Semantic Theory
week 8 – Dynamic Semantics

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Context theory

Natural-language expressions can vary their meaning with context:

- *I, you, here, this, now,* …

Idea:

- Model contexts as vectors: sequences of semantically relevant context data with fixed arity.
- Model meanings as functions from contexts to denotations – more specifically, as functions from specific context components to denotations.

An Example

- Context $c = \langle a, b, l, t, r \rangle$
  - *a* speaker
  - *b* addressee
  - *l* utterance location
  - *t* utterance time
  - *r* referred object

$$[\![I]\!]^{M,g,c} = utt(c) = a$$

$$[\![you]\!]^{M,g,c} = adr(c) = b$$

$$[\![here]\!]^{M,g,c} = loc(c) = l$$

$$[\![now]\!]^{M,g,c} = time(c) = t$$

$$[\![this]\!]^{M,g,c} = ref(c) = r$$

Type-theoretic context semantics

Model structure: $M = \langle U, C, V \rangle$, where U is the universe, C is the context set, and V is value assignment function that assigns non-logical constants functions from contexts to denotations of appropriate type.

Interpretation:

- $[\![\alpha]\!]^{M,g,c} = V(\alpha)(c)$, if α is a non-logical constant
- $[\![\alpha]\!]^{M,g,c} = g(\alpha)$, if α is a variable
- $[\![\alpha(\beta)]\!]^{M,g,c} = [\![\alpha]\!]^{M,g,c}([\![\beta]\!]^{M,g,c})$
- etc.

An example

I am reading this book ⇒ read'(this-book')(I')

$[\![\text{read'(this-book')(I')}]\!]^{M,g,c} = 1$

iff $[\![\text{read'}]\!]^{M,g,c}([\![\text{this-book'}]\!]^{M,g,c})([\![\text{I'}]\!]^{M,g,c}) = 1$

iff V(read')(ref(c))(utt(c)) = 1

Context-invariant expressions are constant functions:

V(read')(c) = V(read')(c') for all c, c' $\in$ C

Context-dependent expressions

Deictic expressions depend on the physical utterance situation:

- *I, you, now, here, this, …*

Anaphoric expressions refer to the linguistic context / previous discourse:

- *he, she, it, then, …*

But there is more ...

More context-dependent expressions

Context dependence is a pervasive property of natural language:

(1) *Every student must be familiar with the basic properties of first-order logic.*

(2) *It is hot and sunny everywhere.*

(3) *John always is late.*

(4) *Bill has bought an expensive car.*

(5) *Another one, please!*

(6) *The student is working.*

Type-theory is too limited to account for this amount of context-dependence

Another problem for traditional type theory

Indefinite noun phrases and conditionals interact strangely…

If a farmer owns a donkey, he ~~beats~~ feeds it.

(1) $\exists x \exists y[\text{farmer}(x) \wedge \text{donkey}(y) \wedge \text{owns}(x,y)] \rightarrow \text{feeds}(x,y)$

→ not closed (x and y occur free)

(2) $\exists x \exists y[\text{farmer}(x) \wedge \text{donkey}(y) \wedge \text{owns}(x,y) \rightarrow \text{feeds}(x,y)]$

→ wrong truth conditions (much too weak)

(3) $\forall x \forall y[\text{farmer}(x) \wedge \text{donkey}(y) \wedge \text{owns}(x,y) \rightarrow \text{feeds}(x,y)]$

→ correct, but how can it be derived compositionally?

Geach, 1962

What are indefinites?

Option I: Existential quantifiers? (cf. Russell, 1919)

No: donkey sentences

Option II: Universal quantifiers?

No: (1) a. A dog came in. It is pretty.

b. Every dog came in. # It is pretty.

Option III: Ambiguous?

Meanwhile at the philosophy department…

What is meaning?

- Truth-conditions vs. context-change
- Sentence vs. discourse
- Semantics vs. pragmatics

A new perspective on meaning

Dynamic Semantics:

I. Basic semantic value: ~~*truth conditions*~~ → context-change potential

II. (In)definite NPs are ~~*quantificational*~~ → variables

III. Existential quantification over ~~*sentence*~~ → discourse

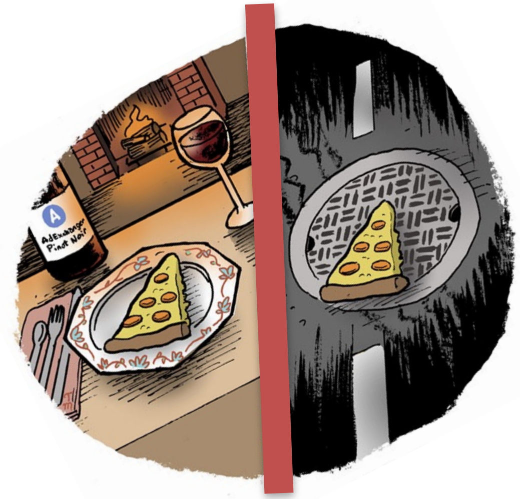
IV. Quantification is ~~*selective*~~ → unselective

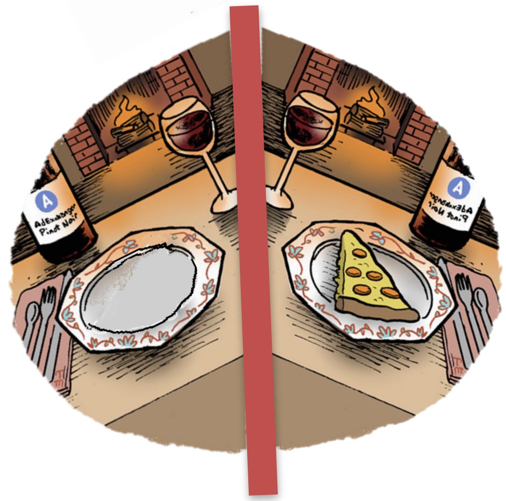
I. Context-change potential

Context ⟺ meaning

⟹ Context changes meaning

⟸ Meaning changes context





In dynamic semantics, the meaning of an expression is the effect it has on its context

N.B. This is a *generalisation* rather than an *alternative* to classical truth-conditional semantics

II/III. Discourse variables & quantification

"Division of labor" between definite and indefinite NPs:

- Indefinite NPs introduce discourse referents, which can serve as antecedents for anaphoric reference.
- Definite NPs refer to "old" or "familiar" discourse referents (which are already part of the meaning representation).

(1) *A dog came in. It barked.*

$dog(x) \wedge came\text{-}in(x) \wedge barked\ (x)$

… is true iff there is a value for x which verifies the conditions.

IV. Unselective quantification

Every | farmer who owns a donkey | feeds it

quantifier | restriction | nuclear scope

… is true iff **for all** values of x and y:

farmer(x) ∧ donkey(y) ∧ owns(x,y) => feeds(x,y)

Quantification is restricted to those individuals who satisfy the restriction (unselectively, i.e., all free variables are bound).

Great minds..

Hans Kamp

Discourse Representation Theory (DRT)

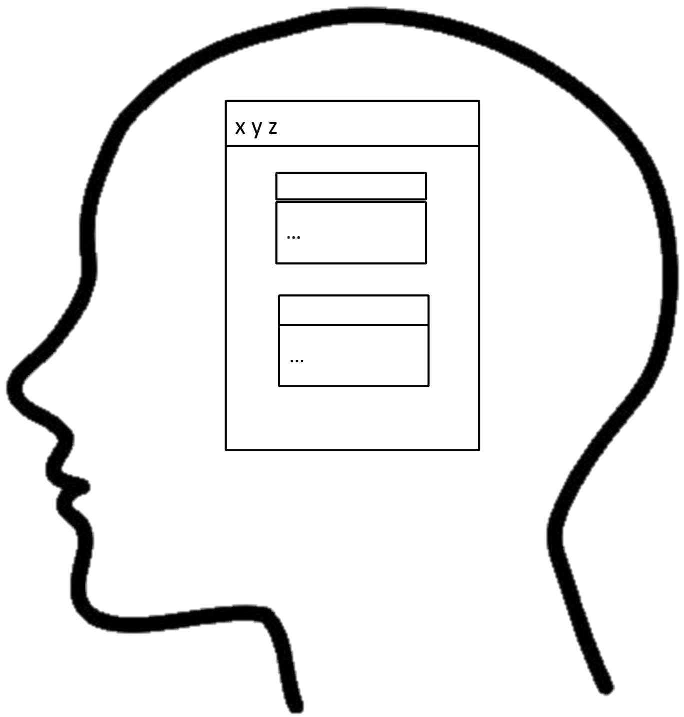
Irene Heim

File Change Semantics (FCS)

Discourse Representation Theory

Mentalist and representationalist theory of the interpretation of discourse

- Discourse Representation Structures
- Construction procedure for DRSs
- Model-theoretic interpretation



(Kamp, 1981; Kamp & Reyle, 1993)

Basic features of DRT

- DRT models linguistic meaning as anaphoric potential (through DRS construction) plus truth conditions (through model embedding).

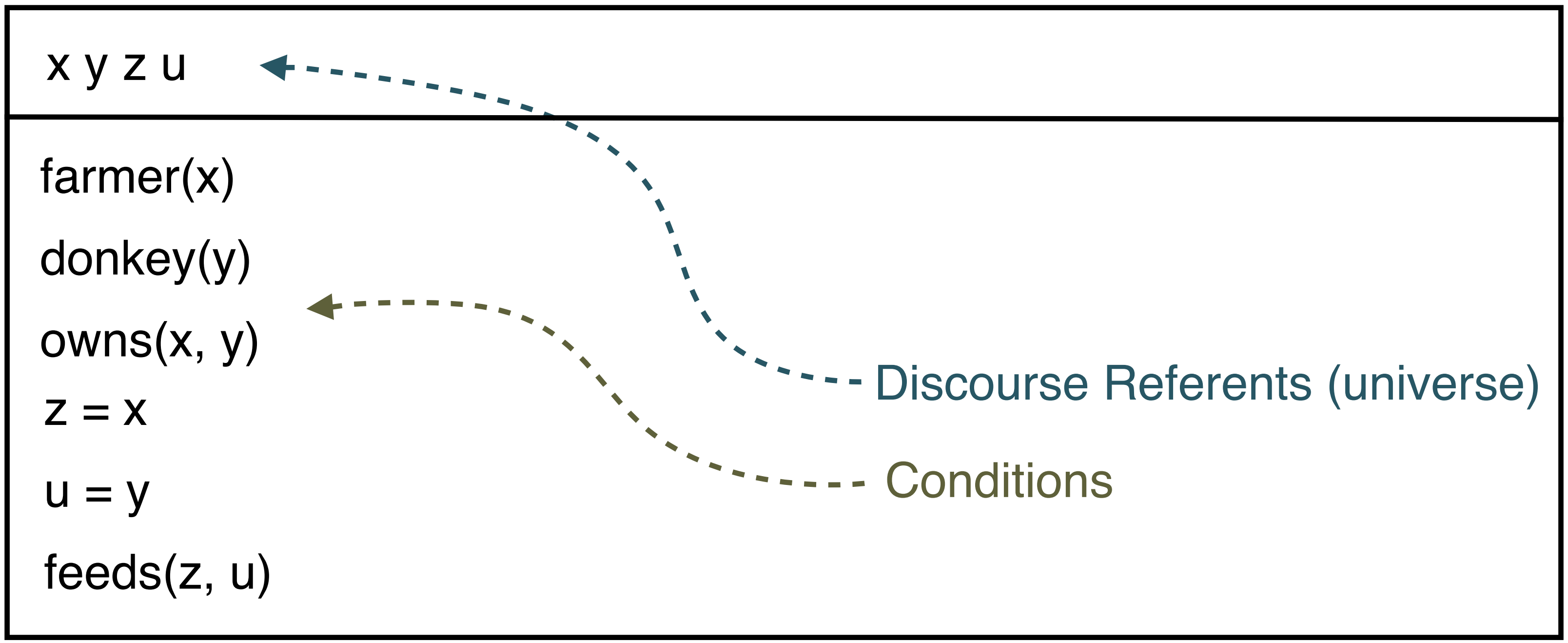
- In particular, DRT explains the ambivalent character of indefinite noun phrases:

  Expressions that introduce new reference objects into the context, and are truth conditionally equivalent to existential quantifiers.

Indefinites and anaphora in DRT

A context is represented as a Discourse Representation Structure (DRS) consisting of a set of referents and a set of conditions

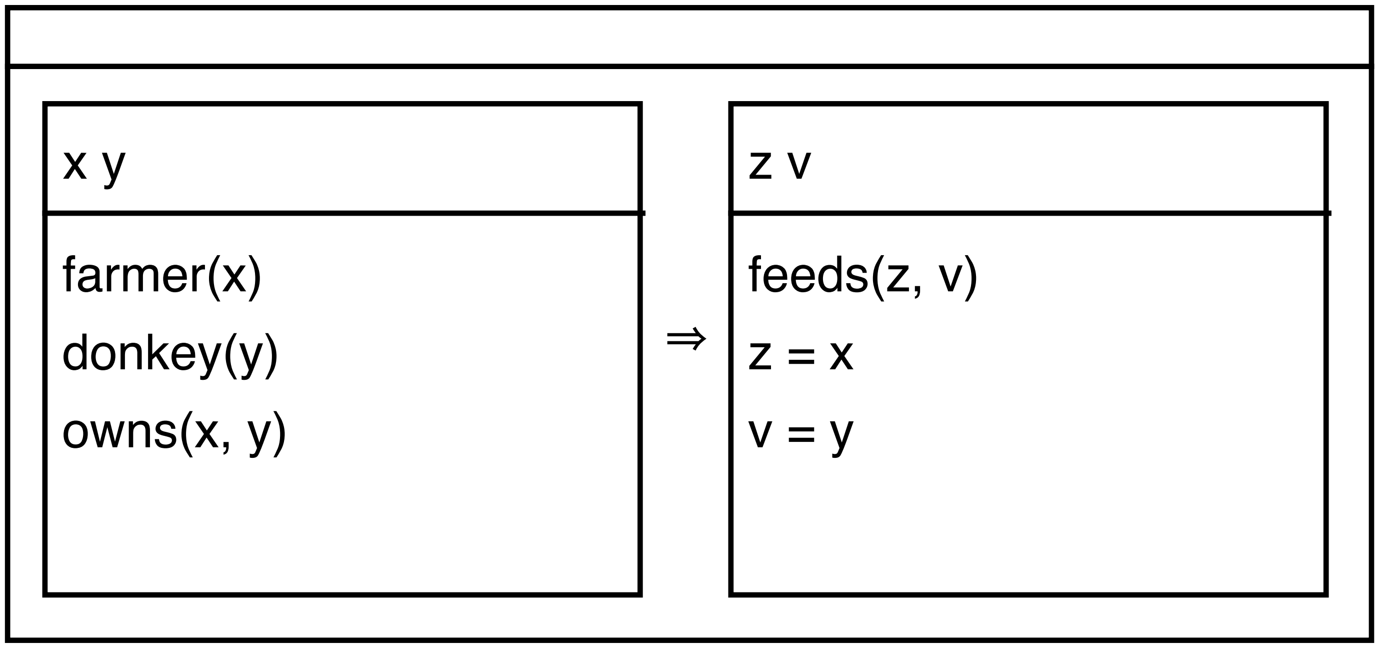
A farmer owns a donkey. He feeds it.



Donkey sentences in DRT

Unselective quantification is achieved by embedded contexts

If a farmer owns a donkey, he feeds it.



DRS Syntax

A discourse representation structure (DRS) K is a pair $\langle U_K, C_K \rangle$, where:

- $U_K \subseteq U_D$ and U_D is a set of discourse referents, and
- C_K is a set of well-formed DRS conditions

Well-formed DRS conditions:

	where:
• $R(u_1, \ldots, u_n)$	R is an n-place relation, $u_i \in U_D$
• $u = v$	$u, v \in U_D$
• $u = a$	$u \in U_D$, a is a constant
• $\neg K_1$	K_1 is a DRS
• $K_1 \Rightarrow K_2$	K_1 and K_2 are DRSs
• $K_1 \vee K_2$	K_1 and K_2 are DRSs