

## 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<sub>MR</sub>

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

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## The Projection Problem<sup>MR</sup>

- 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<sup>MR</sup>

- 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<sup>MR</sup>

- 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<sup>MR</sup>

- 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,  $\alpha$ .
- 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.*

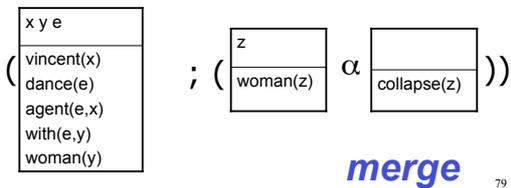
x y e
vincent(x)
dance(e)
agent(e,x)
with(e,y)
woman(y)

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

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## Binding Presuppositions

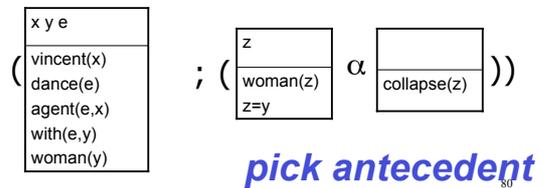
- Example:  
*Vincent danced with a woman.*  
*The woman collapsed.*



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## Binding Presuppositions

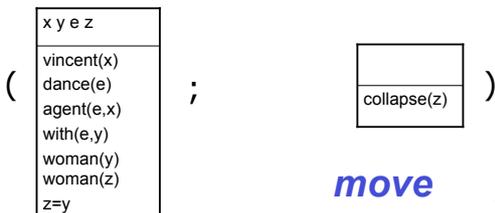
- Example:  
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## Binding Presuppositions

- Example:  
*Vincent danced with a woman.*  
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## Binding Presuppositions

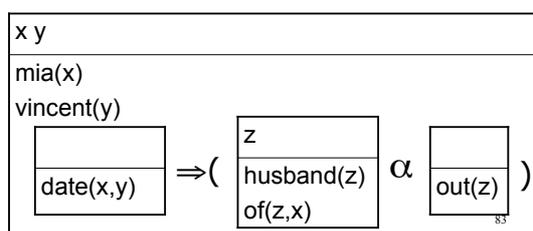
- Example:  
*Vincent danced with a woman.*  
*The woman collapsed.*



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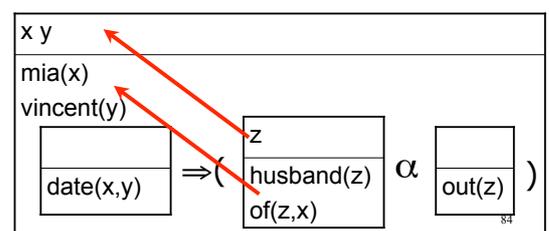
## Accommodating Presuppositions

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



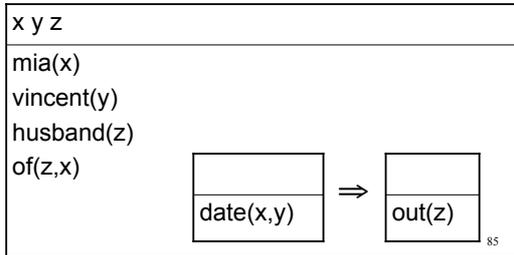
## Global accommodation

- 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*



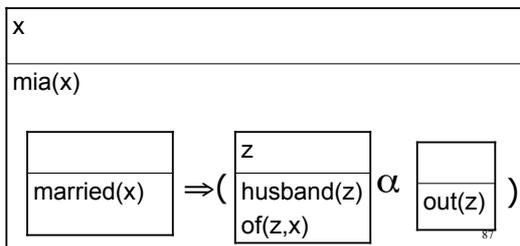
## Non-global accommodation

- 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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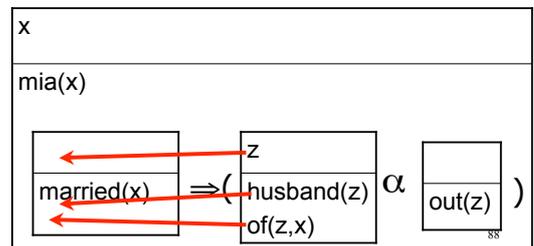
## Non-global Accommodation

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



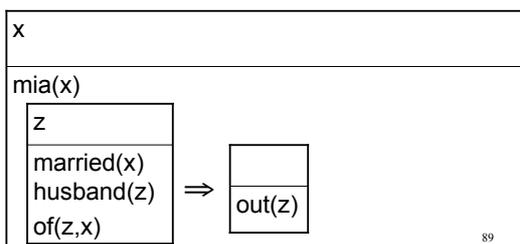
## Non-global Accommodation

- Example:  
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## 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  $\alpha$
2. Merge this DRS with the DRS of the discourse so far processed
3. Traverse the DRS, and on encountering an  $\alpha$ -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<sup>MR</sup>

- 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

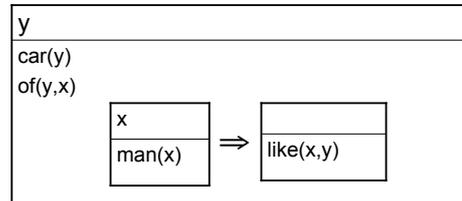
- DRSs should obey the binding rules
- DRSs should not contain free variables
- DRSs should be consistent and informative
- DRSs should also be *locally* consistent and *locally* informative

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

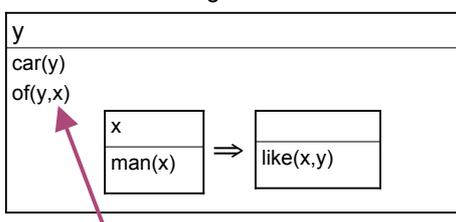
- Consider the example:  
*Every man likes his car*
- DRS obtained with global accommodation:



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## Free Variable Check

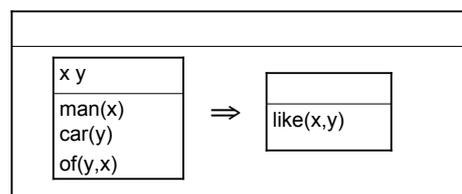
- Consider the example:  
*Every man likes his car*
- DRS obtained with global accommodation:



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## Free Variable Check

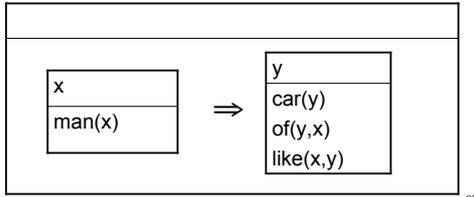
- Consider the example:  
*Every man likes his car*
- DRS obtained via intermediate accommodation:



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## Free Variable Check

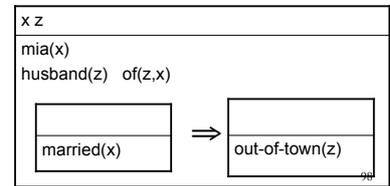
- Consider the example:  
*Every man likes his car*
- DRS obtained with local accommodation:



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## The projection problem solved

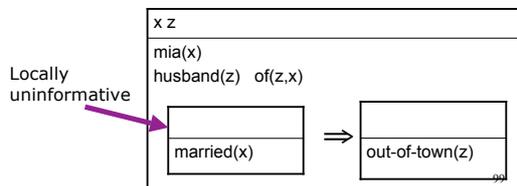
- Recall our example:  
*If Mia is married, then her husband is out of town*
- Local constraints play a crucial role here!



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## The projection problem solved

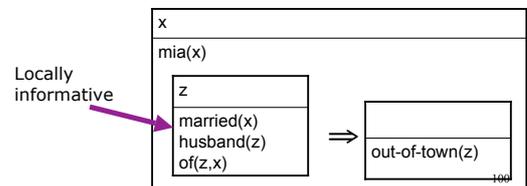
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## The projection problem solved

- 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

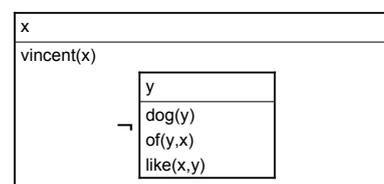
- Question:**  
Recall our previous examples:
- Either John is not a donkey-owner or his donkey is eating quietly in stable.
  - If Mia has a husband, then her husband is out of town.
  - Either John does not have a donkey or his donkey is eating quietly in the stable.
  - If Mia dates Vincent, then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

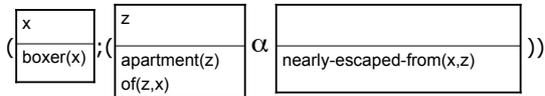
- Example:**  
*Vincent does not like his dog.*  
*He does not have a dog!*



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## The binding problem solved

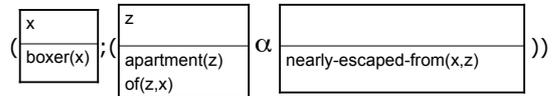
- Example:  
*A boxer nearly escaped from his apartment.*
- Preliminary DRS:



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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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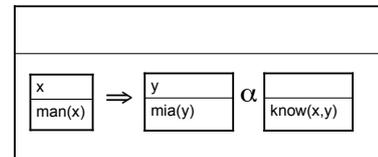
## Proper Names

- 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

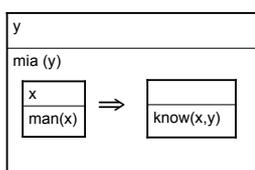
- Example:  
*Every man knows Mia.*  
*She is Marsellus' wife.*



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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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