Semantic Theory

Week 7: 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.

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Defining a context vector

- Context $c = \langle a, b, l, t, r \rangle$

  - a speaker

  - b addressee

  - l utterance location

  - t utterance time

  - r referred object

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

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

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

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

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

Type-theoretic context semantics
First try

Model structure: M = ⟨U, C, V⟩, 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:

- $\llbracket α \rrbracket^{M,g,c} = V(α)(c)$, if α is a non-logical constant

- $\llbracket α \rrbracket^{M,g,c} = g(α)$, if α is a variable

- $\llbracket α(β) \rrbracket^{M,g,c} = \llbracket α \rrbracket^{M,g,c}(\llbracket β \rrbracket^{M,g,c})$

- etc.

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Type-theoretic context semantics

An example

I am reading this book $\Rightarrow$ read'(this-book')(I')

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

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

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Another problem for traditional type theory

Compositional derivation of "donkey sentences"

Indefinite noun phrases and conditionals interact strangely…

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

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

         ➡ **not closed (x and y occur free)**

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

         ➡ **wrong truth conditions (much too weak)**

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

         ➡ **correct, but how can it be derived compositionally?**
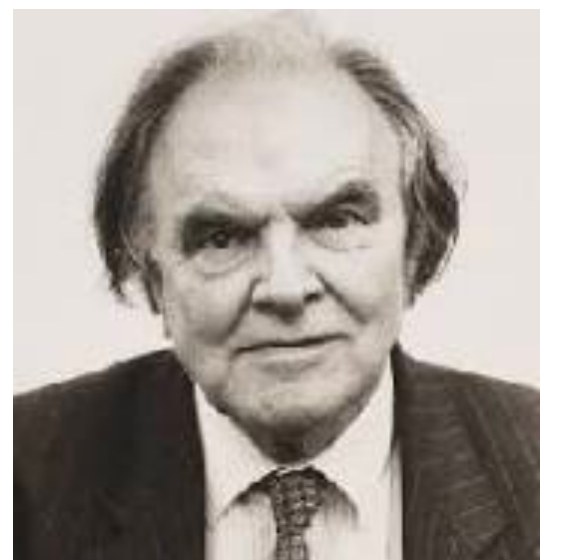
Peter Geach,
1916 - 2013

What are indefinites?

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

No: donkey sentences

Option II: Universal quantifiers?

No: a. A dog came in. It is pretty.

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

Option III: Ambiguous?

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Meanwhile at the philosophy department…

Asking the big questions

What is meaning?

- Truth-conditions vs. context-change

- Sentence vs. discourse

- Semantics vs. pragmatics

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A new perspective on meaning

Truth-conditional semantics ➡️ **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
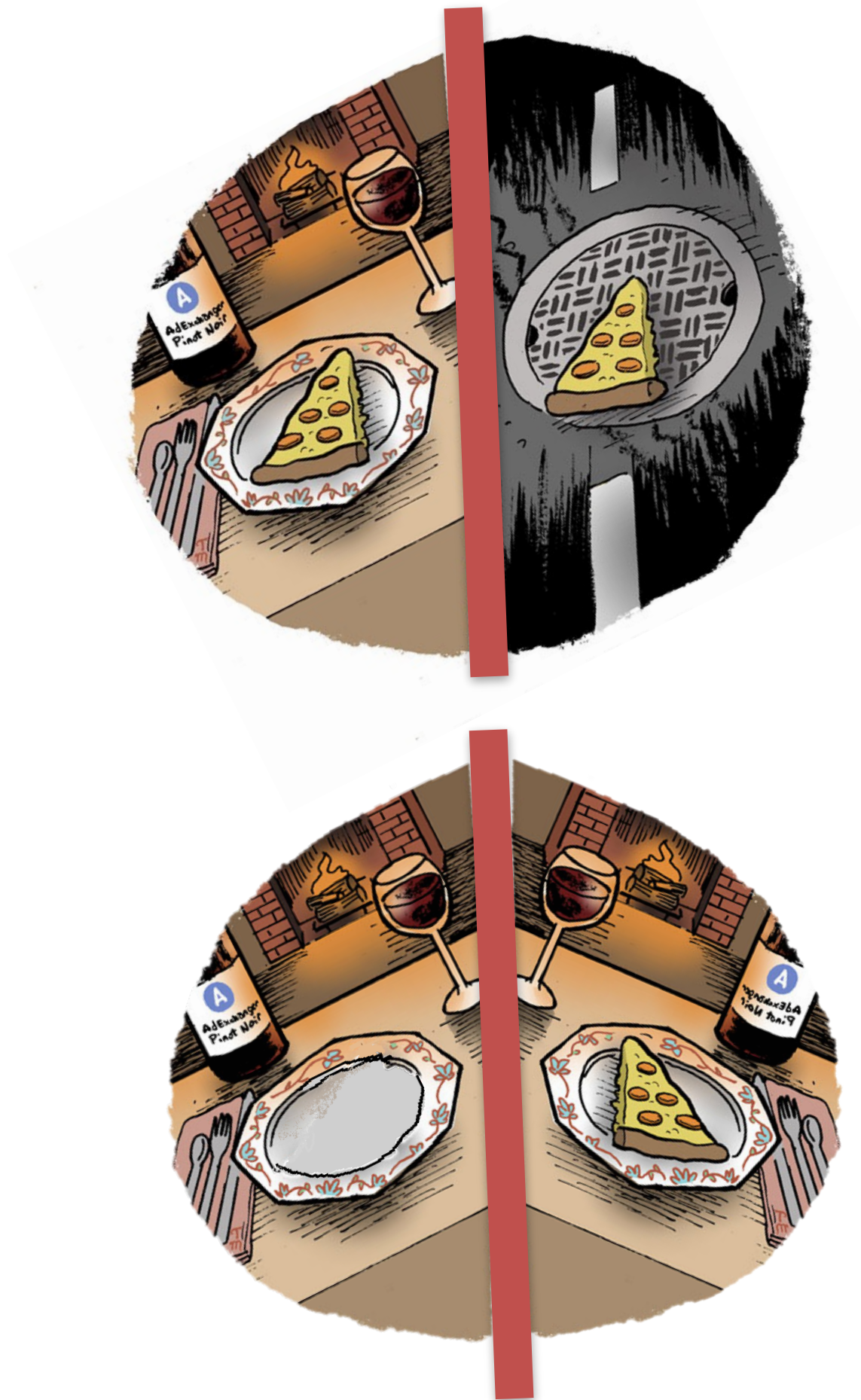
I. Meaning as context-change potential

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

Context ⟸ meaning

⟹ Context changes meaning

⟸ Meaning changes context

Note: This is a *generalisation* rather than an *alternative* to classical truth-conditional semantics

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II/III. Discourse variables and 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) ∧ came-in(x) ∧ barked (x)

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

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IV. Unselective quantification

Every   farmer who owns a donkey   feeds it

quantifier   restriction   nuclear scope

… is true iff **for every value assignment** to x and y:

if $[\![\text{farmer}(x) \land \text{donkey}(y) \land \text{owns}(x,y)]\!]^{M,g} = 1$

then $[\![\text{feeds}(x,y)]\!]^{M,g} = 1$

Quantification is restricted to those individuals who satisfy the restriction → quantification is *unselective*, i.e., all free variables are bound.

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Great minds..

Hans Kamp

Irene Heim

Discourse Representation Theory
(DRT)

File Change Semantics
(FCS)

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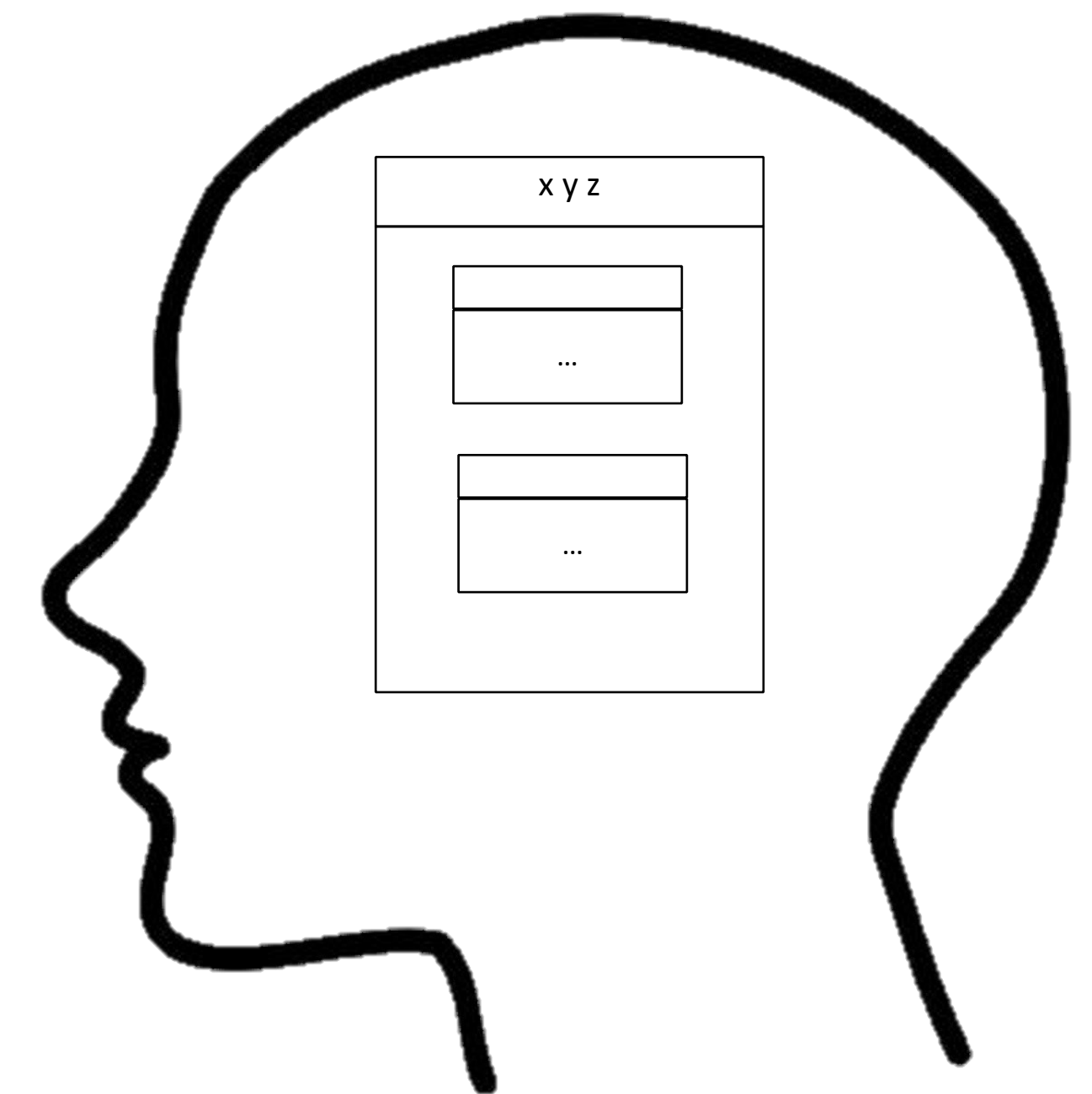SAARLANDES

Discourse Representation Theory

Mentalist and representationalist theory of the interpretation of discourse

Ingredients:

- Discourse Representation Structures

- Construction procedure for DRSs

- Model-theoretic interpretation (at the discourse level)
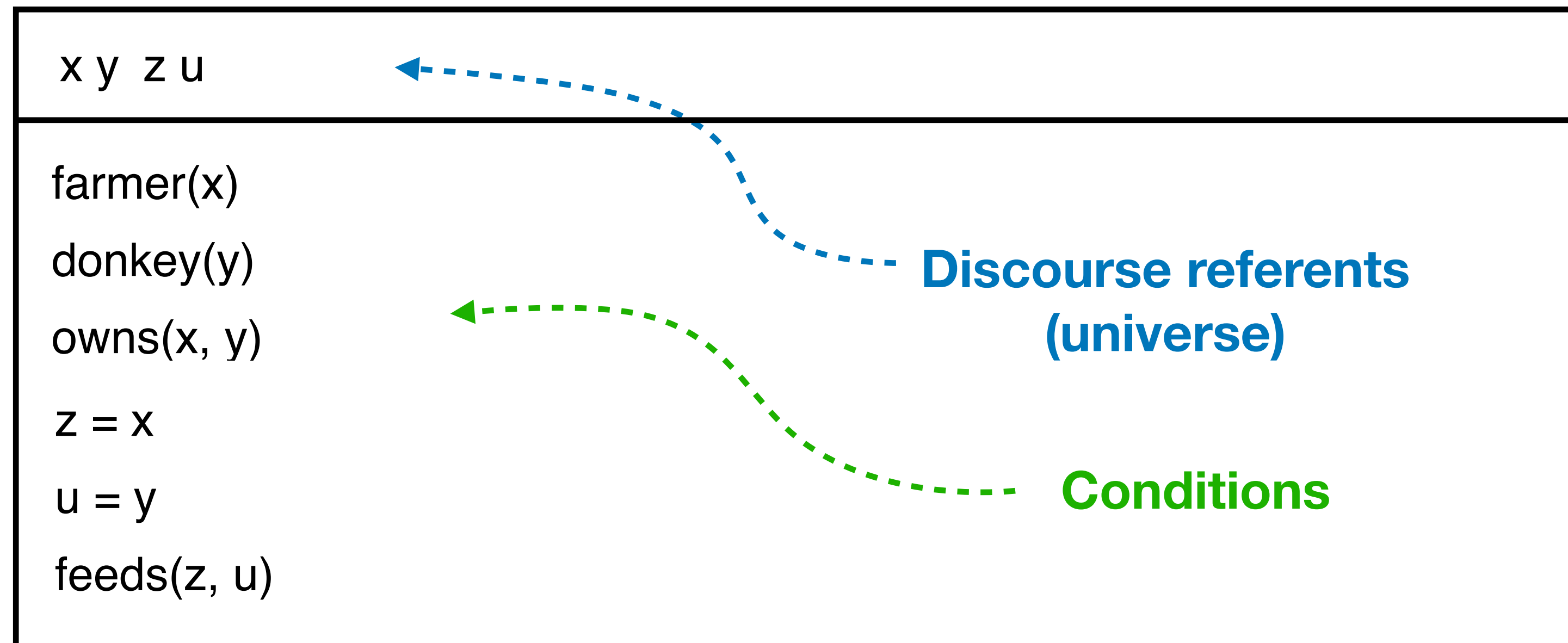

(Kamp, 1981; Kamp & Reyle, 1993)

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Basic features of DRT

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

- DRT explains the ambivalent character of indefinite noun phrases:

  - Indefinite NPs are 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 discourse referents and a set of conditions
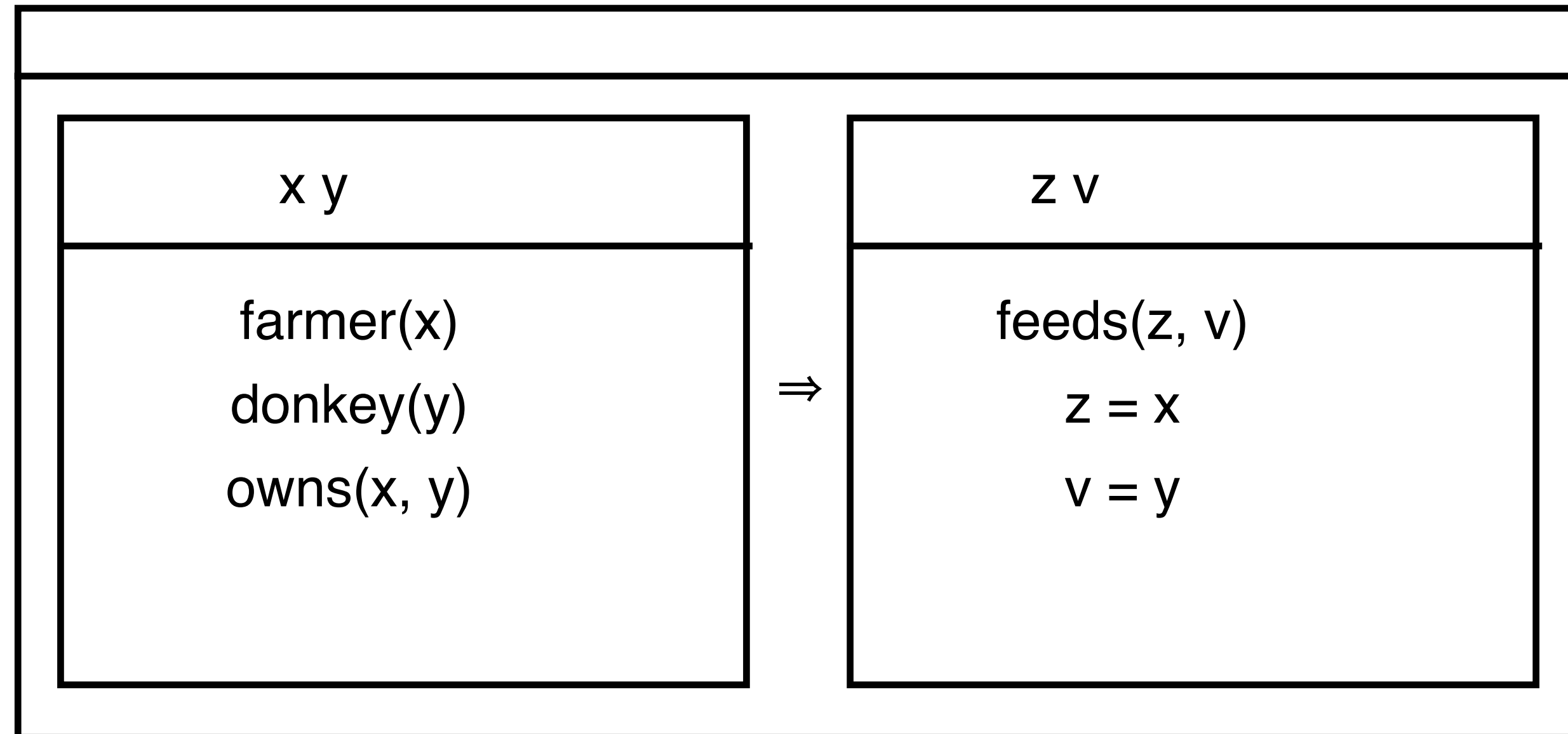
A farmer owns a donkey. He feeds it.

x y z u

farmer(x)

donkey(y)

owns(x, y)

z = x

u = y

feeds(z, u)

Discourse referents (universe)

Conditions

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Donkey sentences in DRT

Unselective quantification is achieved by embedded contexts

If a farmer owns a donkey, he feeds it.

The DRS consists of an outer box containing two sub-boxes connected by $\Rightarrow$:

Left box:
- Universe: x y
- Conditions:
  - farmer(x)
  - donkey(y)
  - owns(x, y)

$\Rightarrow$

Right box:
- Universe: z v
- Conditions:
  - feeds(z, v)
  - z = x
  - v = y

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Literature

References:

- Book: Hans Kamp and Uwe Reyle: From Discourse to Logic, Kluwer: Dordrecht 1993.

Links:

- https://plato.stanford.edu/entries/dynamic-semantics/

- https://plato.stanford.edu/entries/discourse-representation-theory/

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