Presupposition in DRT

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Ling391: Advanced Computational Semantics

PRESUPPOSITION

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

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…

Entailment

- Consider:

> Vincent has a car.
> A car is a vehicle.

- This entails:

> Vincent has a vehicle.

Entailment

- Consider:

> Vincent has a red car.

- This entails:

> Vincent has a car.

Entailment and negation

- Entailments are typically not preserved under negation.

Entailment

- Consider:

> Vincent has no car.
> A car is a vehicle.

- This does not entail:

> Vincent has a vehicle.

Entailment

- Consider:

> Vincent does not have a red car.

- This does not entail:

> Vincent has a car.

Presupposition

- Consider:

> Vincent cleaned his car.

- This entails:

> Vincent has a car.

Presupposition

- Consider:

> Vincent did not clean his car.

- This entails:

> Vincent has a car.

Entailment or presupposition

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

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

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?

Presupposition test

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

Presupposition test

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

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

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

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

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.

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?

Presupposition test

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

Presupposition test

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

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

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

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

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

- Conclusion:
  being a man does not presuppose being male.

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?

Presupposition test

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

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

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

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

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.

Presupposition triggers

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

Possessives

- Example:

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

- Presupposition:

Mia has a husband.

To regret

- Example:

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

- Presupposition:

Vincent left Mia alone.

To like

- Example:

Mia likes Vincent.
Mia does not like Vincent.

- Presupposition:

Mia knows Vincent.

To answer

- Example:

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

- Presupposition:

> The phone was ringing.

Only

- Example:

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

- Presupposition:

> Jules likes big kahuna burgers.

Again

- Example:

> Butch escaped again.
> Butch did not escape again.

- Presupposition:

> Butch escaped once before.

To manage

- Example:

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

- Presupposition:

Butch had difficulties starting the chopper.

Third

- Example:

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

- Presupposition:

Butch lost twice before.

Continue

- Example:

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

- Presupposition:

> Butch interrupted his race.

To win

- Example:

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

- Presupposition:

Germany participated in the world cup.

Another

- Example:

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

- Presupposition:

Peter had at least one beer.

To lie

- Example:

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

- Presupposition:

Butch told something to Marsellus.

Cleft construction

- Example:

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

- Presupposition:

Someone killed Vincent.

Proper names

- Example:

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

- Presupposition:

> There is someone named Marsellus.

Definite NP

- Example:

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

- Presupposition:

There is a boss.

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

The Binding Problem

- Example:

> Butch nearly escaped from his apartment.

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

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?

The Denial Problem

- Vincent does not like his wife.

The Denial Problem

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

The Denial Problem

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

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!

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!

The Projection Problem

- Consider:

> Mia's husband is out of town.

- Presupposes that Mia is married.

The Projection Problem

- Consider:

> If Mia has a husband, then Mia's husband is out of town.

- Does NOT presuppose that Mia is married.

The Projection Problem

- Consider:

> If Mia is married, then
> Mia's husband is out of town.

- Does NOT presuppose that Mia is married.

The Projection Problem

- Consider:

> If Mia dates Vincent, then
> Mia's husband is out of town.

- Does presuppose that Mia is married.

The Projection Problem$_{MR}$

- Consider:

> John's donkey is eating quietly in the stable.

- Presupposes that John has a donkey.

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.

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.

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.

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

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

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

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

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**

Two birds with one stone

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

Presupposition = Anaphora

Anaphora = Presupposition

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.

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

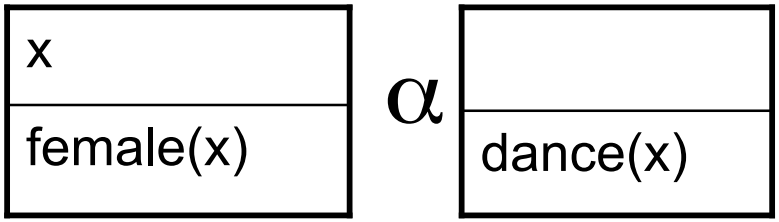
Presuppositions in DRT

- 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

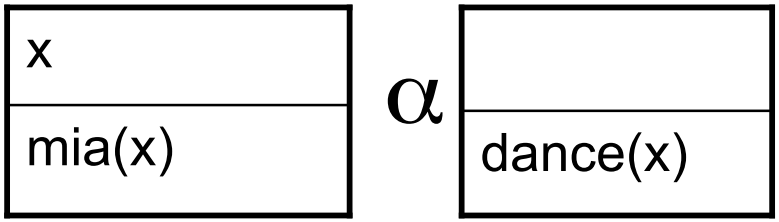
- If B1 and B2 are DRSs, the so is B1αB2
- B1 is the presupposition of B2

Preliminary DRSs

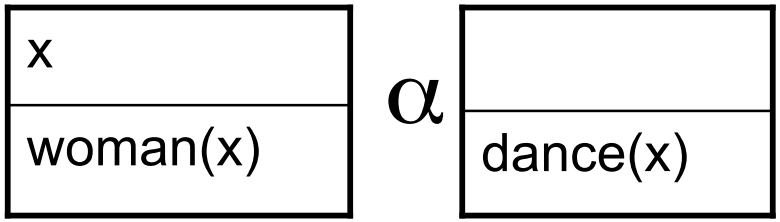
- She dances



- Mia dances

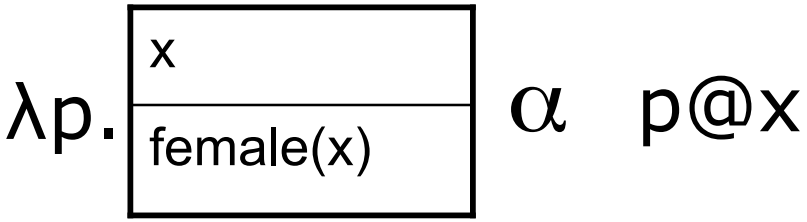


- The woman dances

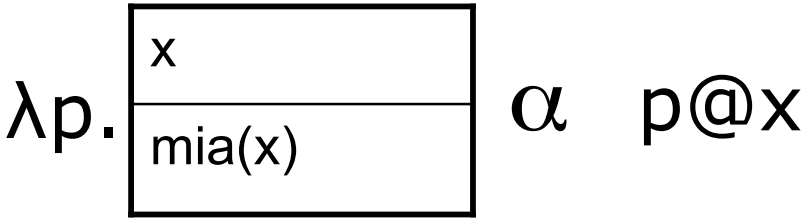


Presupposition in the lexicon

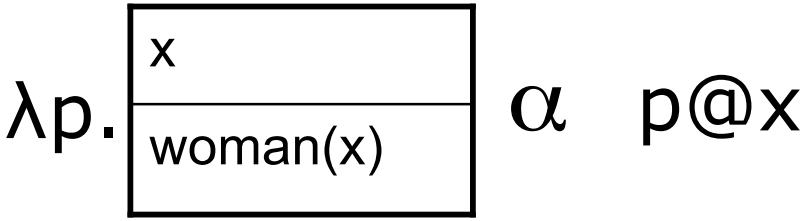
- She



- Mia

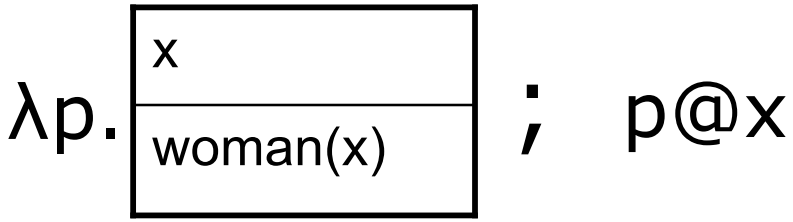


- The woman

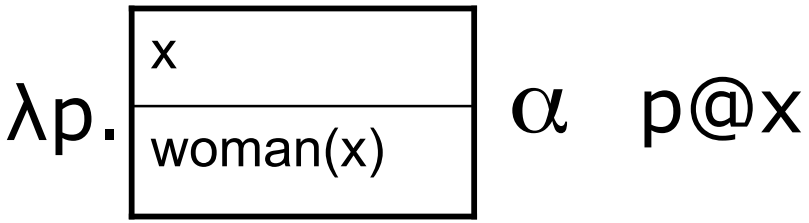


Indefinite vs. Definite NP

- A woman



- The woman



The algorithm

- After constructing a preliminary DRS for an input sentences, 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

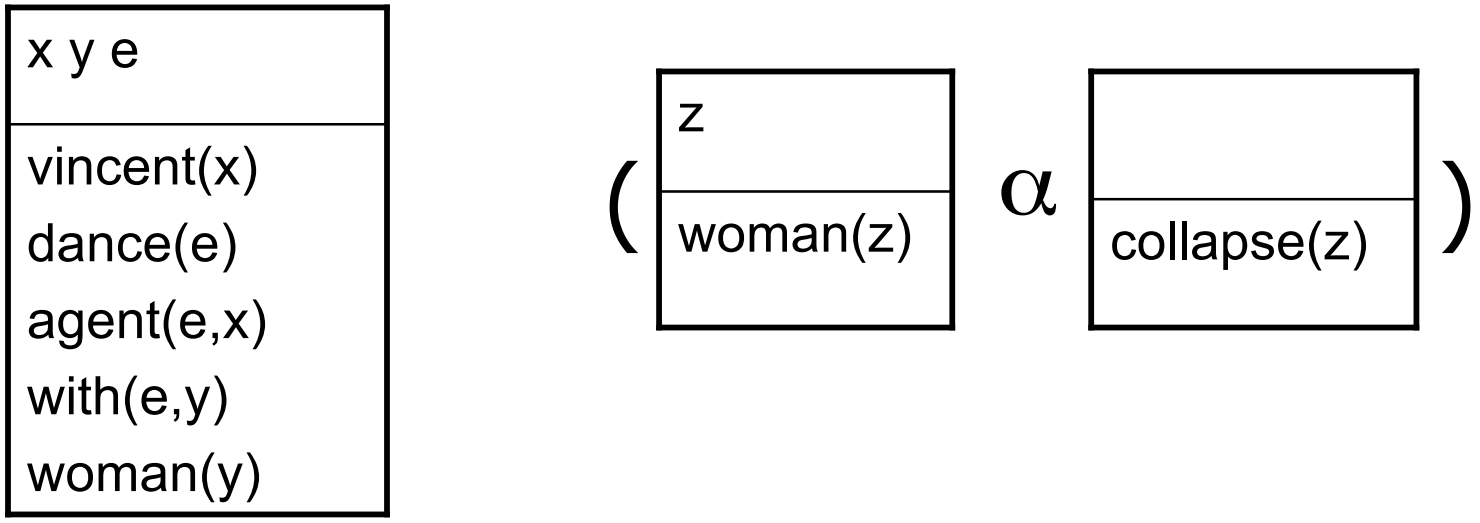
Binding Presuppositions

- Example:
  Vincent danced with a woman.

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

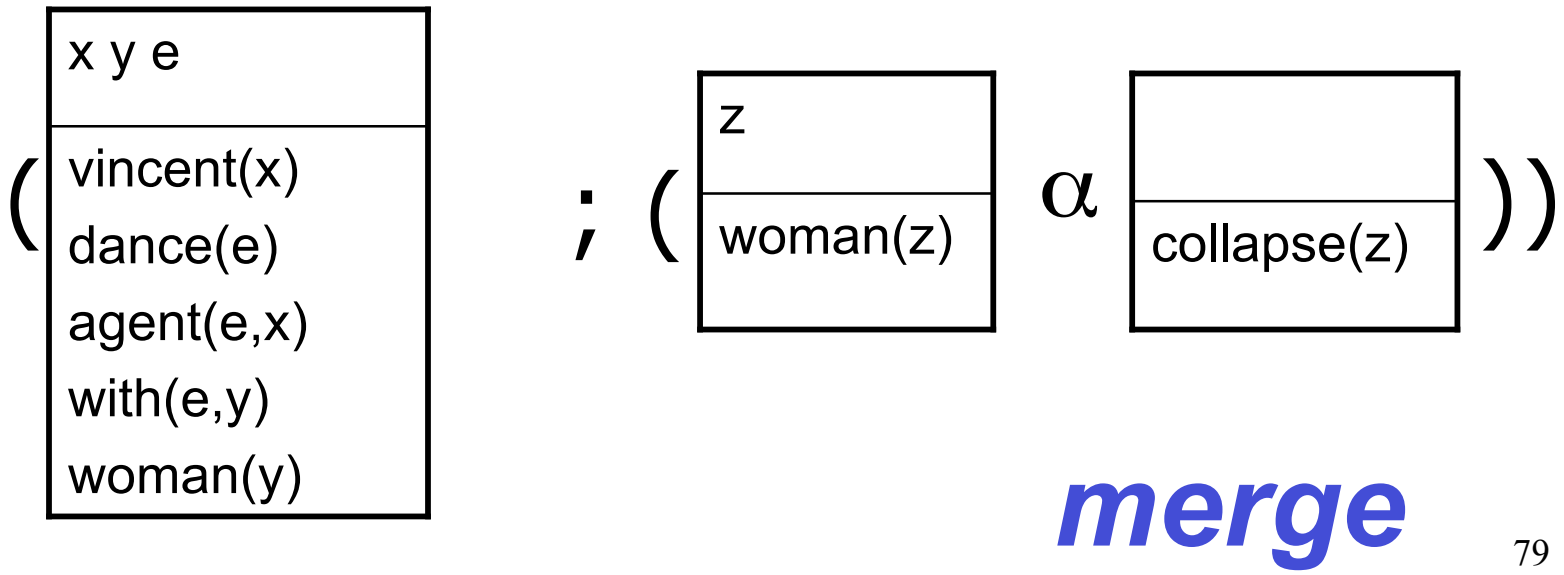
Binding Presuppositions

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



Binding Presuppositions

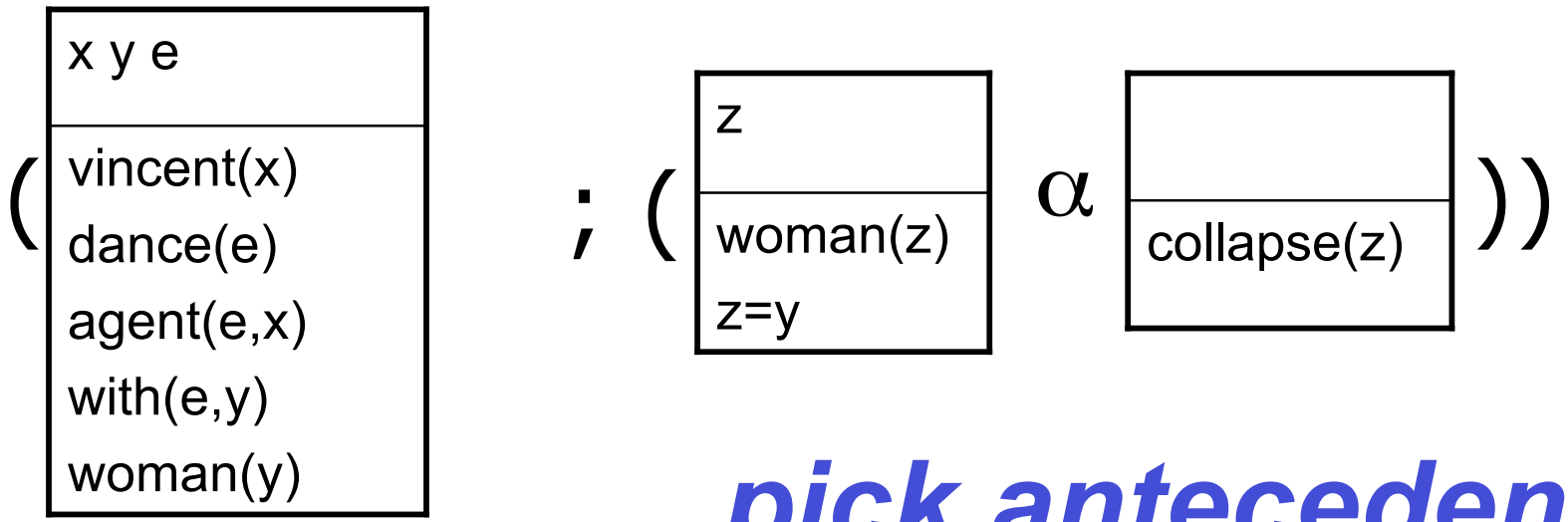
- Example:
  Vincent danced with a woman.
  The woman collapsed.



merge

Binding Presuppositions

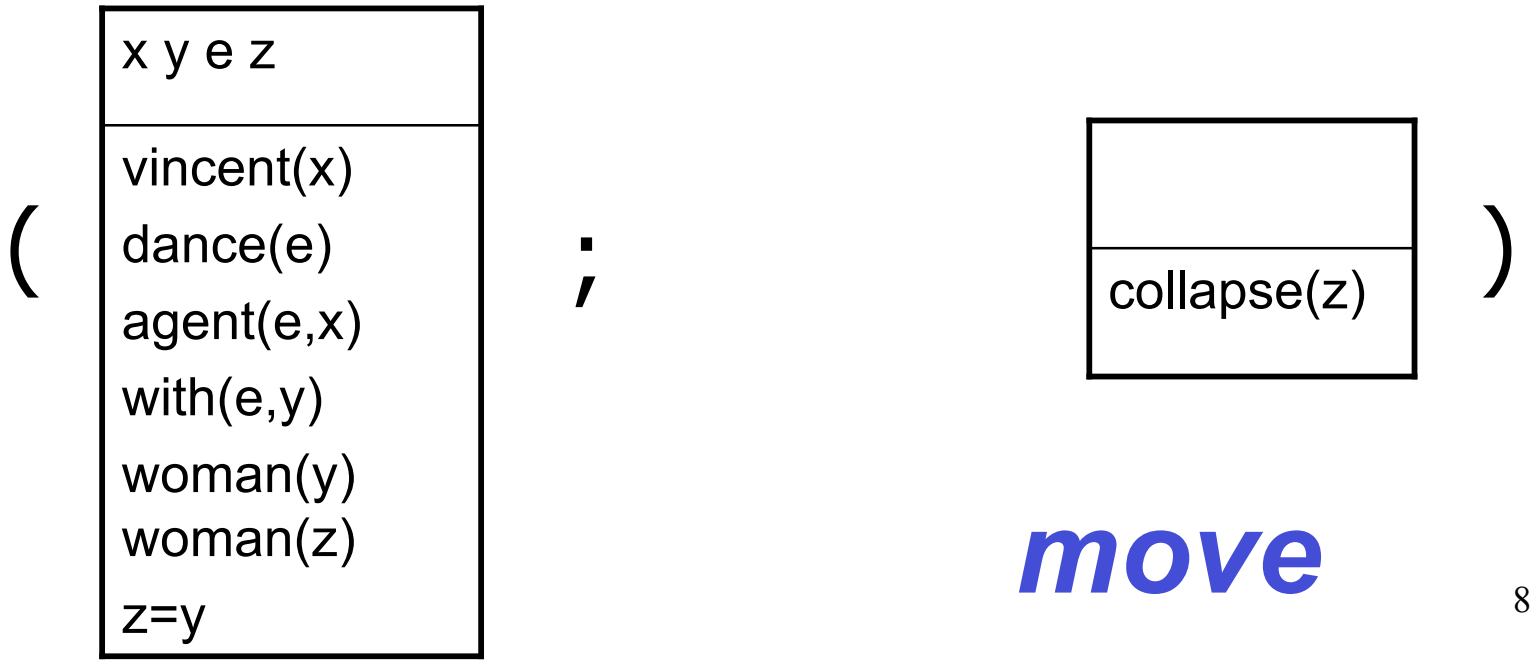
- Example:
  Vincent danced with a woman.
  The woman collapsed.



pick antecedent

Binding Presuppositions

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



move

Binding Presuppositions

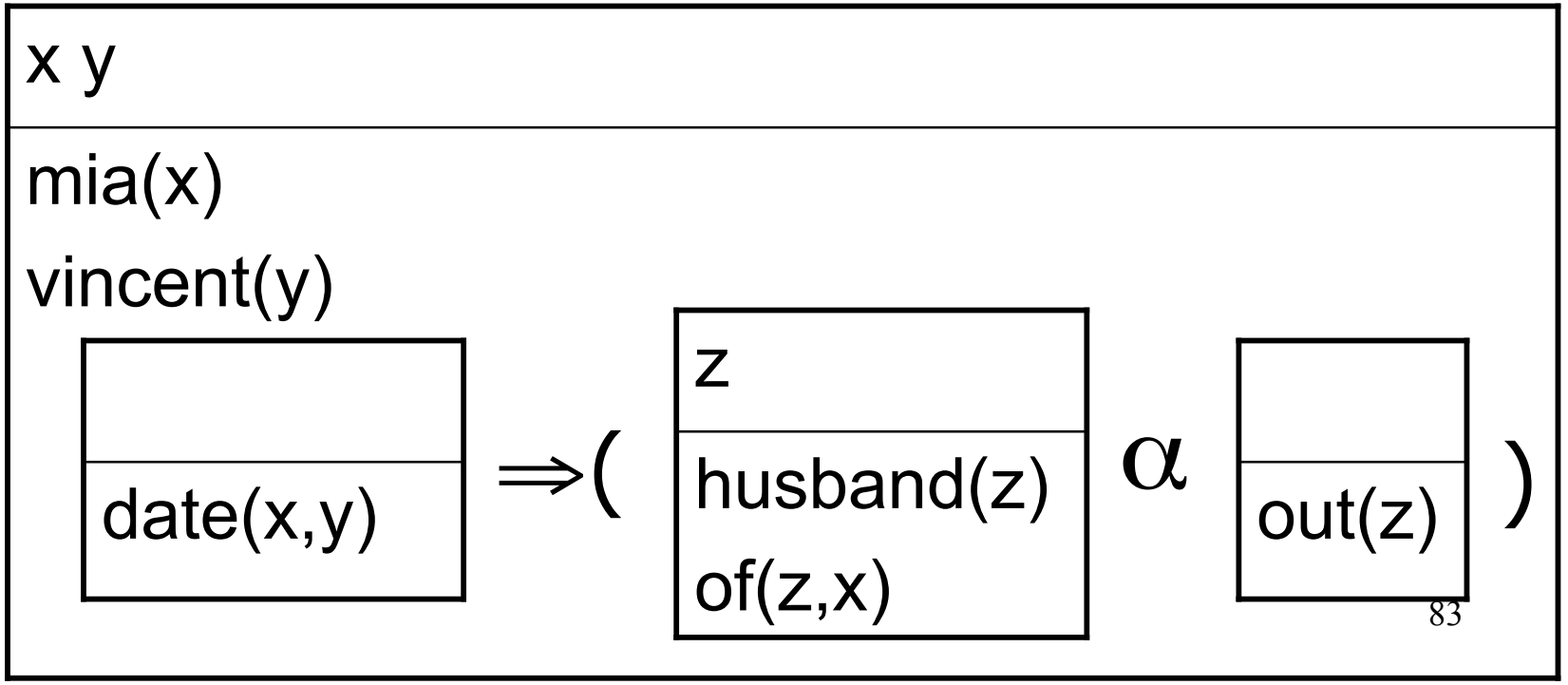
- Example:
  Vincent danced with a woman.
  The woman collapsed.

x y e z
vincent(x)
dance(e)
agent(e,x)
with(e,y)
woman(y) woman(z)
z=y collapse(z)

merge reduction

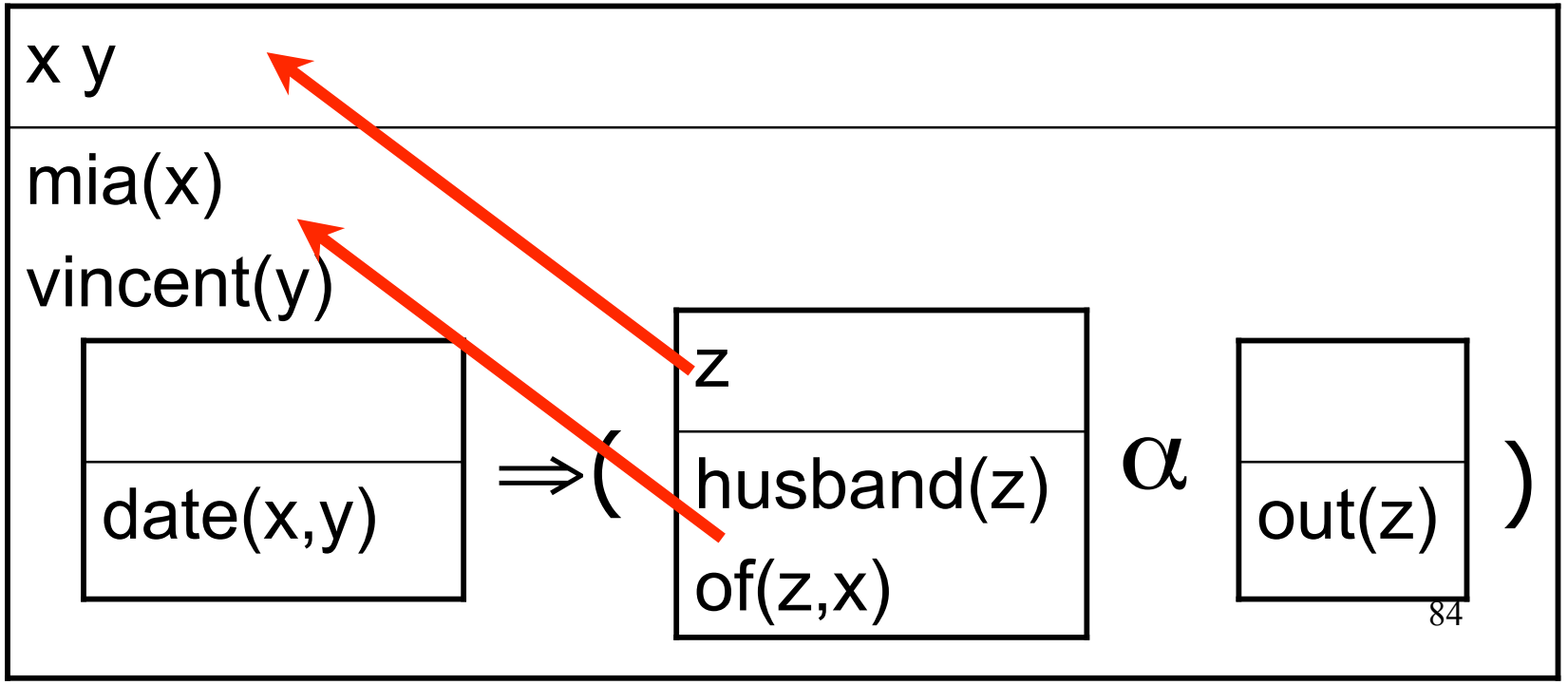
Accommodating Presuppositions

- 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

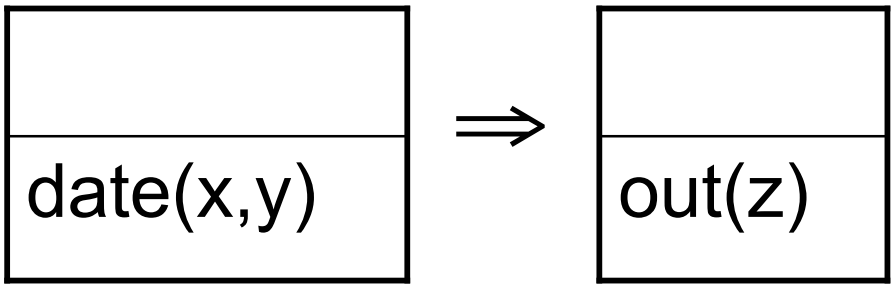
x y z

mia(x)

vincent(y)

husband(z)

of(z,x)

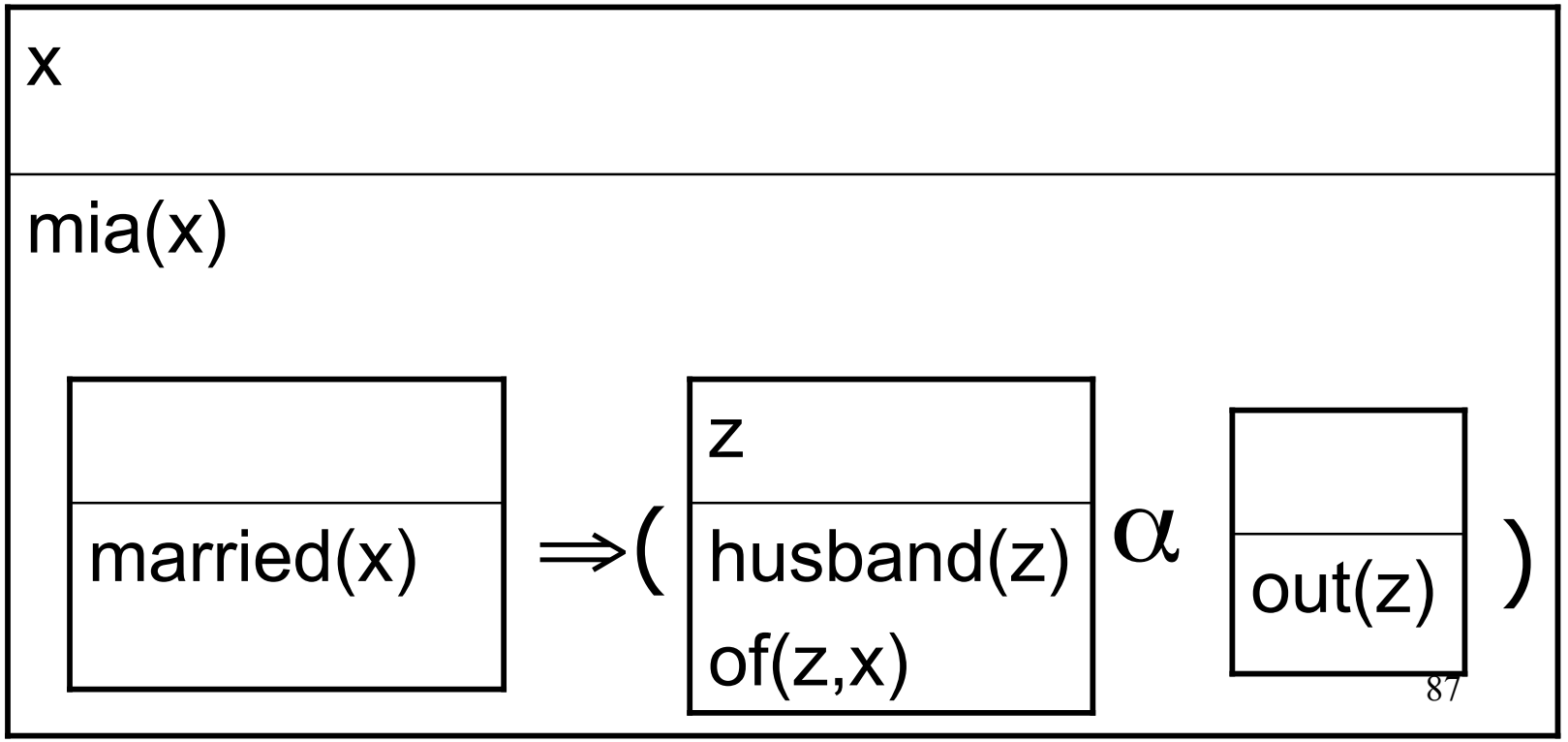


Non-global accommodation

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

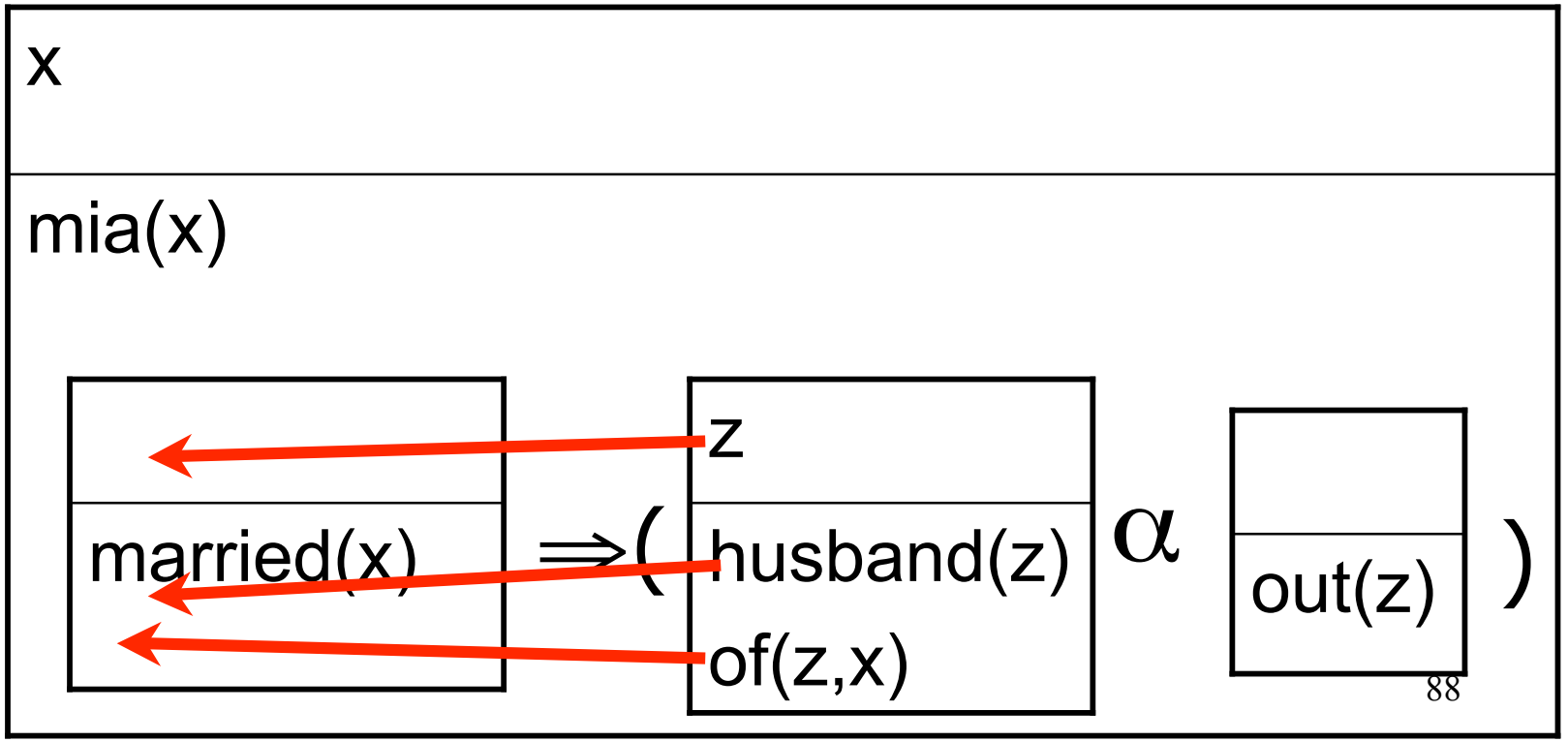
Non-global Accommodation

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



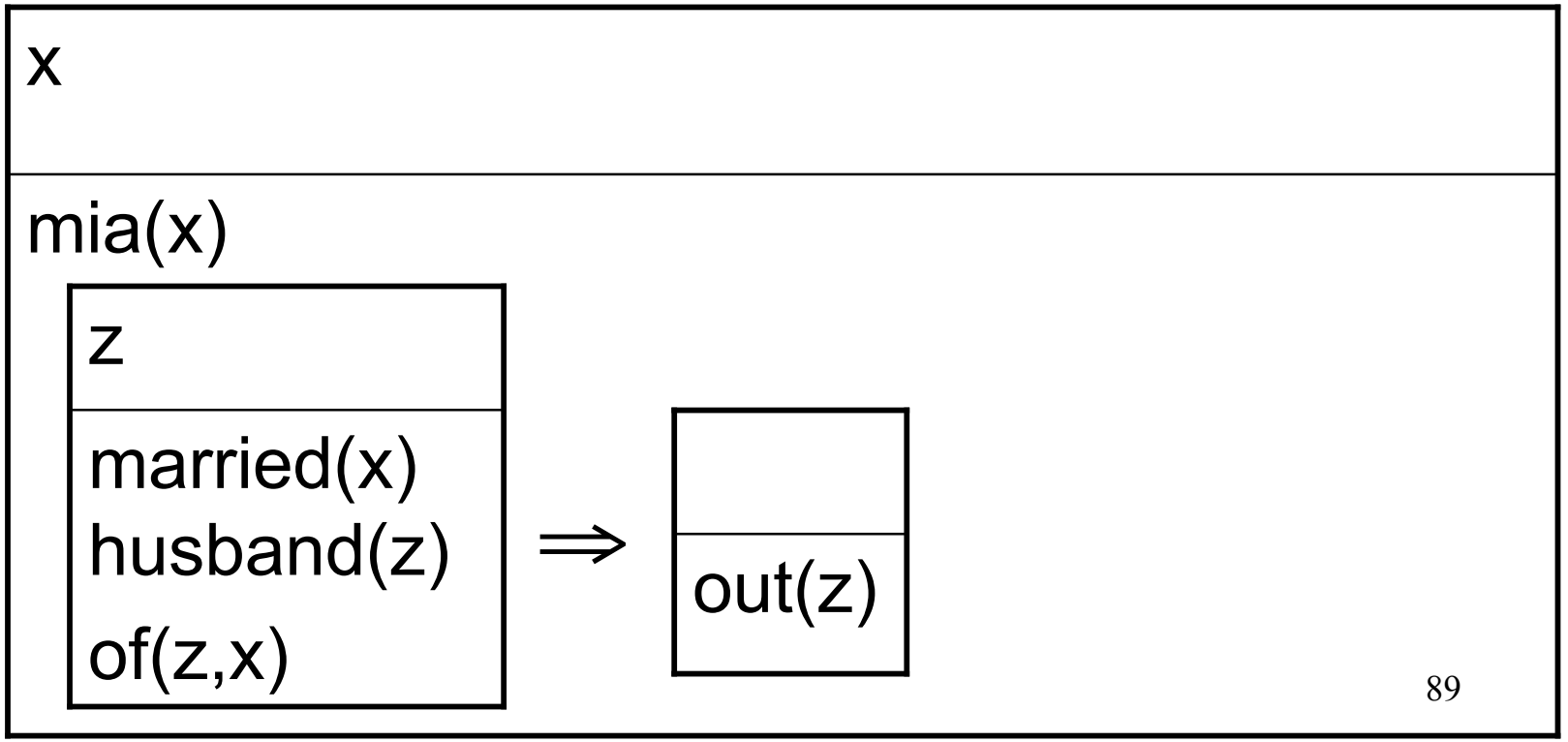
Non-global Accommodation

- 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

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

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

The acceptability constraints

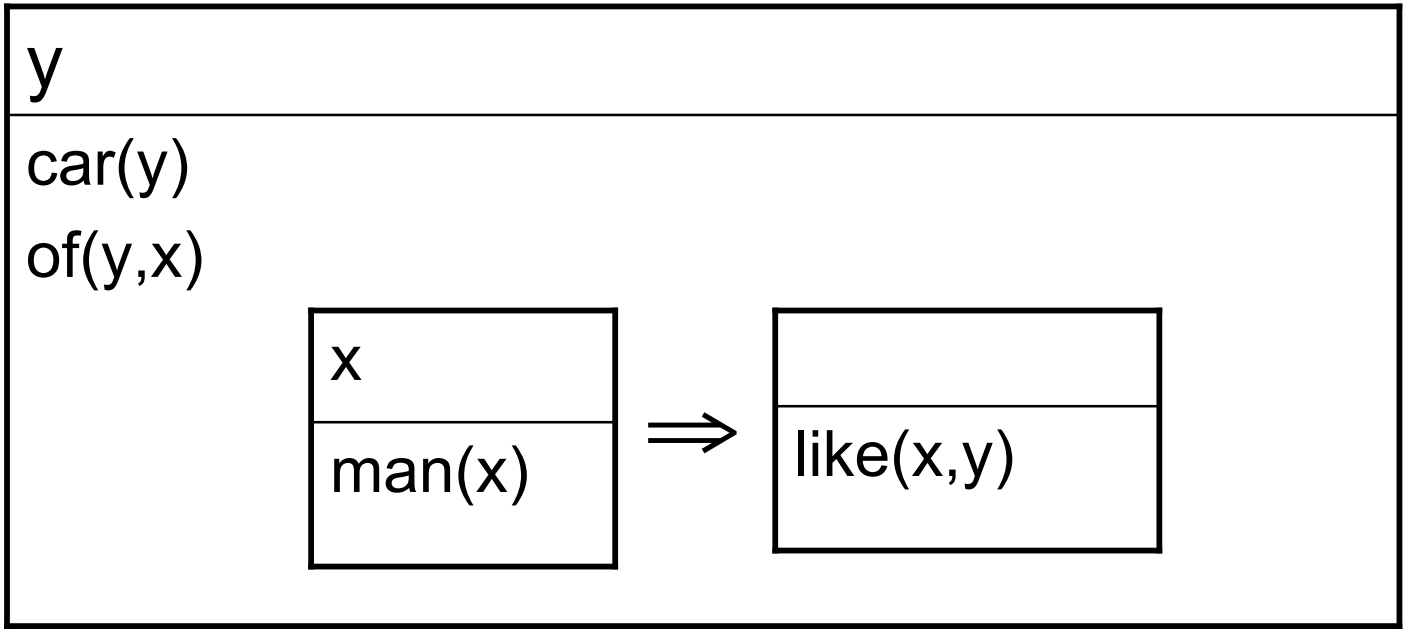
- DRSs should obey the binding rules
- DRSs should not contain free variables
- DRSs should be consistent and informative
- DRSs should also be *locally* consistent and *locally* informative

  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)

Free Variable Check

- Consider the example:
  Every man likes his car

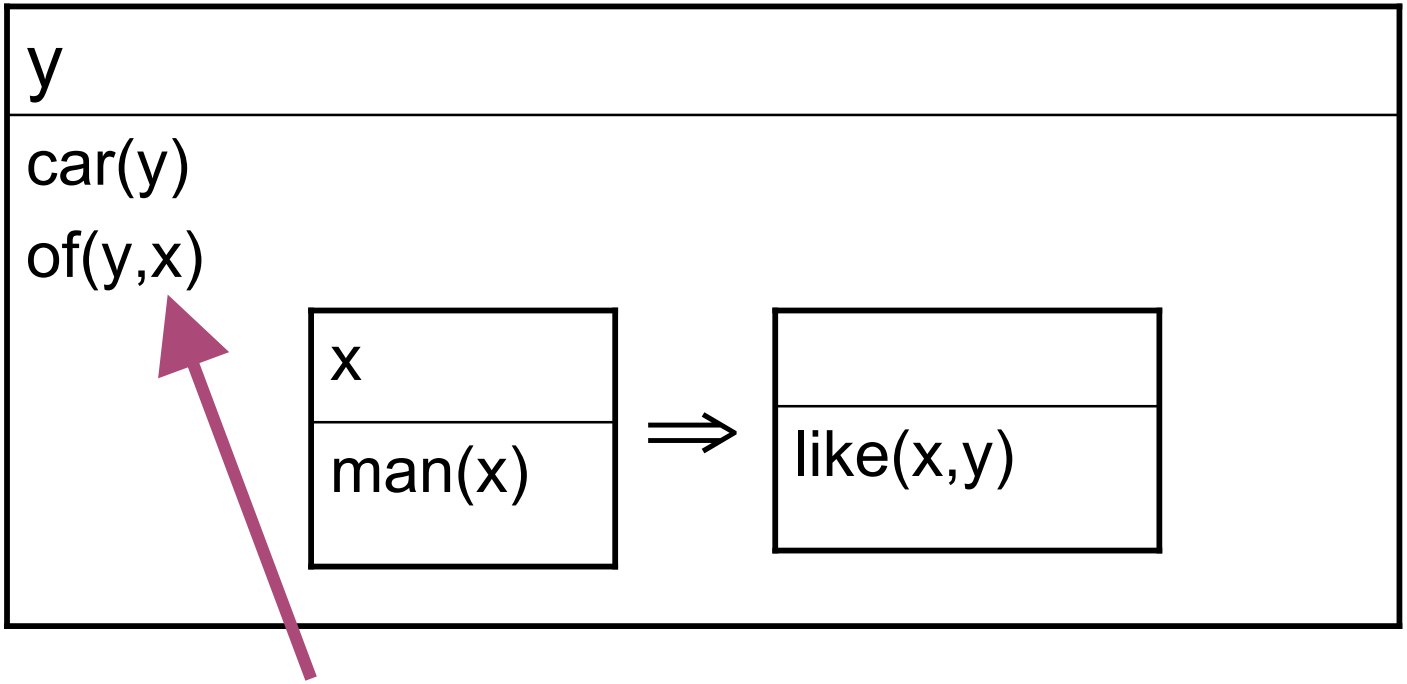
- DRS obtained with global accommodation:



Free Variable Check

- Consider the example:
  Every man likes his car

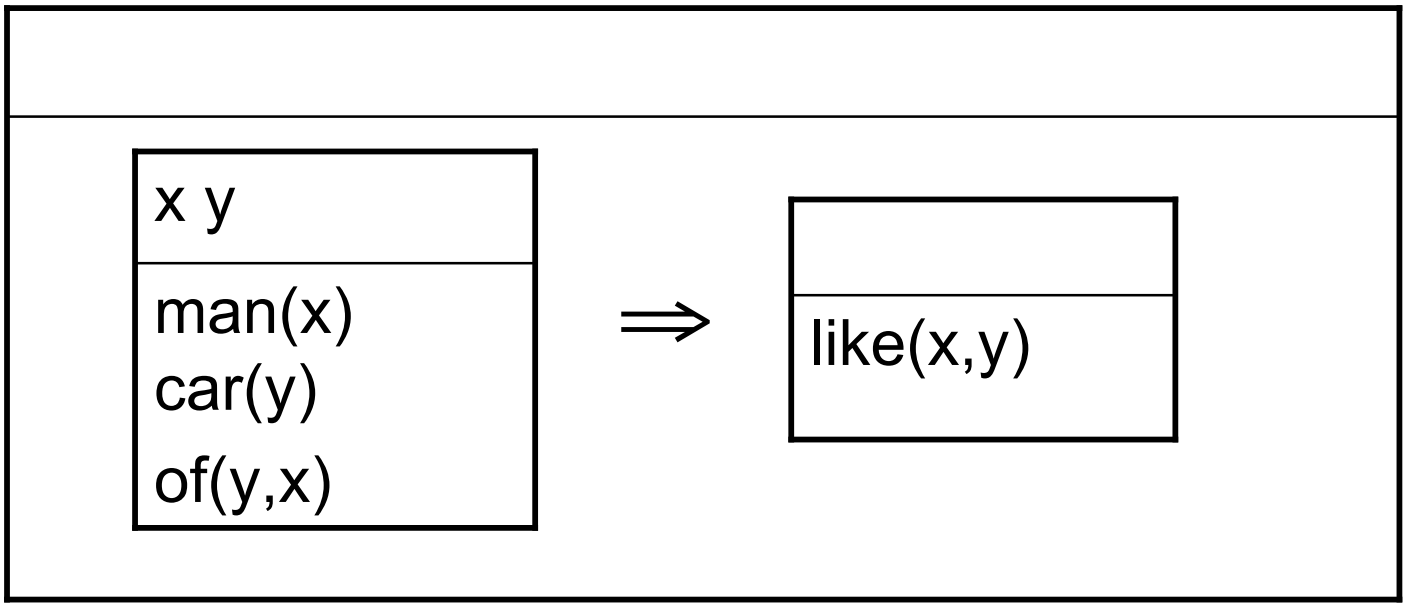
- DRS obtained with global accommodation:



Free Variable Check

- Consider the example:
  Every man likes his car

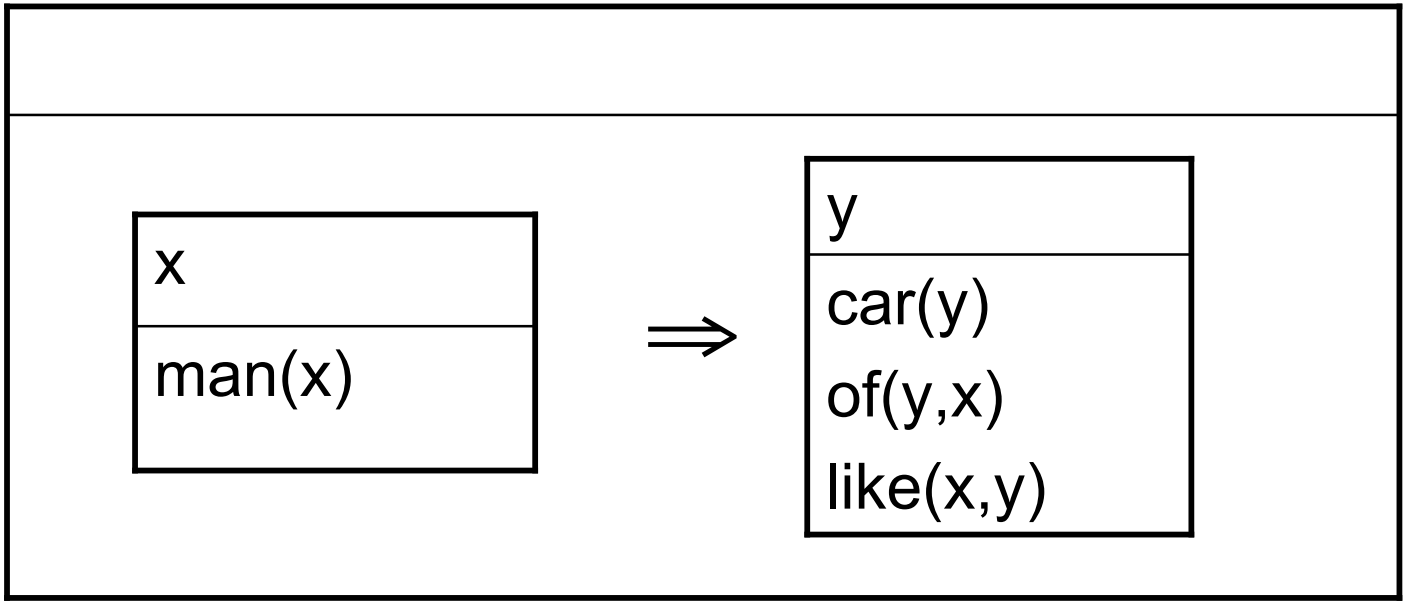
- DRS obtained via intermediate accommodation:



Free Variable Check

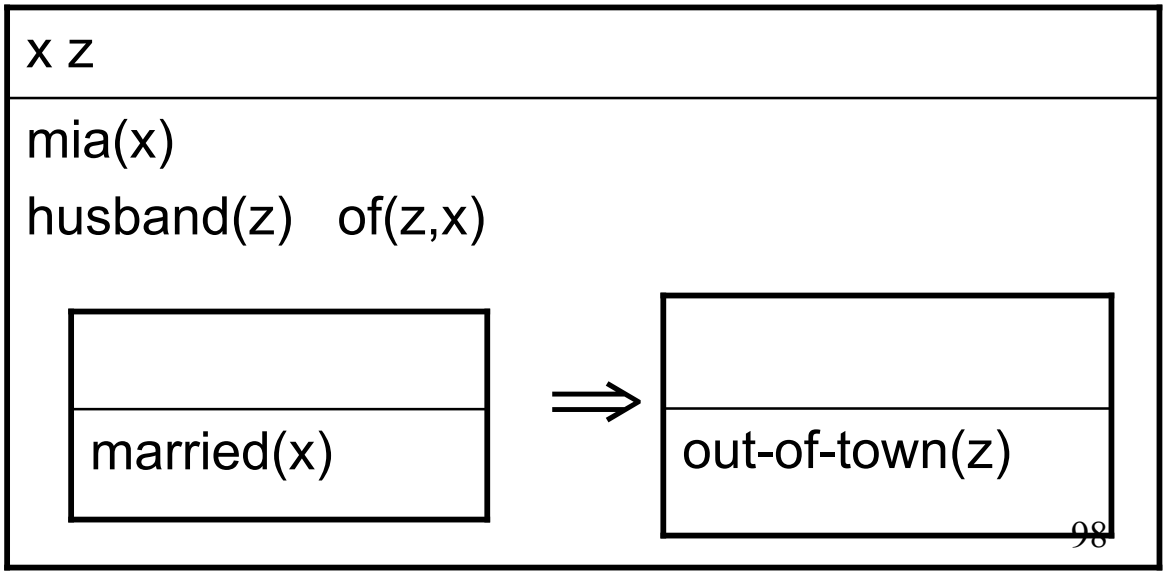
- Consider the example:
  Every man likes his car

- DRS obtained with local accommodation:



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!



The projection problem solved

- Recall our example:
  If Mia is married, then her husband is out of town
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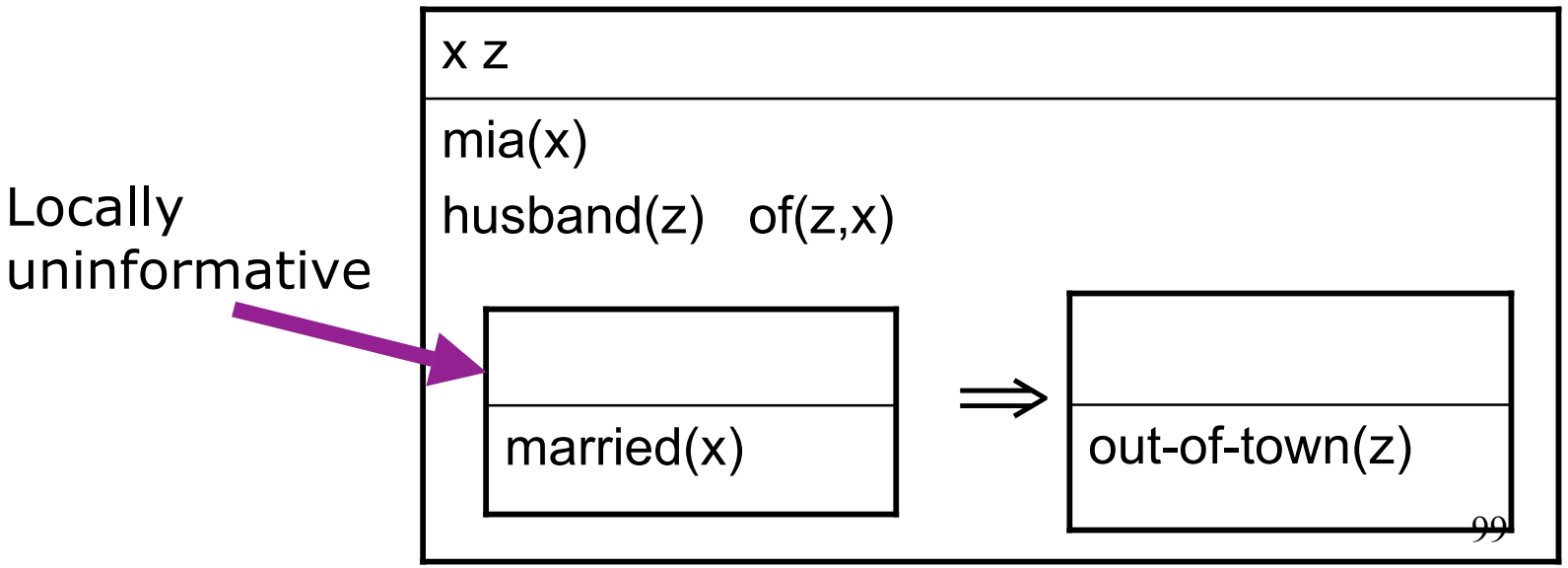

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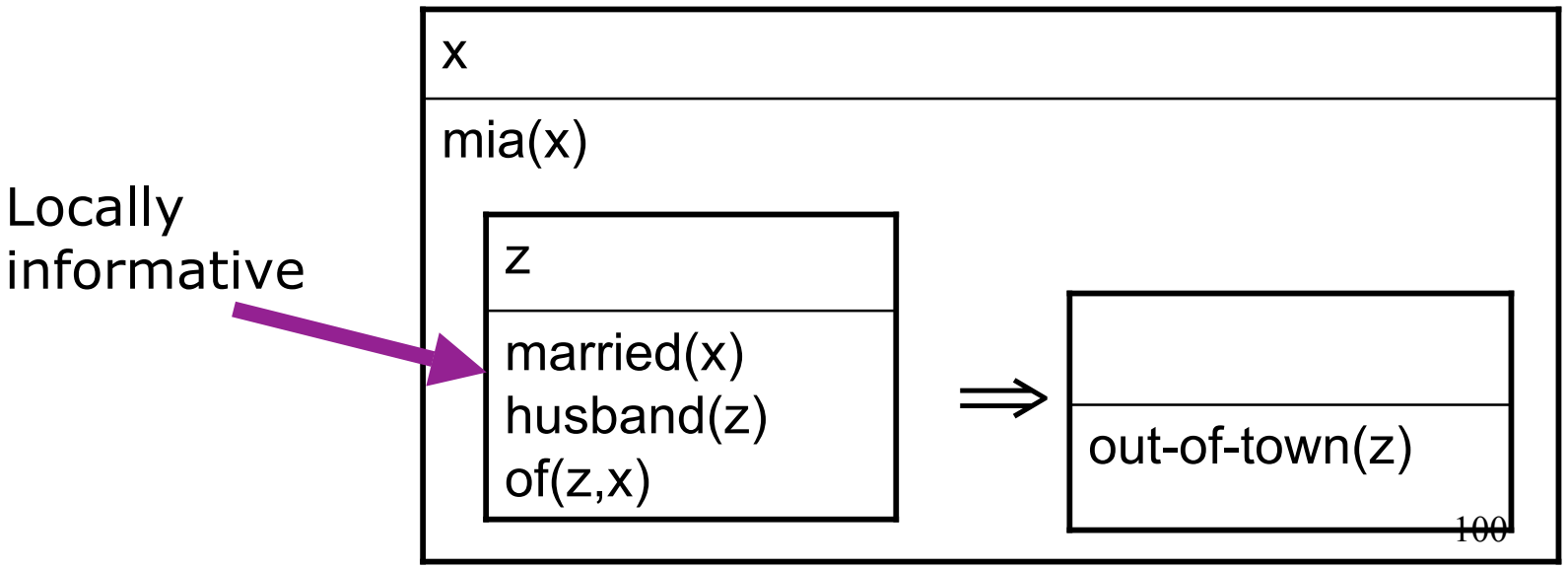


The projection problem solved$_{MR}$

- Question:

  Recall our previous examples:

(1) Either John is not a donkey-owner or his donkey is eating quietly in stable.

(2) If Mia has a husband, then her husband is out of town.

(3) Either John does not have a donkey or his donkey is eating quietly in the stable.

(4) If Mia dates Vincent, then her husband is out of town.

(5) Either John has run out of hay or his donkey is eating quietly in the stable.

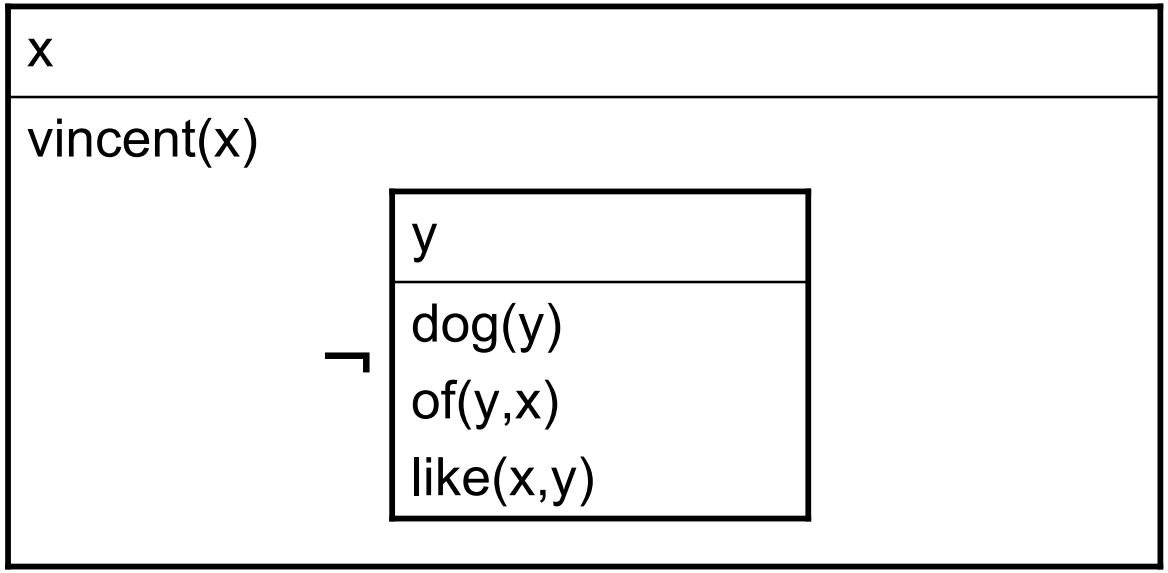
For each example, show how the acceptability constraints plus the preference binding > global accomm. > local accomm. determine the projection possibilities of the presuppositions at issue.

Denial

- Example:

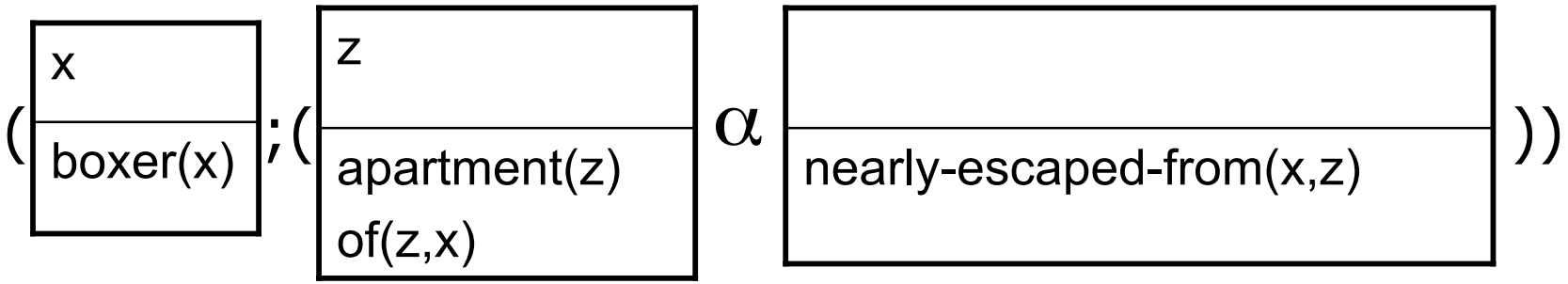
  Vincent does not like his dog.

  He does not have a dog!



The binding problem solved

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



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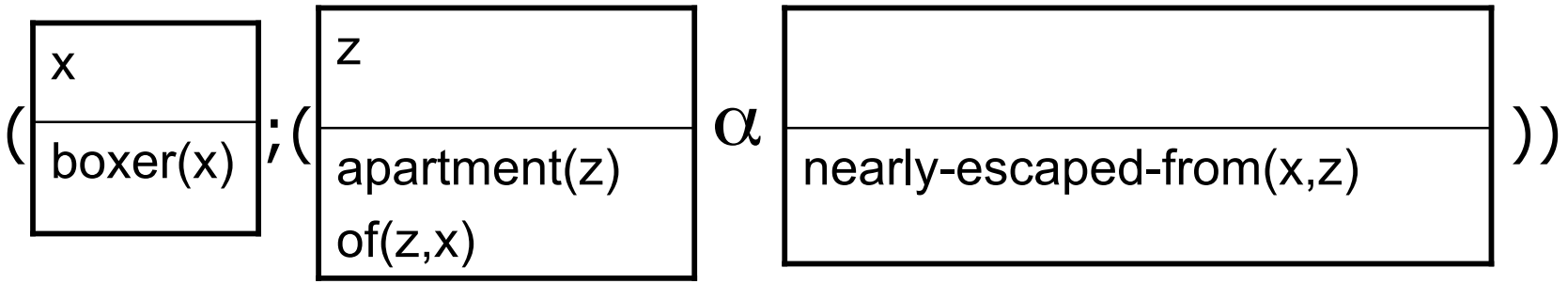


- Final DRS:

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

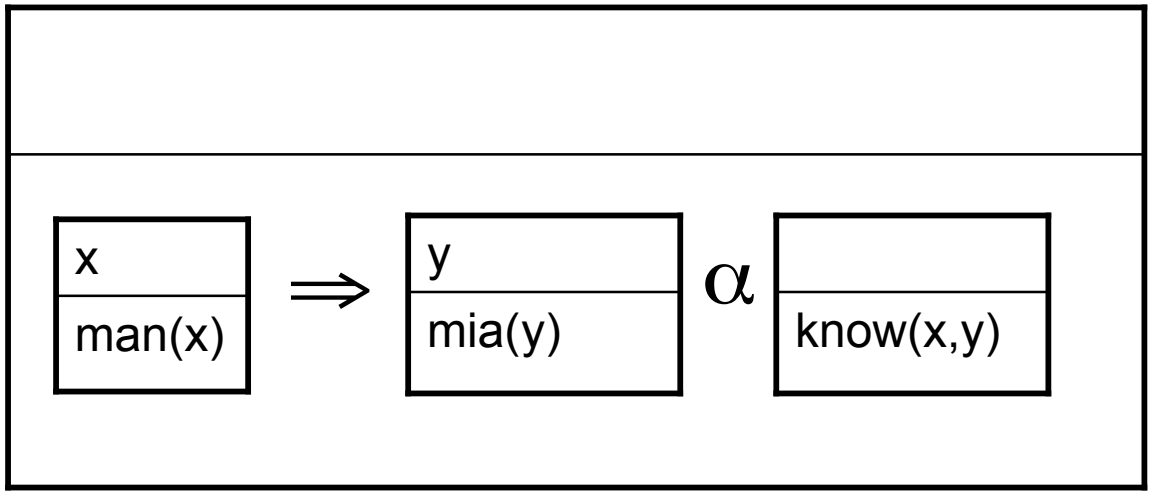
Proper Names

- 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

Proper Names

- Example:

  Every man knows Mia.
  She is Marsellus' wife.



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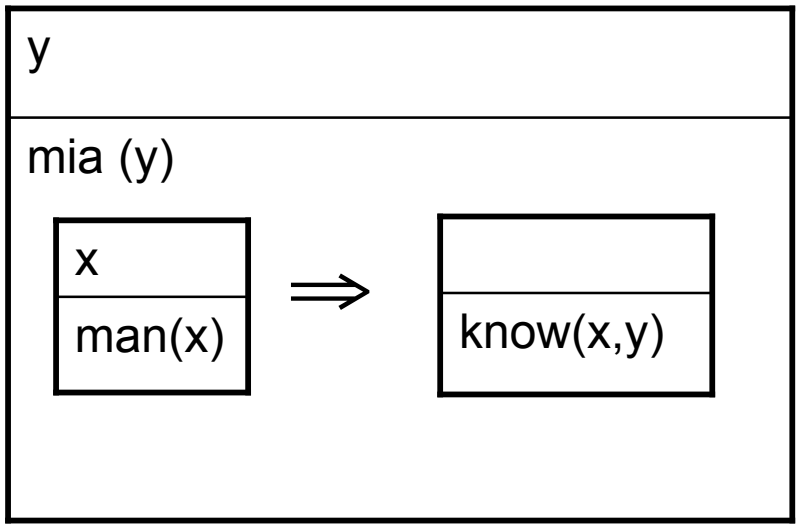

Implementation

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