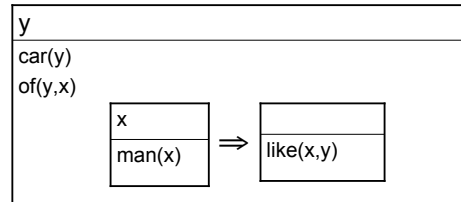
- DRSs should obey the binding rules
- DRSs should not contain free variables
- DRSs should be consistent and informative
- DRSs should also be *locally* consistent and *locally* informative

That is: the resolved DRS should not contain a subordinate DRS K whose falsity or truth is entailed by a DRS superordinate to it. (MR, from v.d.Sandt p. 367)

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Free Variable Check

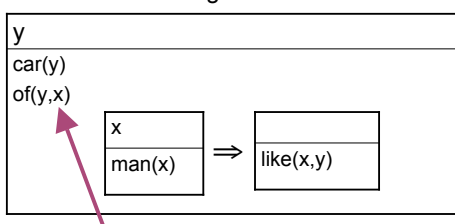
- Consider the example:
Every man likes his car
- DRS obtained with global accommodation:



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Free Variable Check

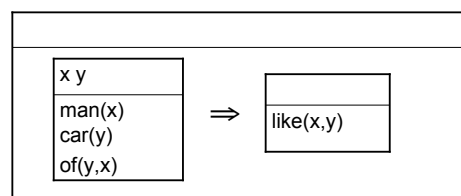
- Consider the example:
Every man likes his car
- DRS obtained with global accommodation:



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Free Variable Check

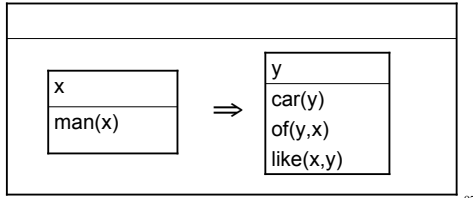
- Consider the example:
Every man likes his car
- DRS obtained via intermediate accommodation:



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Free Variable Check

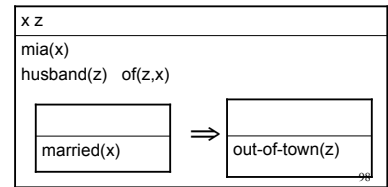
- Consider the example:
Every man likes his car
- DRS obtained with local accommodation:



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The projection problem solved

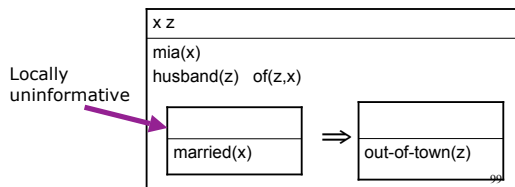
- Recall our example:
If Mia is married, then her husband is out of town
- Local constraints play a crucial role here!



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The projection problem solved

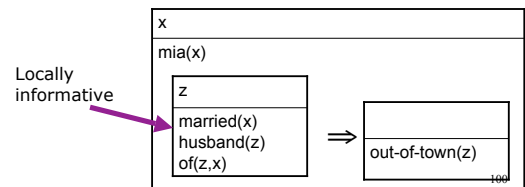
- Recall our example:
If Mia is married, then her husband is out of town
- Local constraints play a crucial role here!



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The projection problem solved

- Recall our example:
If Mia is married, then her husband is out of town
- Local constraints play a crucial role here!



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The projection problem solved MR

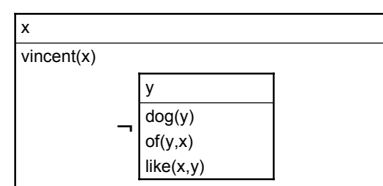
- Question:**
Recall our previous examples:
- Either John is not a donkey-owner or his donkey is eating quietly in stable.
 - If Mia has a husband, then her husband is out of town.
 - Either John does not have a donkey or his donkey is eating quietly in the stable.
 - If Mia dates Vincent, then her husband is out of town.
 - Either John has run out of hay or his donkey is eating quietly in the stable.

For each example, show how the acceptability constraints plus the preference binding $>$ global accomm. $>$ local accomm. determine the projection possibilities of the presuppositions at issue.

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Denial

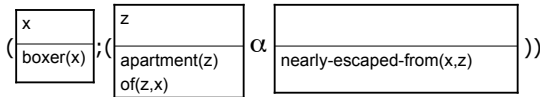
- Example:**
Vincent does not like his dog.
He does not have a dog!



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The binding problem solved

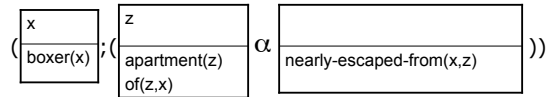
- Example:
A boxer nearly escaped from his apartment.
- Preliminary DRS:



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The binding problem solved

- Example:
A boxer nearly escaped from his apartment.
- Preliminary DRS:



- Final DRS:

x	z
boxer(x)	
apartment(z) of (z,x)	
nearly-escaped-from(x,z)	

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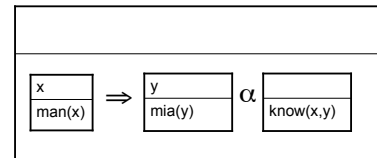
Proper Names

- Proper Names can be treated as presupposition triggers
- Only global accommodation is permitted for proper names
- This assures they will always end up in the global (outermost) DRS, accessible for subsequent pronouns

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Proper Names

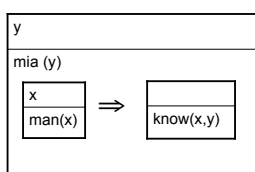
- Example:
Every man knows Mia.
She is Marsellus' wife.



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Proper Names

- Example:
Every man knows Mia.
She is Marsellus' wife.



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Implementation

- The Curt system
- Small fragment of English
 - Pronouns, presupposition triggers
- Uses theorem prover
 - Bliksem
- Uses model builder
 - Mace
- Does all inference tasks

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