

# Semantic Theory

## week 12 – Current issues in semantic theory

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Noortje Venhuizen

Universität des Saarlandes

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# Semantic Theory

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Topics covered in this course:

Predicate logic - Type Theory - Lambda Calculus - Generalised Quantifiers - Event Semantics - Plurals and Mass Nouns - Dynamic Semantics - Discourse Representation Theory - Presuppositions



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# Open questions

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## I. What is meaning?

Truth-conditions vs. context-change potential  
vs. answering the Question Under Discussion



## II. Which phenomena should be captured by a semantic formalism?

Syntax vs. Semantics vs. Pragmatics



## III. How to validate predictions from formal semantic theories?

Experimental approaches, Computational Semantics



# Communication as question-answering

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The Goal of communication: to determine what the world is like.

But: an exhaustive characterisation of the current state of the world – “The Big Question” (Roberts, 1996) – is too big a task

- What makes certain issues more important to us than others has to do with our goals
- Therefore, we establish certain subgoals, which take the form of issues to be resolved or Questions Under Discussion (QUDs)
- Content that addresses the QUD is called *at-issue* content; all other content is *not at-issue*

# Inquisitive semantics

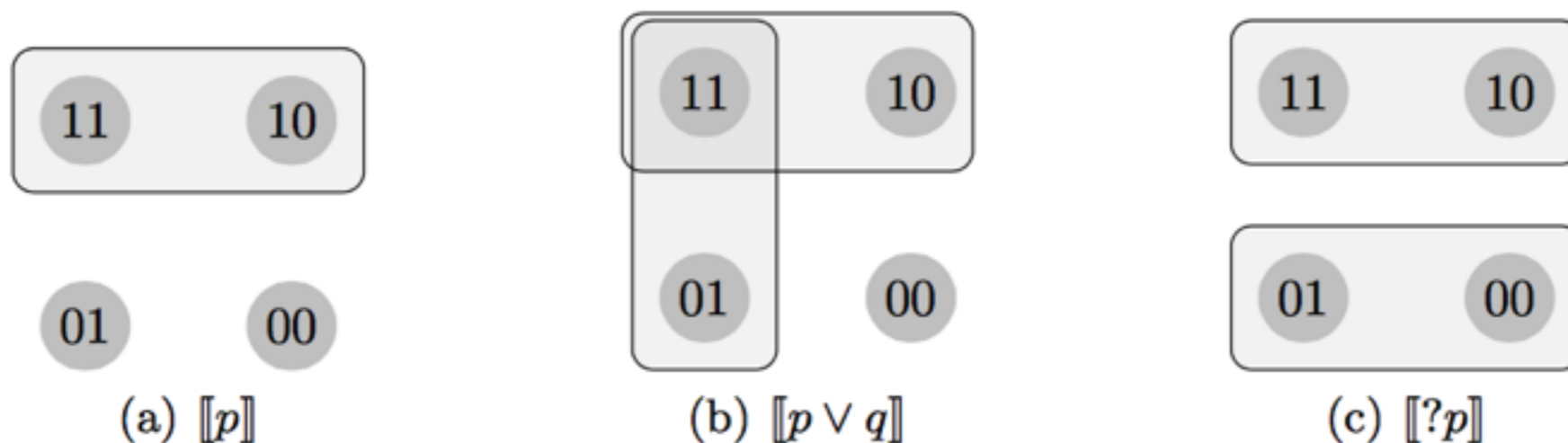


“Meaning is Information EXchange Potential”

(1)  $\llbracket \text{John plays} \rrbracket^{M,w,g} := \{\lambda v. \text{play}(\text{John})(v)\} :: \langle s, t \rangle$

(2)  $\llbracket \text{John or Bill plays} \rrbracket^{M,w,g} := \{\lambda v. \text{play}(\text{John})(v), \lambda v. \text{play}(\text{Bill})(v)\}$

(3)  $\llbracket \text{Does John play?} \rrbracket^{M,w,g} := \{\lambda v. \text{play}(\text{John})(v), \lambda v. \neg \text{play}(\text{John})(v)\}$



(Groenendijk, 2009; Groenendijk & Roelofsen, 2009)

# Defining the playing field of semantic theory

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What can/should be captured in a semantic formalism?

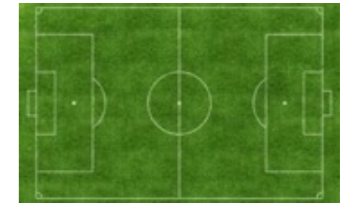
The syntax-semantics interface:

- quantification, anaphora, tense and aspect, thematic roles, ...

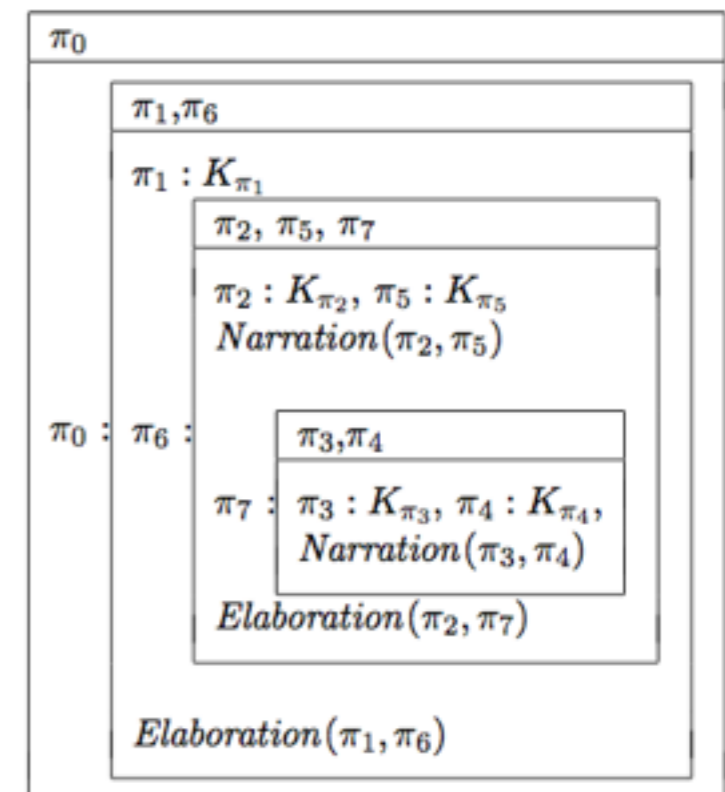
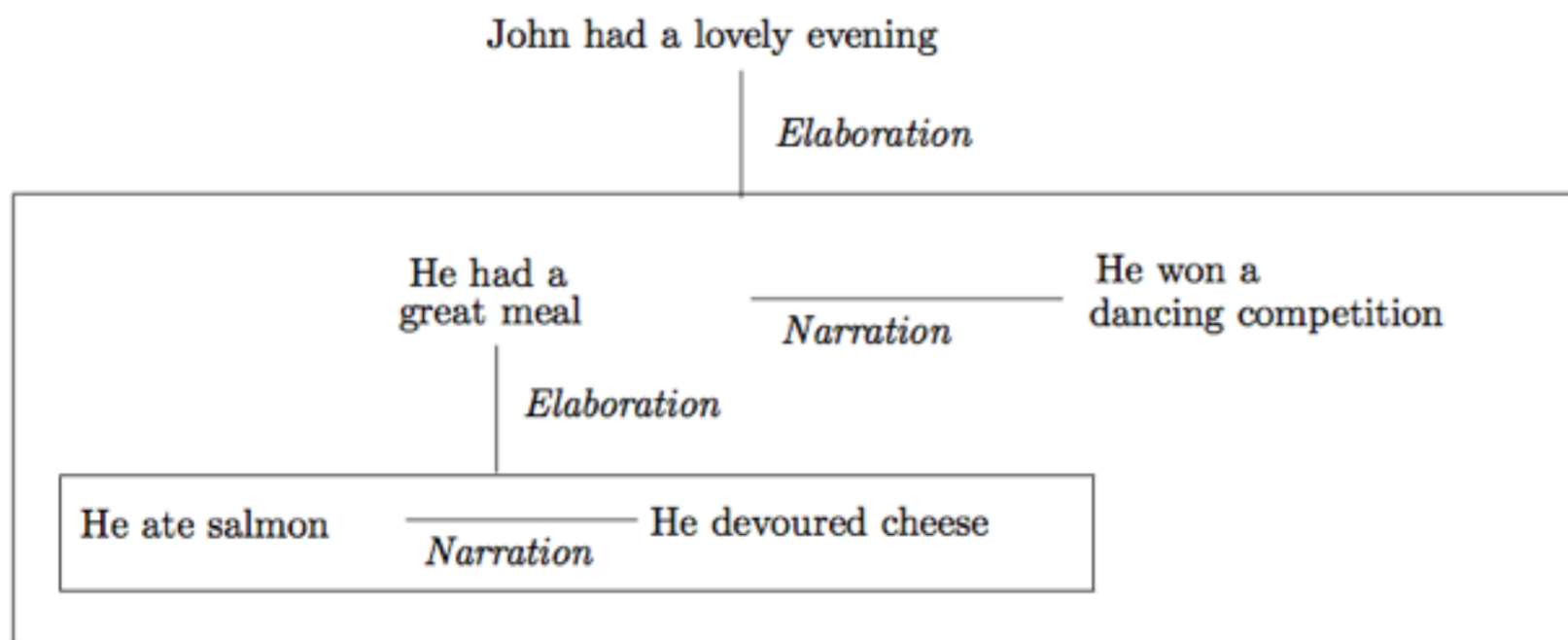
The semantics-pragmatics interface:

- rhetorical structure, implicature, presuppositions, information structure, ...

# Beyond truth-conditional meaning: Rhetorical Structure



(1) *John had a great evening last night. He had a great meal. He ate salmon. He devoured lots of cheese. He won a dancing competition. ??It was a beautiful pink.*



Segmented DRT: DRT with discourse relations

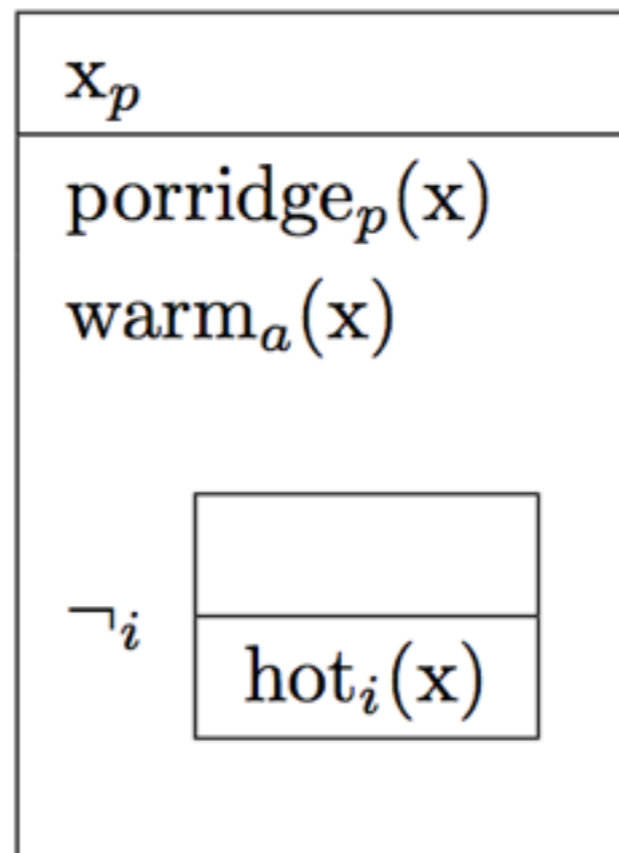
(Asher, 1992; Asher & Lascarides, 2003)

# Beyond truth-conditional meaning: Implicature



- (1) a. The porridge is warm. As a matter of fact, it is hot.  
b. ?The porridge is warm. As a matter of fact, it is cold.

Layered DRT: DRT with multiple layers of meaning





# Beyond truth-conditional meaning: Information structure



- (1) John has a sister. He visits her every week. → **assertion**
- (2) John visits his sister every week. → **presupposition**
- (3) John, who has a sister, visits her every week → **conventional implicature**

## Projective Discourse Representation Theory (PDRT): DRT with information structure



PDRT provides a unified, unidimensional treatment of asserted and projected content (including: presuppositions, anaphora, and *conventional implicatures*)



# Examples of conventional implicatures

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- (1) Ames, the former spy, is now behind bars. appositive
- (2) Ames, who stole from the FBI, is now behind bars. non-restrictive relative clause
- (3) Ames was, as the press reported, a successful spy. as-clause
- (4) Fortunately, Beck survived the descent. parenthetical
- (5) Frankly (speaking), Ed fled. utterance modifier
- (6) I hate your damn dog! expressive adverb
- (7) That bastard Conner got promoted. epithet
- (8) Yamadasensei -ga o -warai-ni nat-ta. honorific  
Yamada teacher - nom hon - laugh - dat be - perf  
'Professor Yamada laughed.' honorific

Potts 2003, 2005

# Conventional implicatures vs. presuppositions

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“Presuppositions are a special case of conventional implicatures, namely, those which, for pragmatic reasons, are presumed to be true already.”

Karttunen & Peters (1979)

“Conventional implicatures are distinguished from presuppositions in that they introduce new information, motivating a *multi-dimensional* approach to meaning.”

Potts (2005)

“Presuppositions and conventional implicatures belong to the larger class of not at-issue content.”

Simons et al. (2010)

Q: How to provide a unified formal treatment of projection?



# Toward a unified treatment of projection

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*A blind man walks into a bar...*

✓ ... he/him ...

✗ ... she/her ...

✓ ... the (blind) man...

✓ ... the policeman ...

✗ ... the man, who is blind, ...

✓ ... the man, who has a dog, ...

✗ ... a man ...

✓ ... a woman ...

} backgrounded  
→ foregrounded

given information

new information

**Proposal:** Projection phenomena (and asserted content) can be categorised based on their *information status*

***Givenness:*** determines whether the contribution is *given* or *new*

***Backgroundedness:*** determines whether the contribution is at-issue or not.

# The information status of semantic content



<b>Type</b>	<b>Given</b>		<b>New</b>	
		<i>backgrounded</i>	<i>foregrounded</i>	
Anaphora	+	—	—	—
Strong presuppositions	+	+	—	—
Weak presuppositions	+	+	+	+
CIs	—	+	—	—
Assertions	—	—	+	+
Indefinites	—	+	+	+



# Information status in DRT

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- givenness ~ anaphoric binding
- new information ~ accommodation / informativity constraint
- backgroundedness ~ embedding (?)

How to represent the difference between foregrounded and backgrounded information *without* assuming different levels of meaning?

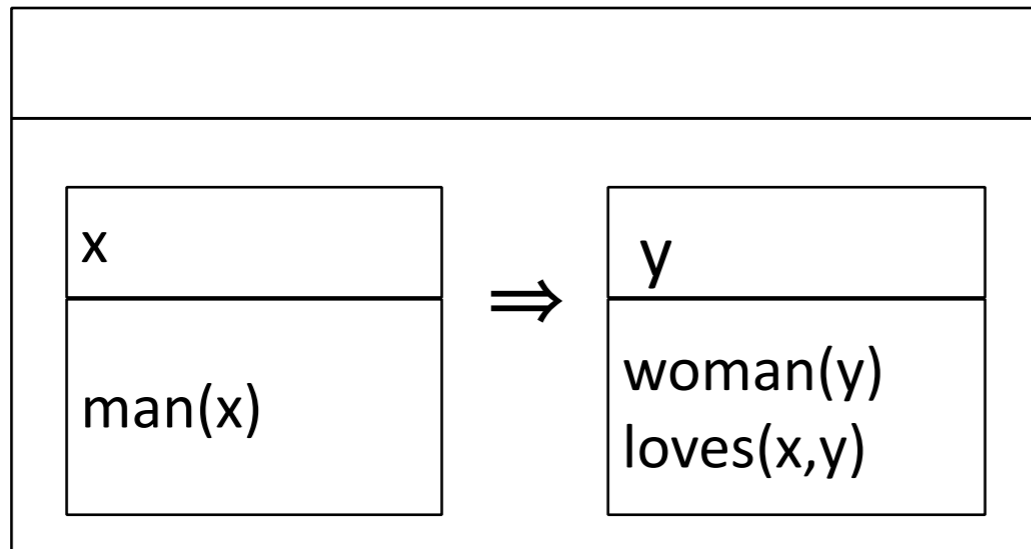
We need a more explicit notion of information status in DRT

# Projective DRT



PDRT is an extension of DRT with an explicit representation of information status; **projection variables** (*pointers* and *labels*) indicate the *interpretation site* of all referents and conditions

*Every man loves a woman.*

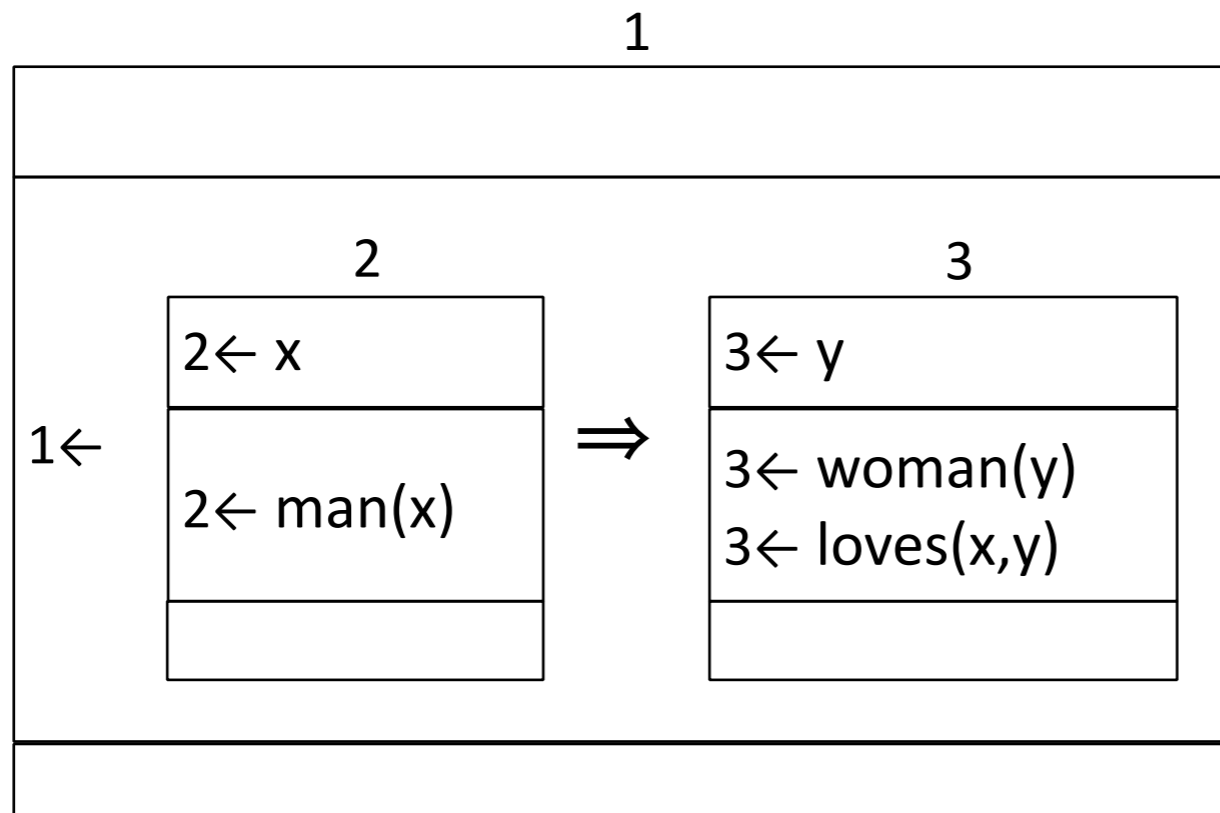


# Projective DRT



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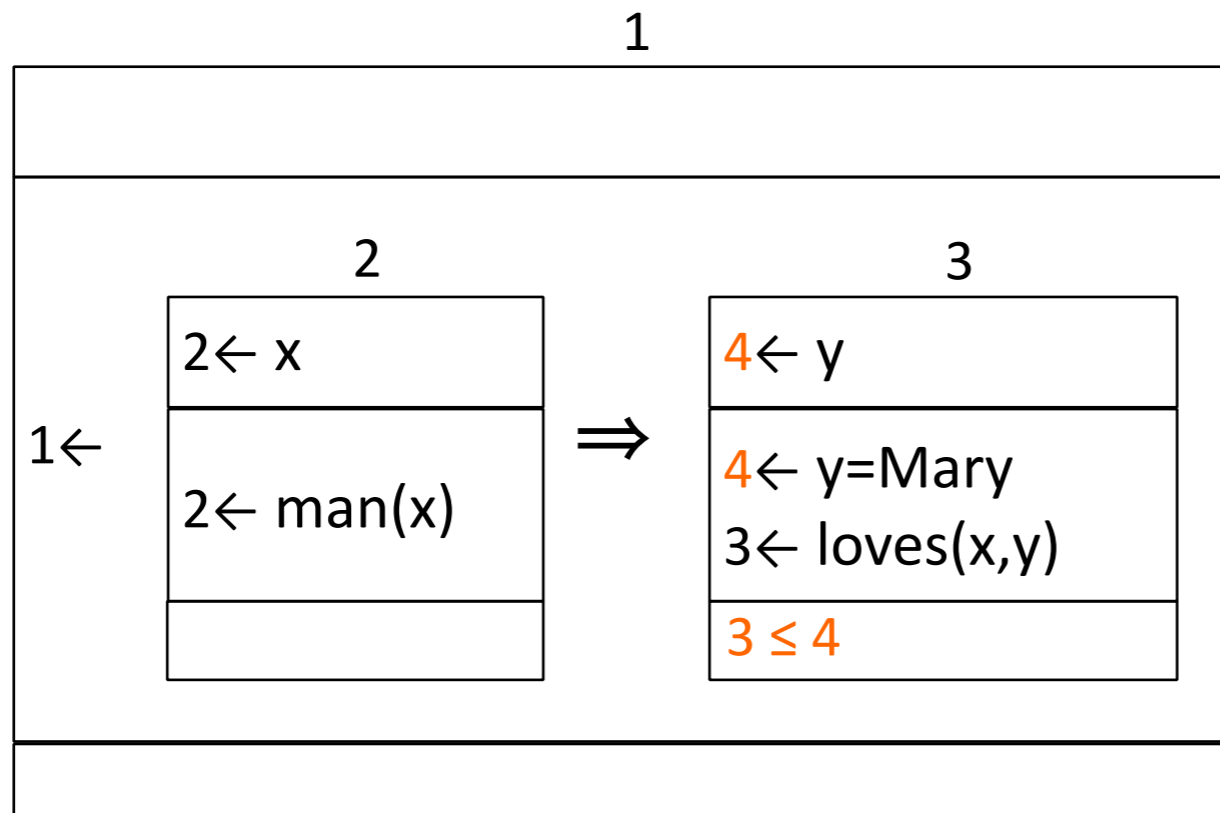


# Projective DRT



PDRT is an extension of DRT with an explicit representation of information status; *projection variables* (*pointers* and *labels*) indicate the *interpretation site* of all referents and conditions

*Every man loves Mary.*



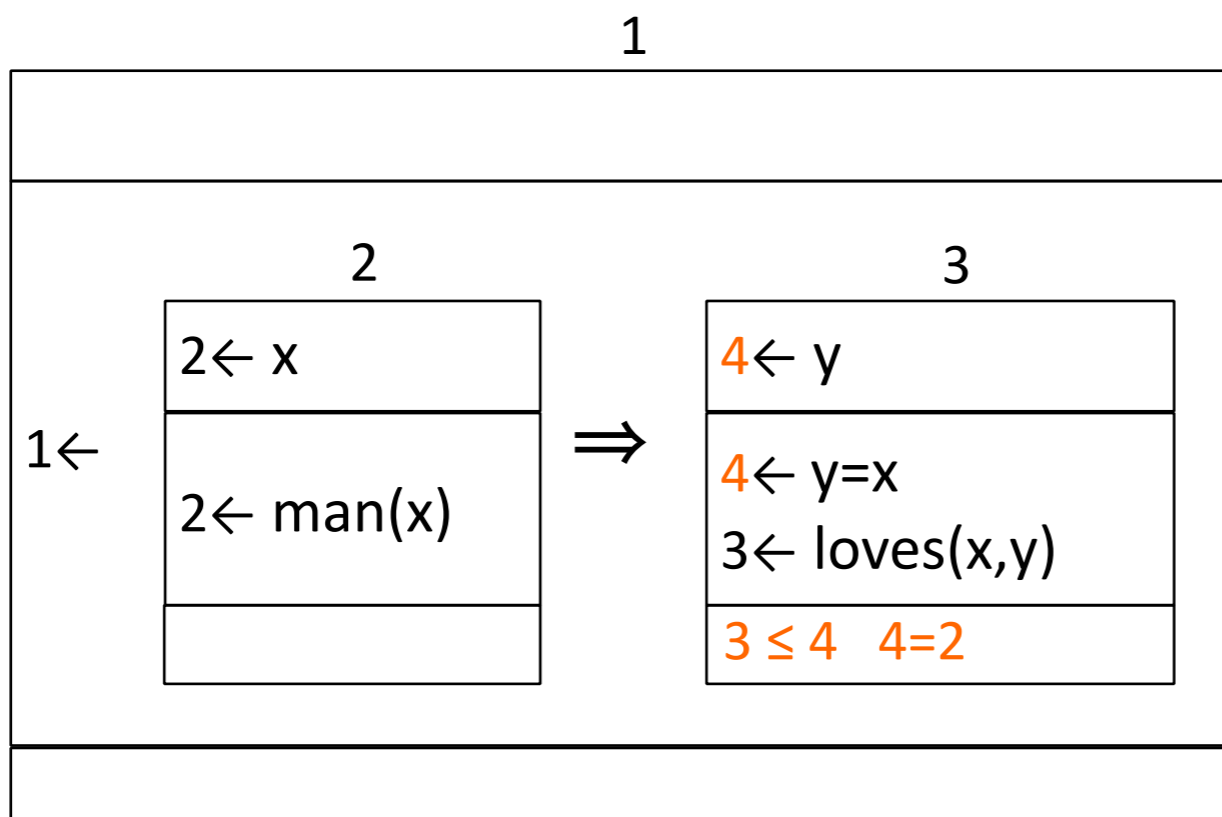
The projection site of unresolved presuppositions is *underspecified*



# Anaphora in PDRT

Anaphoric expressions bind their pointer *and* referent to (the context of) their antecedent.

*Every man loves himself.*

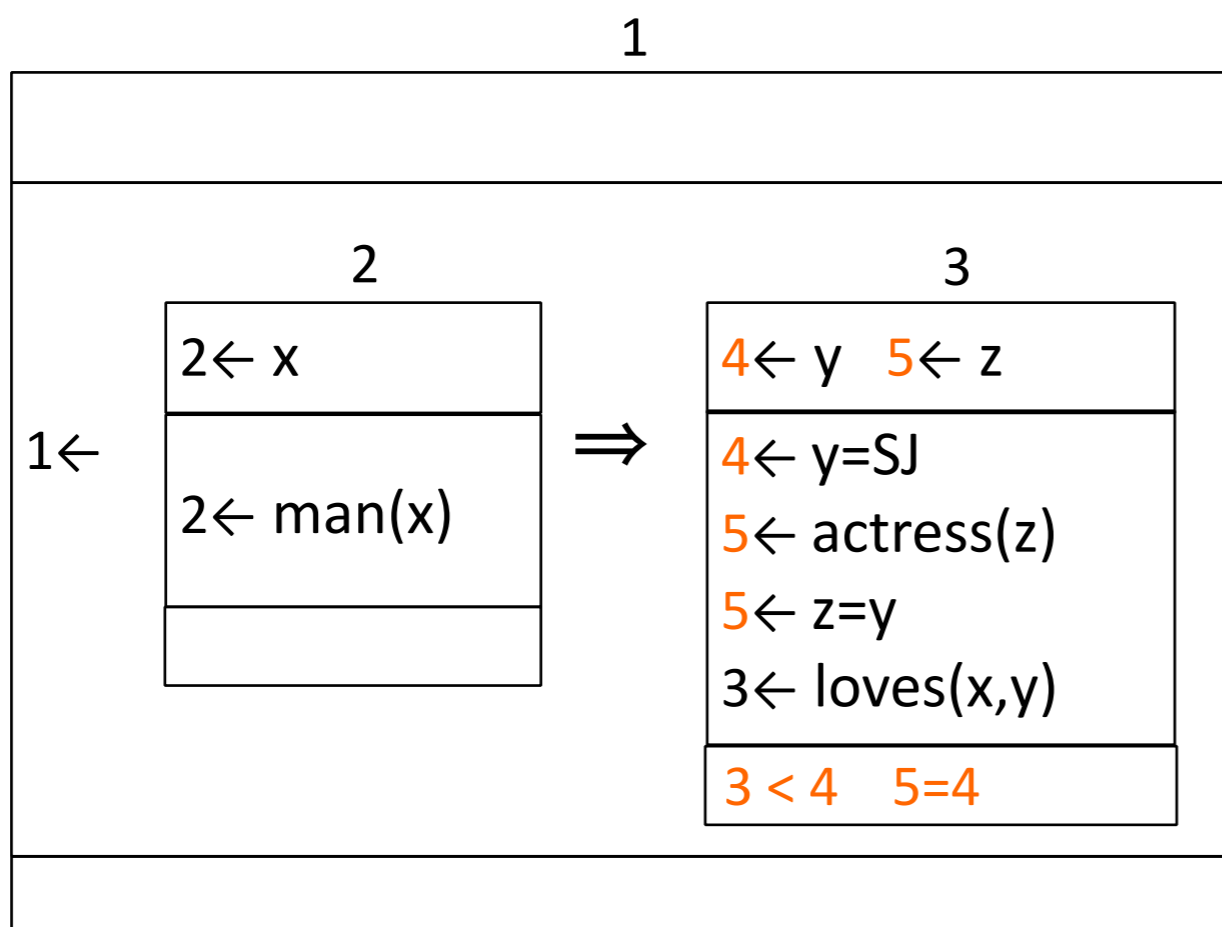




# Conventional implicatures in PDRT

Conventional implicatures are represented as “piggybacking on their projecting anchor”.

*Every man loves Scarlett Johansson, (who is) an actress.*



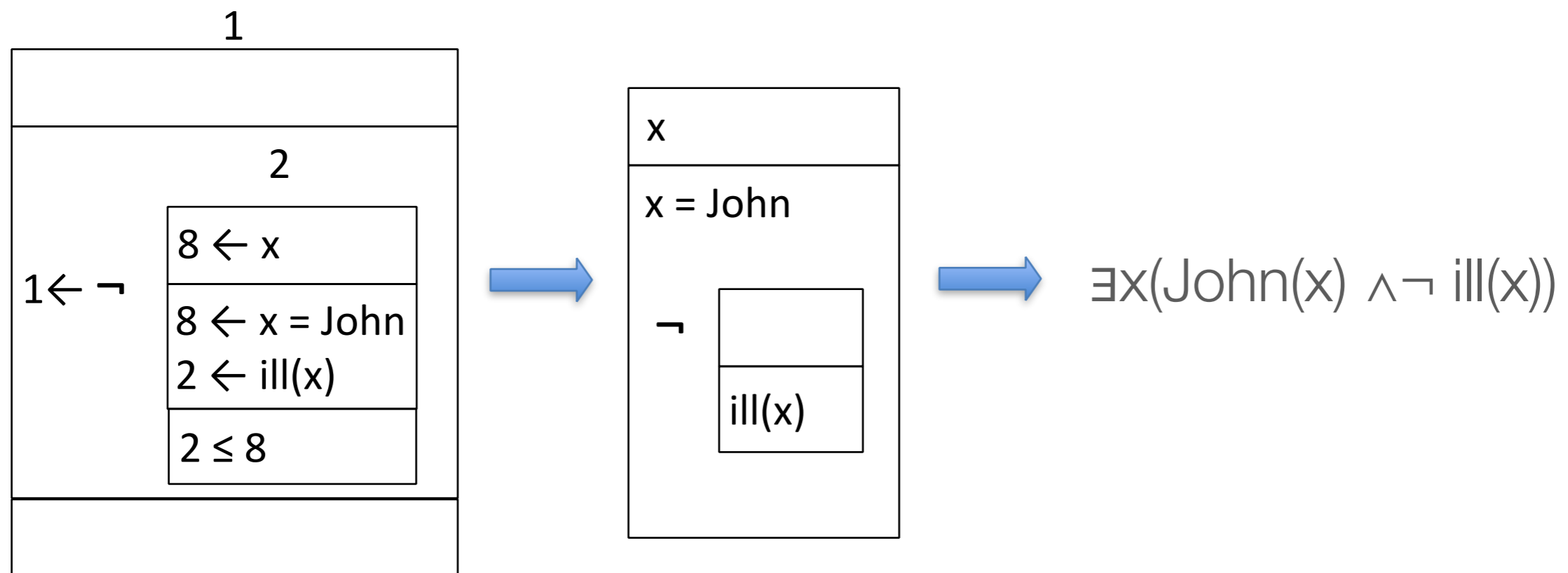
# PDRT versus DRT



PDRSs contain the same information as DRSs **and more!**

This means that we can translate PDRSs into DRSs (and FOL)

*It's not the case that John is ill.*



# Summary PDRT

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- Explicit representation of information structure
- Unified treatment of different types of projection phenomena (presuppositions, anaphora, and conventional implicatures)
- Rich representational structures extend all formal properties of DRT in terms of the accessibility constraints and model-theoretic interpretation
- Projection becomes part of semantic construction; no need for a two-stage resolution procedure

# Formal semantics in the real world

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How to apply and evaluate formal linguistic theories?

⇒ Testing predictions from formal semantic theories using psycholinguistic methods (questionnaires, eye-tracking, EEG)

- Geurts et al (2010); Chemla et al (2011); Florian Schwarz (ed., 2015), ...

⇐ Using implementations of semantic formalisms to perform large-scale computational semantic analyses

- PDRT-Sandbox (Brouwer & Venhuizen, 2013)
- Boxer (Bos, 2008)
- The Groningen Meaning Bank (Basile et al., 2013; Bos et al., 2015)

# Groningen Meaning Bank



Corpus of semantically annotated texts – with (P)DRSs!

k0 : x2 x4 x6 x8 x10 x11 x13 e14 t16 x17 e18 e19 p20

named(x2, u.s., loc)  
ambassador(x2)  
named(x4, vatican, loc)  
to(x2, x4)  
support(x6)  
named(x8, catholic\_church, org)  
of(x10, x8)  
push(x10)  
for(x6, x10)  
more(x11)  
religious(x11)  
freedom(x11)  
named(x13, china, loc)  
in(x11, x13)  
for(x6, x11)  
voice(e14)  
Agent(e14, x2)  
Topic(e14, x6)  
now(t16)  
x17 = t16  
e18 > x17  
e14 > e18  
say(e19)  
Cause(e19, x2)  
Topic(e19, p20)  
p20:  
x23 e25 t16 t26 x28  
named(x23, beijing, loc)  
cooperate(e25)  
Agent(e25, x23)  
openly(e25)  
more(e25)  
now(t16)  
e25 < t26  
t16 < t26  
named(x28, holy\_see, org)  
with(e25, x28)

k29 : x30 x2 e32 p33 t16 t34

ambassador(x2)  
with(x30, x2)  
named(x30, francis\_rooney, per)  
say(e32)  
Cause(e32, x30)  
Topic(e32, p33)  
p33:  
x11 x36 x38 e40 t16 x41 t42 p43  
male(x11)  
named(x36, church, org)  
of(x38, x36)  
mission(x38)  
support(e40)  
Experiencer(e40, x11)  
Stimulus(e40, x38)  
now(t16)  
x41 = t16  
t42 > x41  
e40 > t42  
p43:  
x45 x46 x13 e47  
greater(x45)  
liberty(x45)  
catholic(x46)  
named(x13, china, loc)  
in(x46, x13)  
for(x45, x46)  
secure(e47)  
Cause(e47, x11)  
Theme(e47, x45)  
now(t16)  
e32 < t34  
t34 < t16

k48 : x50 x52 x53 x55 x13 p57 e58 t16 t59

announcement(x50)  
president(x53)  
with(x52, x53)  
named(x52, bush, per)  
of(x55, x52)  
trip(x55)  
named(x13, china, loc)  
where(x13, p57)  
p57:  
x52 x23 p61 e62 t16 t63  
male(x52)  
named(x23, beijing, loc)  
p61:  
x55 x56 x57 x58 x59 e70  
greater(x55)  
x56 < x55  
x57 < x55  
social(x56)  
freedom(x56)  
x58 < x57  
x59 < x57  
political(x58)  
freedom(x58)  
religious(x59)  
freedom(x59)  
allow(e70)  
Agent(e70, x23)  
Theme(e70, x55)  
urge(e62)  
Agent(e62)  
Recipient(e62)  
now(t16)  
e62 < t63  
t63 < t59  
to(x55, x23)  
follow(e58, x55)  
Agent(e58, x55)  
Theme(e58, x55)  
now(t16)  
e58 < t59  
t59 = t16

k71 : x73 e75 p76 t16 x77 e78

named(x73, pope\_benedict, per)  
say(e75)  
Cause(e75, x73)  
Topic(e75, p76)  
p76:  
x73 e80 x81 x13 x82 e83 x84 t16 t85 t16 t86  
male(x73)  
interested(e80)  
theme(e80, x73)  
diplomatic(x81)  
tie(x81)  
named(x13, china, loc)  
x13 = x82  
sever(e83)  
Theme(e83, x82)  
timex(x84, +1951XXXX)  
in(e83, x84)  
now(t16)  
e83 < t85  
t85 < t16  
with(x81, x13)  
re-establishing(e80, x81)  
now(t16)  
e80 < t86  
t86 = t16  
now(t16)  
x77 = t16  
e78 > x77  
e75 > e78

continuation(k0, k29)  
continuation(k29, k48)  
continuation(k48, k71)  
continuation(k71, k87)

# Links

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- Groningen Meaning Bank:  
<http://gmb.let.rug.nl>
- Groningen Meaning Bank Web Demo:  
<http://gmb.let.rug.nl/webdemo/demo.php>