Lecture 8: Dynamic semantics

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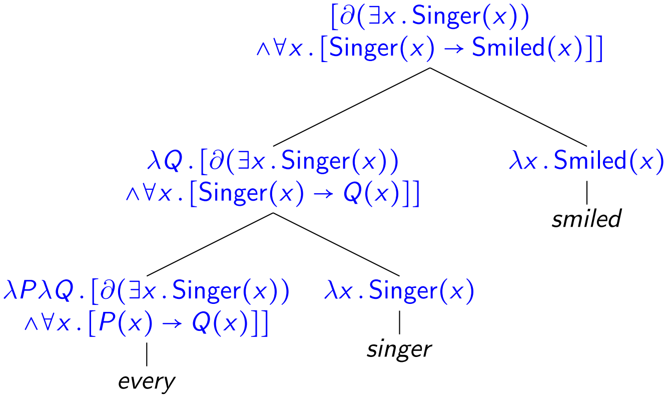
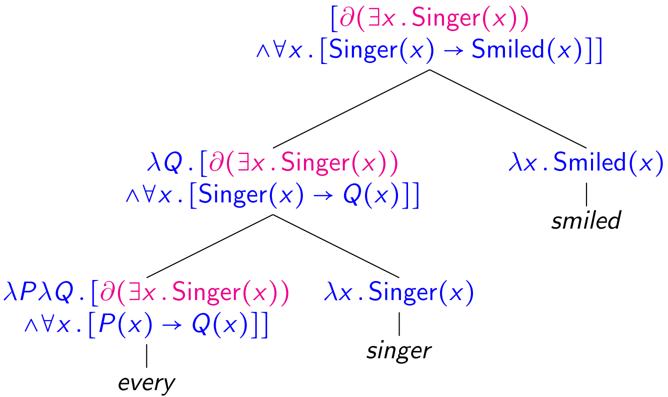
Introduction to Semantics · EGG 2019

Outline

Where we left off yesterday



Where we left off yesterday



Weak Kleene connectives

	$\neg$
T	F
F	T
#	#

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	$\neg$
T	F
F	T
$\#$	$\#$

	∂
T	T
F	$\#$
$\#$	$\#$

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T	F
F	T
#	#

	∂
T	T
F	#
#	#

$\wedge$	T	F	#
T	T	F	#
F	F	F	#
#	#	#	#

Weak Kleene connectives

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T	F
F	T
#	#

	∂
T	T
F	#
#	#

$\wedge$	T	F	#
T	T	F	#
F	F	F	#
#	#	#	#

$\vee$	T	F	#
T	T	T	#
F	T	F	#
#	#	#	#

Weak Kleene connectives

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F	T
#	#

	∂
T	T
F	#
#	#

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T	T	F	#
F	F	F	#
#	#	#	#

$\vee$	T	F	#
T	T	T	#
F	T	F	#
#	#	#	#

$$p \rightarrow q \equiv \neg p \vee q$$

A semantic conception of presupposition

- A **presupposes** B (abbreviation: $A \gg B$) iff:
  Whenever A is true or false, B is true.

Example:

$$[\partial(\exists x.\text{Singer}(x)) \wedge \forall x\,.\,[\text{Singer}(x) \rightarrow \text{Smiled}(x)]] \gg \exists x.\text{Singer}(x)$$

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Cf. the definition of entailment:

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Cf. the definition of entailment:

- A **entails** B iff:
  Whenever A is true, B is true.

So presupposition is a species of entailment on this view.

A pragmatic conception of presupposition

Roughly speaking, the presuppositions of a speaker are the propositions whose truth he takes for granted as part of the background of the conversation. A proposition is presupposed if the speaker is disposed to act as if he assumes or believes that the proposition is true, and as if he assumes or believes that his audience assumes or believes that it is true as well. Presuppositions are what is taken by the speaker to be the common ground of the participants in the conversation, what is treated as their common knowledge or mutual knowledge.

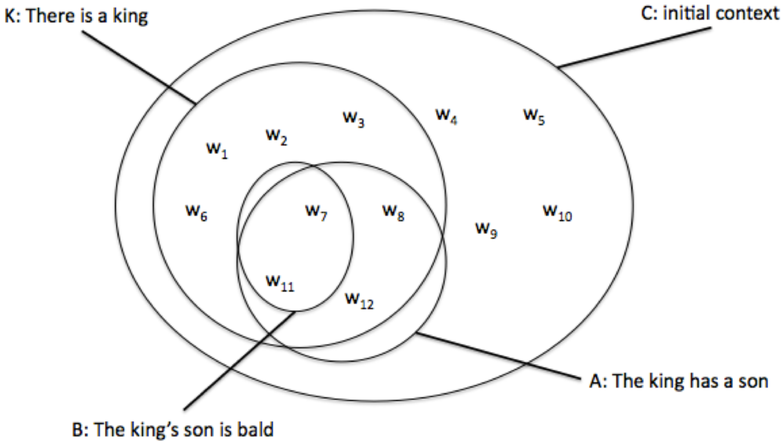
(Stalnaker, 1978)

Presupposition and assertion à la Stalnaker

Stalnaker (1978):

- The **context set** is the set of possible worlds in the common ground.
- A proposition is **presupposed** if it holds in all of the worlds in the context set.
- A (successful) **assertion** shrinks the context set so that it only contains worlds compatible with the proposition expressed.

Example



K: There is a king
C: initial context
w_1
w_2
w_3
w_4
w_5
w_6
w_7
w_8
w_9
w_{10}
w_{11}
w_{12}
A: The king has a son
B: The king's son is bald

Are these notions in conflict?

Karttunen (1973):

> *There is no conflict between the semantic and the pragmatic notions of presupposition. They are related, albeit different notions...*
>
> *However, the results of this investigation suggest to me that the difficulties we face in trying to construct a coherent semantic definition for presupposition are even greater than in the case of the pragmatic notion.*

Projection problem

How can we predict the presuppositions of a complex sentence from the presuppositions of its parts?

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- **Holes**: A **hole** is a predicate which lets all the presuppositions of the complement sentence become presuppositions of the matrix sentence.

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- **Plugs**: A **plug** is a predicate that blocks off all the presuppositions of the complement sentence.
- **Holes**: A **hole** is a predicate which lets all the presuppositions of the complement sentence become presuppositions of the matrix sentence.
- **Filters**: A **filter** is a predicate which, under certain conditions, cancels some of the presuppositions of the complement.

Plugs

(1) Fred stopped beating Zelda.
$\gg$ Fred beat Zelda.

Plugs

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(2) Bill asked Fred to stop beating Zelda.
$\not\gg$ Fred beat Zelda.

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Other **verbs of saying**, or **perfomatives**: *say, mention, tell, ask, promise, warn, request, order, accuse, criticize, blame, ...*

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$\not\gg$ Fred beat Zelda.

Other **verbs of saying**, or **perfomatives**: *say, mention, tell, ask, promise, warn, request, order, accuse, criticize, blame, ...*

(3) Bill believes that Fred stopped beating Zelda.
Does this presuppose that Fred beat Zelda?
Certainly that Bill believes that Fred beat Zelda...

Holes

(4) Fred didn't stop beating Zelda.
$\gg$ Fred beat Zelda.

Holes

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$\gg$ Fred beat Zelda.

(5) Bill forced Fred to stop beating Zelda.
$\gg$ Fred beat Zelda.

Holes

(4) Fred didn't stop beating Zelda.
$\gg$ Fred beat Zelda.

(5) Bill forced Fred to stop beating Zelda.
$\gg$ Fred beat Zelda.

(6) Bill knows that Fred stopped beating Zelda.
$\gg$ Fred beat Zelda.

Filter: Conditionals

(7) Tom's son is bald.
$\gg$ Tom has a son.

Filter: Conditionals

(7) Tom's son is bald.
$\gg$ Tom has a son.

(8) If baldness is hereditary, then Tom's son is bald.
$\gg$ Tom has a son.

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Filter: Conditionals

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(8) If baldness is hereditary, then Tom's son is bald.
$\gg$ Tom has a son.

(9) If Tom has a son, then his son is bald.
$\not\gg$ Tom has a son.

Filtering with conditionals

If Tom has a son then his son is bald

↓ *presupposes*

Tom has a son

Filtering with conditionals

If Tom has a son then his son is bald

equals *presupposes*

Tom has a son

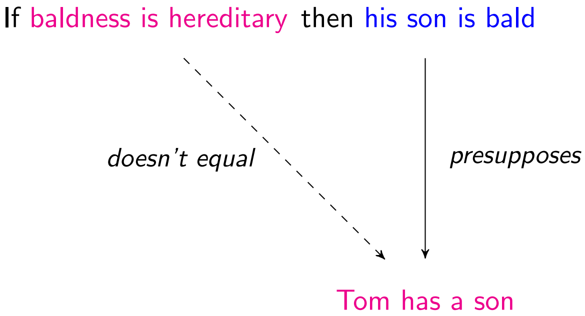
Filtering with conditionals

If baldness is hereditary then his son is bald

↓ *presupposes*

Tom has a son

Filtering with conditionals



Filtering condition for conditionals (first pass)

Let S stand for any sentence of the form

$$\textit{If } A \textit{ then } B$$

- If $A \gg C$, then $S \gg C$.
- If $B \gg C$, then $S \gg C$, unless $A = C$.

Filtering with conditionals

If Fred has managed to kiss Cecilia then Fred will kiss Cecilia again

presupposes

Fred has kissed Cecilia

Filtering with conditionals

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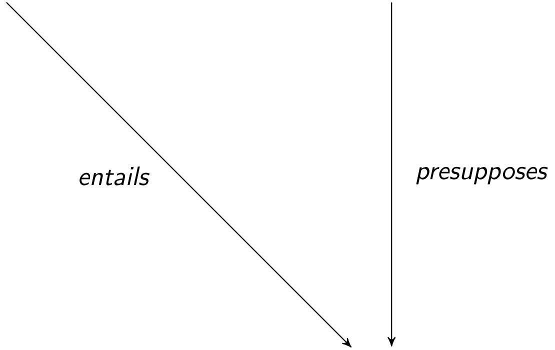

Fred has kissed Cecilia

Filtering condition for conditionals (second pass)

Let S stand for any sentence of the form

If A then B

- If $A \gg C$, then $S \gg C$.
- If $B \gg C$, then $S \gg C$, unless A entails C.

Filtering with disjunction

Either Harry isn't married or Harry's spouse is no longer with him

presupposes

Harry has a spouse

Filtering with disjunction

Either Harry isn't married or Harry's spouse is no longer with him

negation entails

presupposes

Harry has a spouse

Filtering condition for disjunctions

Let S stand for any sentence of the form

Either A or B

- If $A \gg C$, then $S \gg C$.
- If $B \gg C$, then $S \gg C$, unless the negation of A entails C.

Filter: Conjunctions

(10) Only Ann smokes
$\gg$ Ann smokes.

(11) Bill doesn't smoke, and (in fact) only Ann smokes.
$\gg$ Ann smokes.

(12) Ann smokes heavily, but only Ann smokes.
$\not\gg$ Ann smokes.

Filter: Conjunctions

(10) Only Ann smokes
$\gg$ Ann smokes.

(11) Bill doesn't smoke, and (in fact) only Ann smokes.
$\gg$ Ann smokes.

(12) Ann smokes heavily, but only Ann smokes.
$\not\gg$ Ann smokes.

Note: that Ann smokes is still *entailed*, but it is not presupposed:

(13) If Ann smokes heavily, but only Ann smokes, then exactly one ashtray will suffice.

Filtering with conjunctions

Ann smokes heavily and only Ann smokes

↓ *presupposes*

Ann smokes

Filtering with conjunctions

Ann smokes heavily and only Ann smokes

entails (Ann smokes heavily → Ann smokes)

presupposes (only Ann smokes → Ann smokes)

Ann smokes

Filtering condition for conjunctions

Let S stand for any sentence of the form

$$A \textit{ and } B$$

- If $A \gg C$, then $S \gg C$.
- If $B \gg C$, then $S \gg C$, unless A entails C.

Filtering with disjunction

Either Geraldine isn't a Mormon or she no longer wears her holy underwear

↓ *presupposes*

Geraldine has holy underwear

Filtering with disjunction

Either Geraldine isn't a Mormon or she no longer wears her holy underwear

negation doesn't entail

presupposes

Geraldine has holy underwear

Fact: Mormons wear holy underwear.

Filtering with disjunction

Either Geraldine isn't a Mormon or she no longer wears her holy underwear

negation + knowledge entails

presupposes

Geraldine has holy underwear

Filtering condition for disjunctions

Let S stand for any sentence of the form

Either A or B

- If $A \gg C$, then $S \gg C$.
- If $B \gg C$, then $S \gg C$, unless the negation of A, combined with world knowledge W entails C.

Summary

In context C:

- S = 'If A then B'
  If $B \gg P$ then $S \gg P$ unless:
  $C + A$ entails P.
- S = 'A and B'
  If $B \gg P$ then $S \gg P$ unless:
  $C + A$ entails P.
- S = 'A or B'
  If $B \gg P$ then $S \gg P$ unless:
  $C + \neg A$ entails P.

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Local contexts

Karttunen (1974):
Preuppositions must be satisfied in their **local context**.

	Local context for A	Local context for B
'If A then B'	C	$C + A$
'A and B'	C	$C + A$
'A or B'	C	$C + \neg A$

Another way to look at it

In what contexts are the presuppositions of a sentence satisfied?

Context C **satisfies-the-presuppositions-of** A just in case C entails all of the basic presuppositions of A.

Context C **satisfies-the-presuppositions-of** 'if A then B' just in case $C + A$ entails all of the basic presuppositions of B.

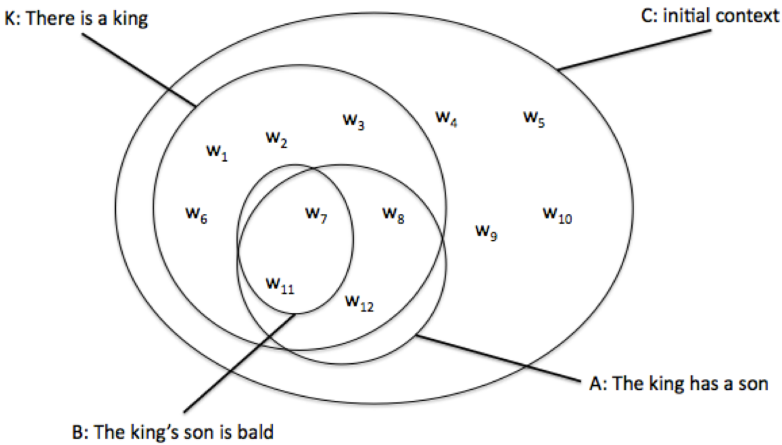
Another way to look at it

In what contexts are the presuppositions of a sentence satisfied?

Context C **admits** A just in case C entails all of the basic presuppositions of A.

Context C **admits** 'if A then B' just in case $C + A$ entails all of the basic presuppositions of B.

Does C admit *If the king has a son, his son is bald*?



Karttunen's conclusion

In this paper I have argued that a theory of presuppositions is best looked upon as a theory of constraints on successive contexts in a fully explicit discourse in which the current conversational context satisfies-the-presuppositions-of, or let us say from now on, admits the next sentence that increments it.

(Karttunen, 1974)

Outline

Indefinites as existential quantifiers (Russell)

(14) I found [a cat].
$\exists x[\text{Cat}(x) \wedge \text{Found}(\text{i}, x)]$

(15) I didn't find [a cat].
$\neg\exists x[\text{Cat}(x) \wedge \text{Found}(\text{i}, x)]$

Anaphora across sentence boundaries

(16) I found [a cat]$_i$. Then it$_i$ ran away.

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Anaphora across sentence boundaries

(16) I found [a cat]$_i$. Then it$_i$ ran away.

$\exists x[\mathrm{Cat}(x) \wedge \mathrm{Found}(\mathrm{i}, x) \wedge \mathrm{RanAway}(x)]$ ✓

This analysis was proposed by Geach [1962, 126ff]. It implies as a general moral that the proper unit for the semantic interpretation of natural language is not the individual sentence, but the text. [The formula] provides the truth condition for the bisentential text as a whole, but it fails to specify, and apparently even precludes specifying, a truth condition for the [first] sentence.'

(Heim, 1982, p. 13)

Against assigning truth conditions to whole discourses only

(17) A: A dog came in.
B: What did it do next?

Karttunen's *discourse referents*

- Karttunen (1976): "the appearance of an indefinite noun phrase establishes a *discourse referent* just in case it justifies the occurrence of a coreferential pronoun or a definite noun phrase later in the text."

Karttunen's *discourse referents*

- Karttunen (1976): "the appearance of an indefinite noun phrase establishes a *discourse referent* just in case it justifies the occurrence of a coreferential pronoun or a definite noun phrase later in the text."
- This definition allows the study of coreference to proceed "independently of any general theory of extralinguistic reference" (p. 367).

Discourse referents are mortal

(18) Bill didn't find [a cat]$_i$ and keep it$_i$. *It$_i$ is black.

The "life span" of the discourse referent is limited within the scope of negation.

Lifespan differences

(19) A_i dog came in. It_i lay down under the table.

(20) *$Every_i$ dog came in. It_i lay down under the table.

(21) *No_i dog came in. It_i lay down under the table.

(From Heim's (1982) dissertation)

Donkey sentences

(22) If [a cat]$_i$ purrs, it$_i$ is happy.

Donkey sentences

(22) If [a cat]$_i$ purrs, it$_i$ is happy.

$[\exists x[\text{Cat}(x) \wedge \text{Purrs}(x)] \rightarrow \text{Happy}(x)]$ ✗

Donkey sentences

(22) If [a cat]$_i$ purrs, it$_i$ is happy.

$\exists x[[\text{Cat}(x) \wedge \text{Purrs}(x)] \rightarrow \text{Happy}(x)]$ ✗

Donkey sentences

(22) If [a cat]$_i$ purrs, it$_i$ is happy.

$\forall x[[\text{Cat}(x) \wedge \text{Purrs}(x)] \rightarrow \text{Happy}(x)]$ ✓

More donkey sentences

Donkey sentence: A sentence that contains an indefinite NP inside an if-clause or relative clause, and a pronoun which is outside that if-clause or relative clause, but is anaphorically related to the indefinite NPs.

(23) If someone is in Athens, he is not in Rhodes.

(24) If a man owns a donkey, he beats it.

(25) Every man who owns a donkey beats it.

Geach's view

Geach: Indefinites just get a wide-scope universal interpretation under such circumstances.

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Under what circumstances, exactly? What on earth do relative clauses have to do with *if*-clauses?

Moreover, it doesn't work with just any relative clause:

(26) A friend of mine who owns a donkey beats it.

No wide-scope universal reading here.

The non-quantificational analysis of indefinites

Heim's idea: Indefinites have no quantificational force of their own, but are like variables, which may get bound by whatever quantifier there is to bind them.

Adaptability of indefinites

(27) In most cases, if a table has lasted for 50 years, it will last for 50 more.
$\Longleftrightarrow$ Most tables that have lasted for 50 years will last for another 50.

(28) Sometimes, if a cat falls from the fifth floor, it survives.
$\Longleftrightarrow$ Some cats that fall from the fifth floor survive.

i

(29) If a person falls from the fifth floor, he or she will very rarely survive.
$\Longleftrightarrow$ Very few people that fall from the fifth floor survive.

Dynamic interpretation

- As a sentence or text unfolds, we construct a representation of the text using discourse referents.
- A pronoun picks out a discourse referent.
- An indefinite contributes a new referent, but has no quantificational force of its own. The quantificational force arises from the indefinite's environment.

File-card semantics

A woman was bitten by a dog.

1	2
woman bitten by 2	dog bit 1

File-card semantics

A woman was bitten by a dog.
She hit him with a paddle.

1	2	3
woman bitten by 2 hit 2 with 3	dog bit 1 was hit by 1 with 3	paddle used by 1 to hit 2

File-card semantics

A woman was bitten by a dog.
She hit him with a paddle.
It broke in half.

1	2	3
woman bitten by 2 hit 2 with 3	dog bit 1 was hit by 1 with 3	paddle used by 1 to hit 2 broke in half

File-card semantics

A woman was bitten by a dog.
She hit him with a paddle.
It broke in half.
The dog ran away.

1	2	3
woman bitten by 2 hit 2 with 3	dog bit 1 was hit by 1 with 3 ran away	paddle used by 1 to hit 2 broke in half

Satisfaction and truth of files

Heim (1982): In order to establish the truth of a file, we must find a sequence of individuals that satisfies it.

A sequence of individuals satisfies a file (in a possible world) if the first individual in the sequence fits the description on card number 1 in the file (according to what is true in the world), etc.

A file is true (a.k.a. satisfiable) in a possible world iff it has there is a sequence that satisfies it in that world.

Example

$F =$

1	2	3
woman bitten by 2 hit 2 with 3	dog bit 1 was hit by 1 with 3 ran away	paddle used by 1 to hit 2 broke in half

A sequence $\langle a_1, a_2, a_3 \rangle$ satsifies F in world w iff:

- a_1 is a woman in w
- a_2 is a dog in w
- a_3 is a paddle in w
- a_2 bit a_1 in w
- a_1 hit a_2 with a_3 in w
- a_3 broke in half in w
- a_2 ran away in w

Example

1	2	3
woman bitten by 2 hit 2 with 3	dog bit 1 was hit by 1 with 3 ran away	paddle used by 1 to hit 2 broke in half

World 1	**World 2**
Pug bit Joan	Fido bit Joan
Joan hit Pug with Paddle	Joan hit Fido with Paddle
Paddle broke in half	Paddle broke in half
Pug ran away	Fido ran away

	Sequence 1	**Sequence 2**	**Sequence 3**
1	Joan	Pug	Sue
2	Fido	Pug	Pug
3	Paddle	Paddle	Paddle

Example

Informal representation of file:

[1: woman, bitten by 2]
[2: dog, bit 1]

The same file as a set of world-sequence pairs:

$$\{\langle w, a\rangle : \begin{array}{l} a(1) \text{ is a woman in } w \\ a(1) \text{ was bitten by } a(2) \text{ in } w \\ a(2) \text{ bit } a(1) \text{ in } w \\ a(2) \text{ is a dog in } w\} \end{array}$$

Files and common ground

Stalnaker: common ground = context set (possible worlds compatable with what the speaker presupposes)

Heim: common ground = "file" of the context. A file is not a set of possible worlds but it *determines* a set of possible worlds.

File Change Semantics

The meaning of a sentence will be a *file change potential*.

$$F + p = F'$$

means: The result of updating file F with logical form p is F'.

Novelty-Familiarity Condition

For every indefinite, start a new card; for every definite, update a suitable old card.

Discourse Representation Structures

Kind of like files with one big filecard.

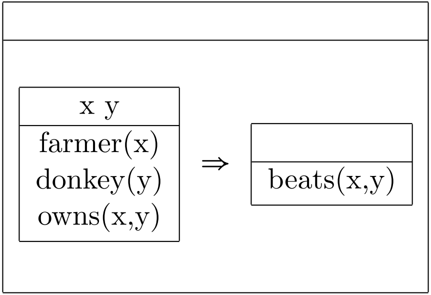
A farmer owns a donkey

x y
farmer(x) donkey(y) owns(x,y)

$$\sim \exists x \exists y[\text{Farmer}(x) \wedge \text{Donkey}(y) \ \wedge \ \text{Owns}(x, y)]$$

Conditionals in DRT

If a farmer owns a donkey, then he beats it



$\leadsto \forall x \forall y [[\text{Farmer}(x) \wedge \text{Donkey}(y) \ \wedge \ \text{Owns}(x, y)] \rightarrow \text{Beats}(x, y)]$

Definition of DRS

- Syntax: A DRS K consists of a pair $\langle U_K, \mathrm{Con}_K \rangle$
- U_K is a subset of *discourse referents* drawn from a set R.
- Con_K is a set of conditions, of the form $x = y$, $\nu(x)$, $\neg K$, $K_1 \rightarrow K_2$, etc.

Truth

Informally, a DRS K is true in a model M if there is a way of associating individuals in the universe of M with the discourse referents of K so that each of the conditions in K is verified in M.

An embedding is a function that maps discourse referents to individuals (like an assignment or sequence). More formally, a DRS is true in a model if there is an embedding that verifies it.

Verifying a DRS: Example

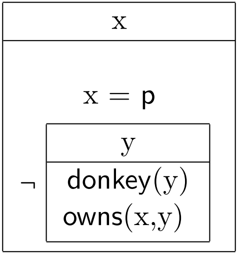
x y
farmer(x) donkey(y) owns(x,y)

A function g verifies this DRS with respect to model M if:

- the domain of g contains at least x and y
- according to M it is the case that $g(x)$ is a farmer, $g(y)$ is a donkey, and $g(x)$ owns $g(y)$.

Verifying a negated condition

Pedro does not own a donkey.



Intuitively, this should be true if and only if there is no way to assign a value to x such that x is Pedro, and there is some individual y such that y is a donkey and x owns y.

Auxiliary notions

- **Compatibility**
  We say that two functions f and g are **compatible** if they assign the same values to those arguments for which they are both defined. I.e., f and g are compatible if for any a which belongs to the domain of both f and g:

  $$f(a) = g(a)$$

- **Extension**
  g is called an **extension** of f if g is compatible with f and the domain of g includes the domain of f.

Verifying negated conditions

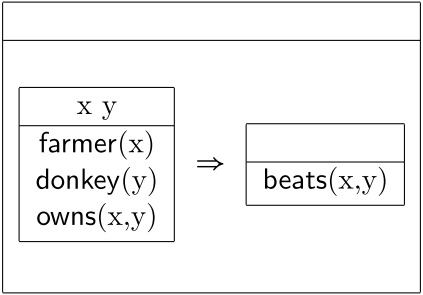
Pedro does not own a donkey.

$$\begin{array}{|c|}\hline x \\ \hline \\ x = \mathsf{p} \\ \neg \begin{array}{|c|}\hline y \\ \hline \mathsf{donkey}(y) \\ \mathsf{owns}(x,y) \\ \hline \end{array} \\ \hline \end{array}$$

A function f verifies the negated condition iff:

- f verifies $x = \mathsf{p}$, and
- There is no function g such that: (i) g extends f, and (ii) g verifies $\begin{array}{|c|}\hline y \\ \hline \mathsf{donkey}(y) \\ \mathsf{owns}(x,y) \\ \hline \end{array}$

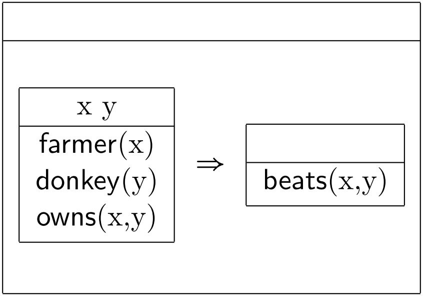
Verifying conditional conditions



To verify a conditional statement:

1. What kind of embedding would be necessary to verify the antecedent?
2. Must the consequent hold, given that embedding?

Verifying conditional conditions



Verification of a conditional condition

An embedding function f verifies a condition of the form $K \Rightarrow K'$ with respect to model M if and only if: For all extensions g of f that verify K, there is an extension h of g that verifies K'.

Consequences

So:

- Unembedded indefinites get existential interpretation
- Indefinites acquire universal import in conditionals
- Indefinites can bind from antecedent to consequent

Semantics of Discourse Representation Structures

Embedding f verifies DRS K in model M iff:

$$M, f \models K \quad \textit{iff} \quad M, f \models c \text{ for each } c \in \mathrm{Con}_K$$
$$\text{where the domain of } f \text{ includes } U_K.$$

Verification of conditions:

$$\begin{aligned}
M, f \models x = y \quad & \textit{iff} \quad f(x) = f(y) \\
M, f \models \nu(x) \quad & \textit{iff} \quad f(x) \in I(\nu) \\
M, f \models \neg K \quad & \textit{iff} \quad \text{for no } g \geq_{U_K} f, M, g \models K \\
M, f \models K_1 \Rightarrow K_2 \quad & \textit{iff} \quad \forall g \geq_{U_{K_1}} f, \text{if } M, g \models K_1 \\
& \qquad \text{then } \exists h \geq_{U_{K_2}} g, M, h \models K_2
\end{aligned}$$

where $f \geq_r g$ means "f *extends* g, and $\mathrm{Dom}(f) = \mathrm{Dom}(g) \cup r$".

Semantics of Discourse Representation Structures

Embedding f verifies DRS K in model M iff:

$$M, f \vDash K \quad \textit{iff} \quad M, f \vDash c \text{ for each } c \in \text{Con}_K$$
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Verification of conditions:

$$\begin{aligned}
M, f \vDash x = y \quad & \textit{iff} \quad f(x) = f(y) \\
M, f \vDash \nu(x) \quad & \textit{iff} \quad f(x) \in I(\nu) \\
M, f \vDash \neg K \quad & \textit{iff} \quad \text{for no } g \geq_{U_K} f, M, g \vDash K \\
M, f \vDash K_1 \Rightarrow K_2 \quad & \textit{iff} \quad \forall g \geq_{U_{K_1}} f, \text{if } M, g \vDash K_1 \\
& \qquad \text{then } \exists h \geq_{U_{K_2}} g, M, h \vDash K_2
\end{aligned}$$

where $f \geq_r g$ means "f *extends* g, and $\text{Dom}(f) = \text{Dom}(g) \cup r$".

Summary

In dynamic semantics, meanings are context change potentials.

Dynamic semantics provides:

- An insightful approach to the projection problem;
- An account of the anaphoric potential of indefinites, especially in donkey sentences.

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