Semantic Theory: DRT IV: Presupposition

Summer 2008

M.Pinkal/ S. Thater

Presupposition phenomena

- Presuppositions are triggered by a variety of different words and linguistic constructions, including definite noun phrases.
- Presuppositions behave differently than assertions in semantics construction: They are typically projected unchanged, rather than fused through functional application. In particular, they survive even when the presupposition trigger is in the scope of negation.
- Projected presuppositions can be filtered in the semantic composition process, and can be cancelled by contextual knowledge.
- Presupposed information which is missing in context can be accomodated.

Examples

- *Presupposition Projection*
  - *John **possibly** regrets that he has married.*
- *Presupposition cancellation*
  - *John possibly regrets that he has married. But possibly, he hasn't married at all.*
- *Presupposition filtering*
  - *If John is out of town, then **his wife** is unhappy.*
  - *If John is married, then **his wife** is unhappy.*
- *Accommodation*
  - ***The king of Samoa** will visit Germany in July.*

Presuppositions in DRT

- Rob van der Sandt: DRT-based modelling of presuppositions
  - Basic assumption: Presupposition is anaphora.
  - More specifically: All presupposition triggers are anaphoric expressions. The presupposition is the requirement a context must satisfy to enable the anaphoric expression to refer.
- Reference: van der Sandt, R.: 1992, "Presupposition Projection as Anaphora Resolution", Journal of Semantics 9: 333-377

Presupposition as Anaphora

- *The student works.*
  - Nominal anaphora
  - Context contains an individual who is a student // <u>she</u> works
- *John regrets that he is married.*
  - Propositional Anaphora
  - Context contains the proposition that Mary is married // John regrets <u>this</u>
- *John stopped smoking*
  - Event anaphora
  - Context contains the habitual event of John's smoking // John has stopped doing <u>that</u>

Presupposition in DRT

- DRS Construction Rules for definite NPs (and other presupposition triggers) introduce "α-conditions" or "α-DRSs" as a new type of complex condition.
- DRS construction proceeds in two steps:
  - In a first step, DRS construction rules are applied, resulting in a "proto-DRS", containing α-conditions
  - In a second step, the α-DRSs are resolved (transforming the proto-DRS into a standard DRS)
- Anaphora resolution is done either by binding or by accomodation.

Example: Binding [1]

- *A student works.*

x
student(x) works(x)

Example1: Construction of Proto-DRS

- *A student works. The student is successful.*

<table>
<tr><td>x</td></tr>
<tr><td>student(x)
works(x)

αy <table><tr><td>y</td></tr><tr><td>student(y)</td></tr></table>
successful(y)</td></tr>
</table>

Example1: Binding

- *A student works. The student is successful.*

x y

student(x)
works(x)

αy [y | student(y), x = y]

successful(y)

Example1: Binding

- *A student works. The student is successful.*

x y

student(x)
works(x)
student(y)
x = y
successful(y)

Example2: Construction of Proto-DRS

- The king of Samoa is visiting.

αx [x | king-of-samoa(x)]

visit(x)

Example2: Accommodation

- The king of Samoa is visiting.

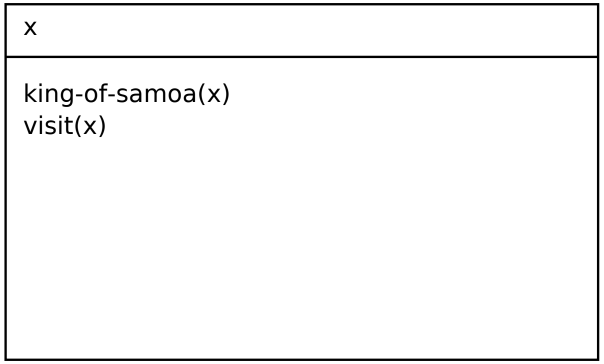
x

αx [x | king-of-samoa(x)]

visit(x)

Example2: Accommodation

- The king of Samoa is visiting.

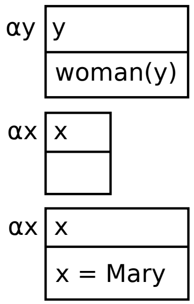


(Proto-)DRSes

- A (proto-) DRS is a triple ⟨U_K, C_K, A_K⟩ such that
  - U_K is a set of discourse referents
  - C_K is a set of (atomic or complex) conditions
  - A_K is a set of “anaphoric” (α-) DRSs of the form αzK’, where z is a discourse referent and K’ is a proto-DRS.

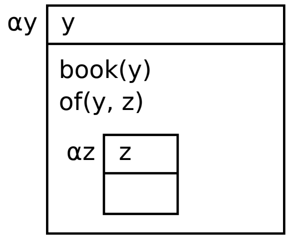
DRSConstruction for Definite NPs

- The DRS construction rules for all definite noun phrase types introduce α-DRSs:
  - Definite descriptions (“the woman”)
  - pronouns
  - proper names (“Mary”)

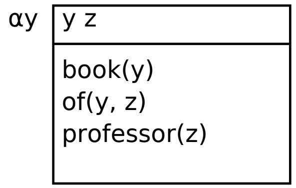


Complex Alpha-DRSs

“his book”



“the book of a professor”



Subordination and Accessibility

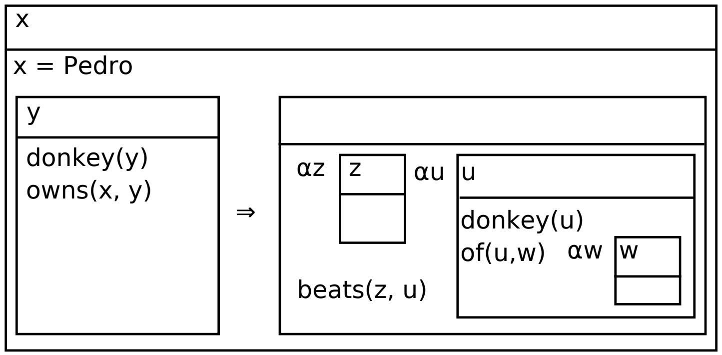
- K_1 is an immediate sub-DRS of a DRS $K = \langle U_K, C_K, A_K \rangle$ iff C_K contains a condition of the form $\neg K_1$, $K_1 \Rightarrow K_2$, $K_2 \Rightarrow K_1$, $K_1 \vee K_2$, $K_2 \vee K_1$, or $\alpha x K_1 \in A_K$
- Definitions of sub-DRS, proper sub-DRS and accessibility as before.

Resolution by Binding

- Let K, K', K_t DRSs, $K' \leq K$, $K_t \leq K$ and
  - $\gamma = \alpha x K_S \in K'$, K_S is α-free
  - $y \in U_{Kt}$ a DR that is accessible and suitable for γ
- Remove γ from K' and extend K_t with U_{Ks}, C_{Ks}, and the condition $x = y$.
- Note: The content of an α-DRS is released into the DRS of the discourse referent, which it is bound to.
- Note: Because K_s must be α-free, complex Alpha-DRSs are always resolved from the inside out.

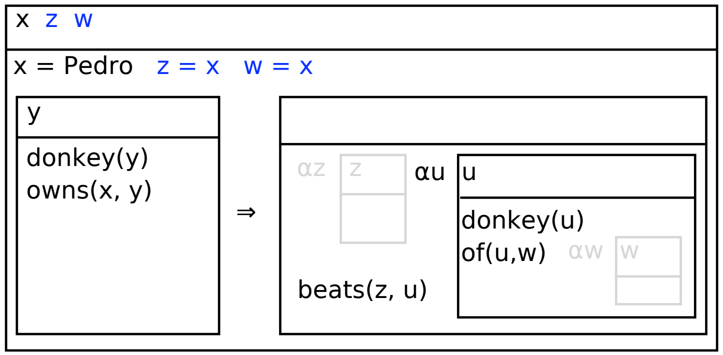
Example: Binding [1]

- If Pedro owns a donkey, he beats his donkey.



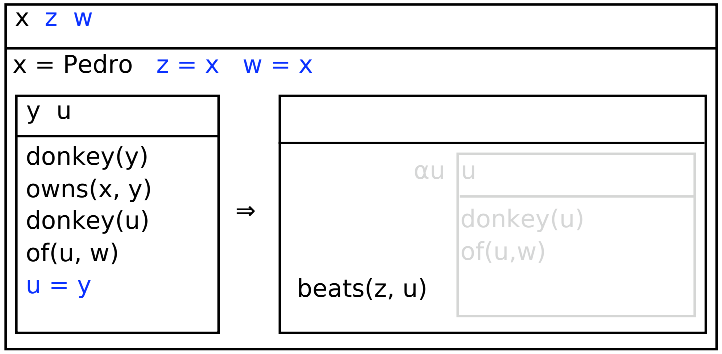
Example: Binding [2]

- If Pedro owns a donkey, he beats his donkey.



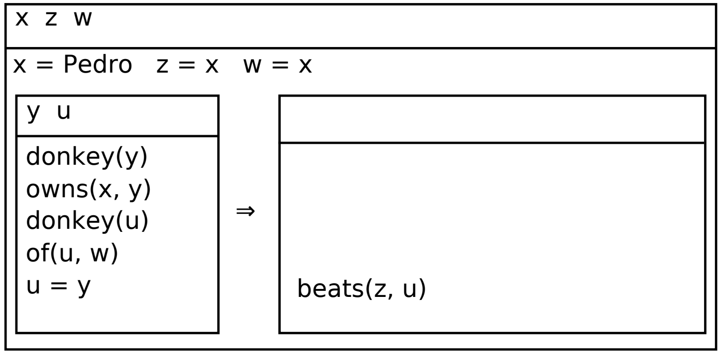
Example: Binding [2]

- If Pedro owns a donkey, he beats his donkey.



Example: Binding [2]

- If Pedro owns a donkey, he beats his donkey.



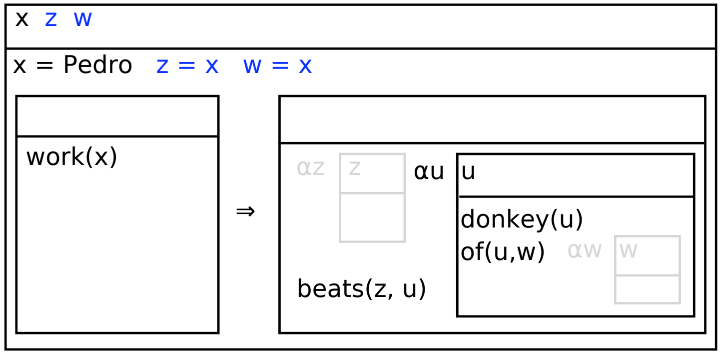
Resolution by Accommodation

- Let K, K' DRSs, $K' \leq K$, $K_t \leq K$
  - $\gamma = \alpha x K_s \in K'$, K_s is α-free
  - K_t a DRS that is accessible for γ.

- Remove γ from K' and extend K_t with U_{Ks} and C_{Ks}.

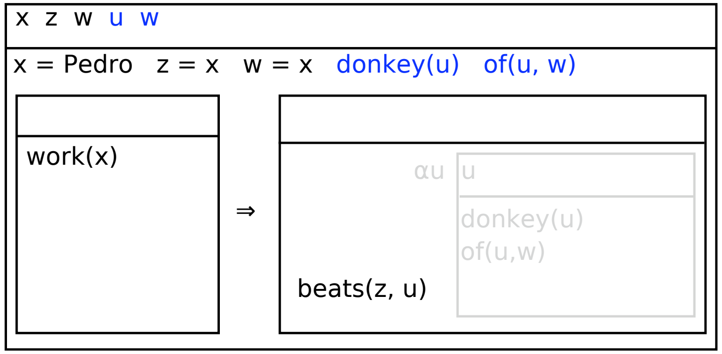
Example: Accommodation [1]

- If Pedro works, he beats his donkey.



Example: Accommodation [1]

- If Pedro works, he beats his donkey.



Presupposition Projection:Constraints and Preferences

- The two resolution rules specify possible sites where α-DRSs can be bound or accommodated.
- But so far, they are highly non-deterministic: We can bind or accommodate almost anywhere!
- We need constraints or preferences for binding and accommodation.

Preference Principles

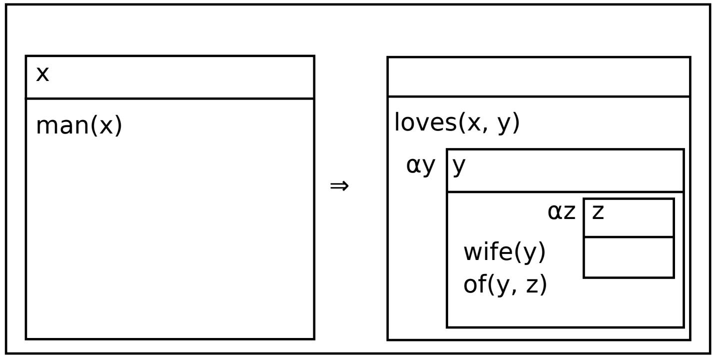
- Binding is preferred over accommodation.
- Binding works “upwards” along the accessibility relation: The “closest” possible antecedent is preferred.
- Accommodation works “downwards” along the accessibility relation. It is preferred to accommodate into the highest possible DRS.

Constraints on Projection

- Free variable constraint: The resolved DRS may not contain any free discourse referents.
- (Local) consistency and informativity constraints

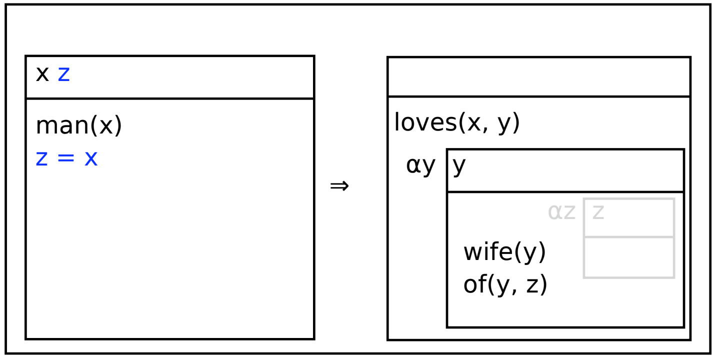
The Free Variable Constraint

- Every man loves his wife.



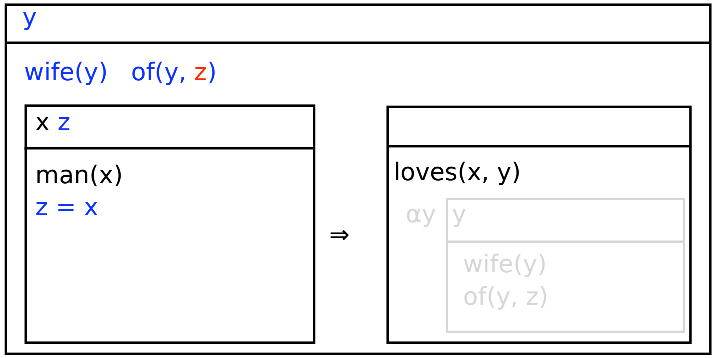
The Free Variable Constraint

- *Every man loves his wife.*



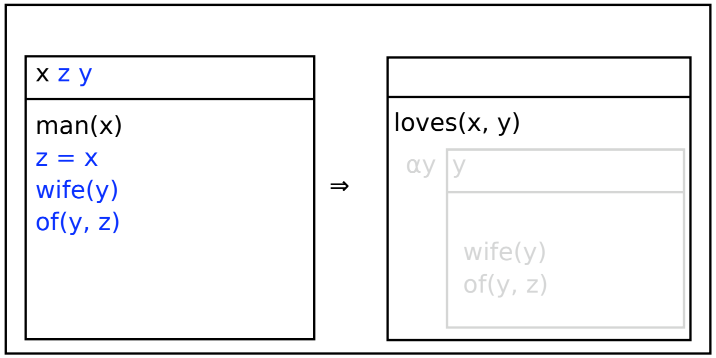
The Free Variable Constraint

- Binding of “his” to “every man” blocks the - otherwise preferred - top-level accommodation.



The Free Variable Constraint

- Therefore: Local accommodation only

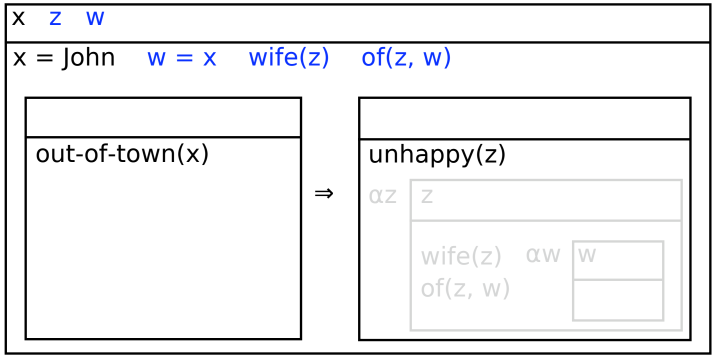


Presupposition Filtering

- *If John is out of town, then his wife is unhappy.*
  presupposes: John is married
- *If John is married, then his wife is unhappy.*
  does not presuppose: John is married

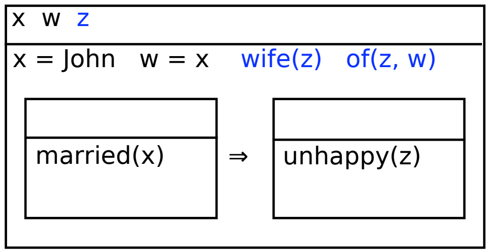
Presupposition Filtering

- If John is out of town, then his wife is unhappy.



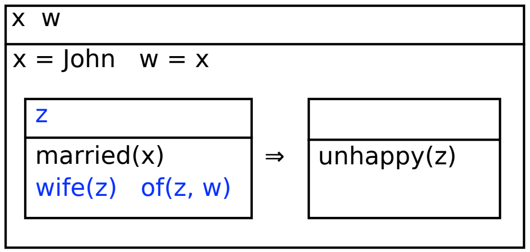
Presupposition filtering

- *If John is married, then his wife is unhappy.*
- Here, global accommodation does not work. It would render the antecedent DRS uninformative.



(Local) Informativity

- "Local informativity" constraint blocks global accommodation



Further Constraints

- The resolved DRS must be consistent and informative.
- **Consistency:** The resolved DRS must be satisfiable (taking background knowledge into account).
- **Informativity:** The resolved DRS must not be entailed by our background knowledge.
- **Local consistency:** No sub-DRS must be inconsistent with any superordinate DRS.
- **Local informativity:** No sub-DRS must be entailed by any superordinate DRS.

Presupposition phenomena

- Presuppositions behave differently than assertions in semantics construction: They are typically projected unchanged, rather than fused through functional application. In particular, they survive even when the presupposition trigger is in the scope of negation. --> Global accommodation
- Projected presuppositions can be cancelled by contextual knowledge. --> Consistency and informativity constraints
- Projected presuppositions can be filtered in the semantic composition process. --> Local consistency and informativity constraints

The following slides are meant as an outlook to further topics and research questions in discourse semantics. They will not be part of the final exam.

Plural NPs, cardinalities, collective readings

- Plural NPs, cardinalities, collective readings
  - Two students gave a presentation.
  - Three men carried the piano upstairs.
  - The students gathered.
  - Three students ate five pizzas.
- Mass nouns:
  - An apple + an apple: apples
  - Apple juice + apple juice: apple juice

DRT extensions

- UDRT: U for „Underspecified“
- SDRT: S for „Segmented“
- λ-DRT: λ for „ λ-calculus“

λ-DRT: λ-abstraction over DRSs

- *every student* ⇒ λG

z	
student(z)	⇒ G(x)

  alternative notation: λG [∅ | [z | student(z)] ⇒ G(z)]

- *works* ⇒ λx [∅ | work(x)]

  An expression consists of a lambda prefix and a (partially instantiated) DRS.

λ-DRT: β-reduction of λ-DRSs

- *every student works*

  ⇒ λG[∅ | [z | student(z)] ⇒ G(z)]](λx.[∅ | work(x)])

  ⇔ [∅ | [z | student(z)] ⇒ λx.[∅ | work(x)](z)]

  ⇔ [∅ | [z | student(z)] ⇒ [∅ | work(z)]]

λ -DRT: The “Merge” operation

- *a student* ⇒ λG ([z | student(z)]; G(z))
- *works* ⇒ λx [∅ | work(x)]

- *A student works*

  ⇒ λG ([z | student(z)];G(z))(λx.[∅ | work(x)])

  ⇔ [z | student(z)]; λx.[∅ | work(x)](z)

  ⇔ [z | student(z)]; [∅ | work(z)]

  ⇔ [z | student(z), work(z)]

Merge

- The "merge" operation on DRSs combines two DRSs (conditions and universes).
- It has a similar function as the beta reduction in type theory: Replace a complex formula (the ";"-combination of two DRSs) by an equivalent simpler formula.
- It is also similar to DPL conjunction.
- Let K_1 = [U_1 | C_1] and K_2 = [U_2 | C_2].
  We define: K_1; K_2 = [$U_1 \cup U_2$ | $C_1 \cup C_2$]
  under the assumption that no discourse referent $u \in U_2$ occurs free in a condition $\gamma \in C_1$.

Naive λ-DRT: The problem

- *A student works. She is successful.*
- Compositional analysis:
- λK λK'(K;K')([z | student(z), work(z)])([|successful(z)])
  ⇔ λK'([z | student(z), work(z)];K')([|successful(z)])
  ? ⇔ [z | student(z), work(z)];[|successful(z)]
  ⇔ [z | student(z), work(z), successful(z)]

  Via the interaction of β-reduction and DRS-binding, discourse referents are "captured!"

Higher-order DRT: The challenge

- Via the interaction of β-reduction and DRS-binding, discourse referents are captured.
- But the β-reduced DRS must still be equivalent to the original DRS!
- This means that we somehow have to encode the potential for capturing discourse referents into the denotation of a λ-DRS. Getting this right is tricky.
- Discourse referents and bound variables behave differently! (Discourse referents may be captured.)
- The most transparent formalism of higher-order dynamic semantics is Muskens' Compositional DRT.