Semantic-pragmatic account of syntactic structures

Ivan Rygaev
Laboratory of Computational Linguistics
Institute for Information Transmission Problems RAS, Moscow
irygaev@gmail.com

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Communication

- Communication is the primary function of language
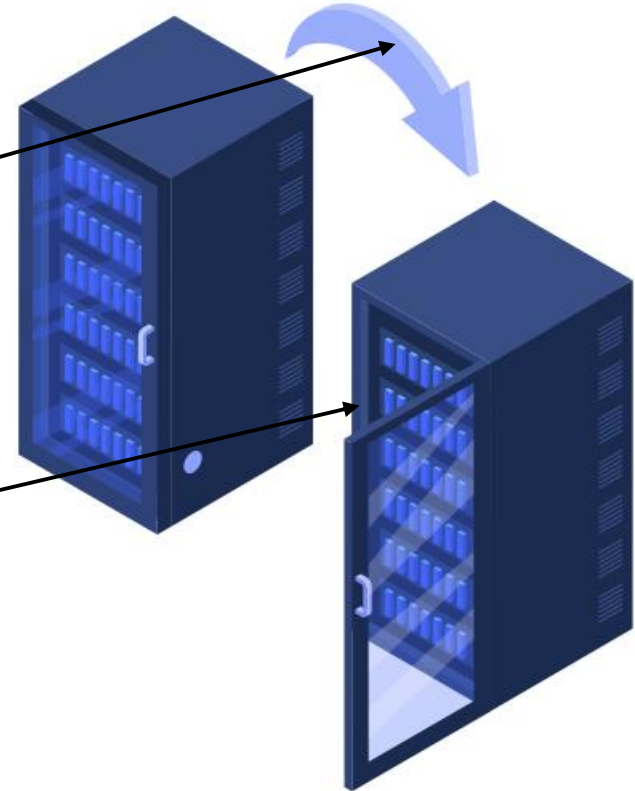 - Information transfer from a speaker to a hearer

Information transfer

- New information should be linked to the old one:
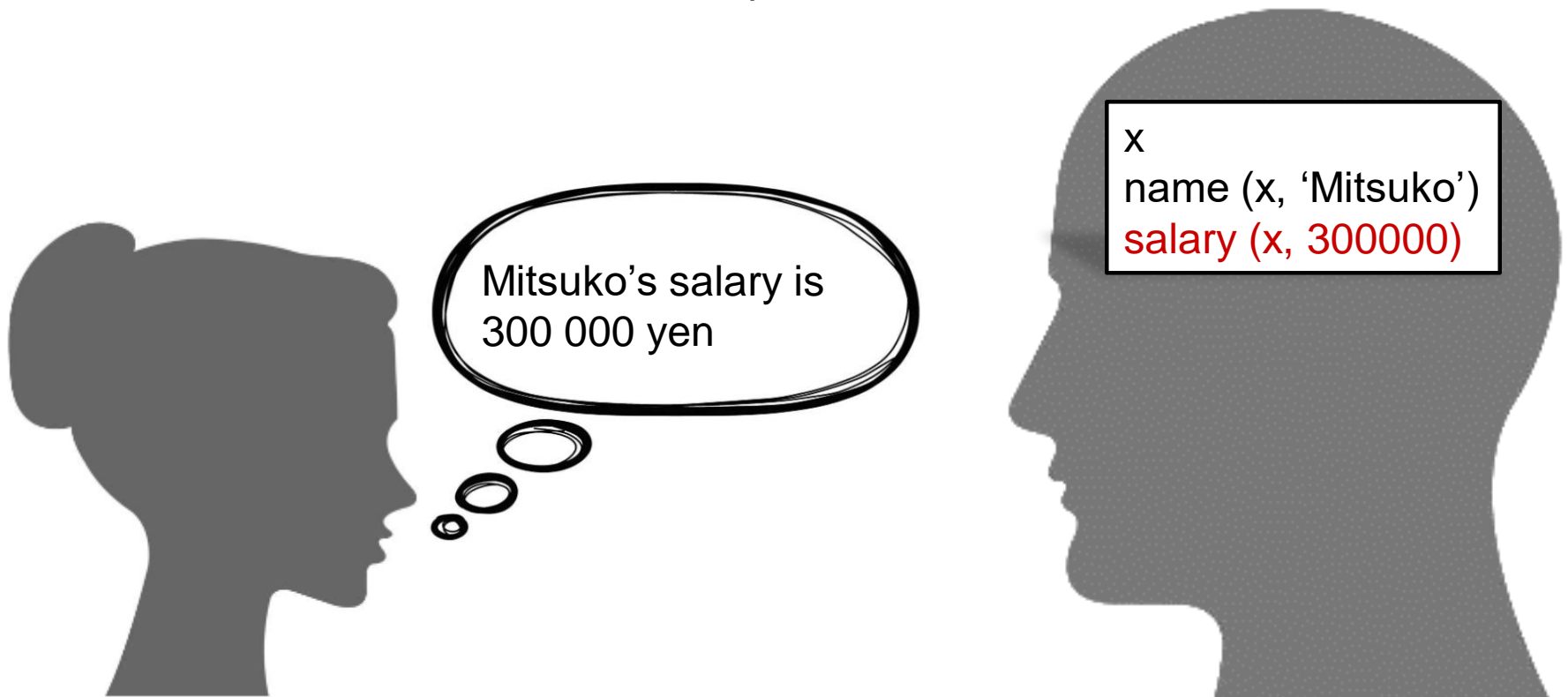
  Mitsuko's salary is 300 000 yen.

```
update employees
set salary = 50000
where name = 'Mitsuko'
[where id = 2837]
```

id	name	salary	...
...			
2837	Mitsuko	300 000	...
...			

Linguistic communication

- New information should be linked to the old one in the hearer's mind. One part of the sentence serves to find a mental file, the other – to update it.

File Change Semantics

- File of cards metaphor:
  - *"B's task is to construct and update a file which, at any point in the conversation, contains all the information that A has conveyed up to that point"* (Heim 1982:178)

- A card corresponds to a discourse referent

- The meaning of noun phrases is procedural
  - *"For every indefinite, start a new card; for every definite, update a suitable old card"* (Heim 1982:179)

- Sentence meaning is its context change potential
  - It the entire file, not a sentence, which has truth conditions

Discourse Representation Theory

- *Mary met a student. He needed help*

- Cards:

$\rightarrow$

- Discourse Representation Structure (DRS, Kamp 1981):

Represents the whole discourse,
aka context,
aka common ground

Pronoun resolution

- ## Nested DRSes (local contexts) are introduced for negation, implication, disjunction, etc.

  - *If Pedro owns a donkey **he** beats **it***
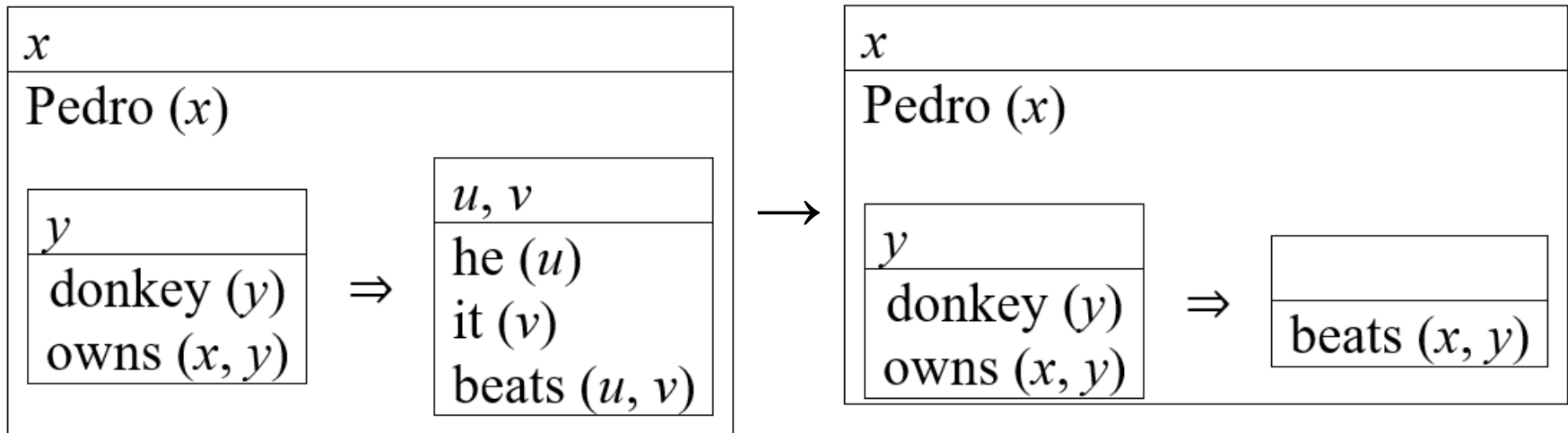
  - *he* and *it* search for their antecedents in the context
  - Both the main DRS and the local context of the implication premises are accessible for them

Definites

- The rule for pronouns has been extended to other referential expressions:

  - Definite descriptions and proper names

  - As a special case of presuppositions (van der Sandt 1992)

- *If Pedro owns a donkey, **Pedro** beats **the donkey***
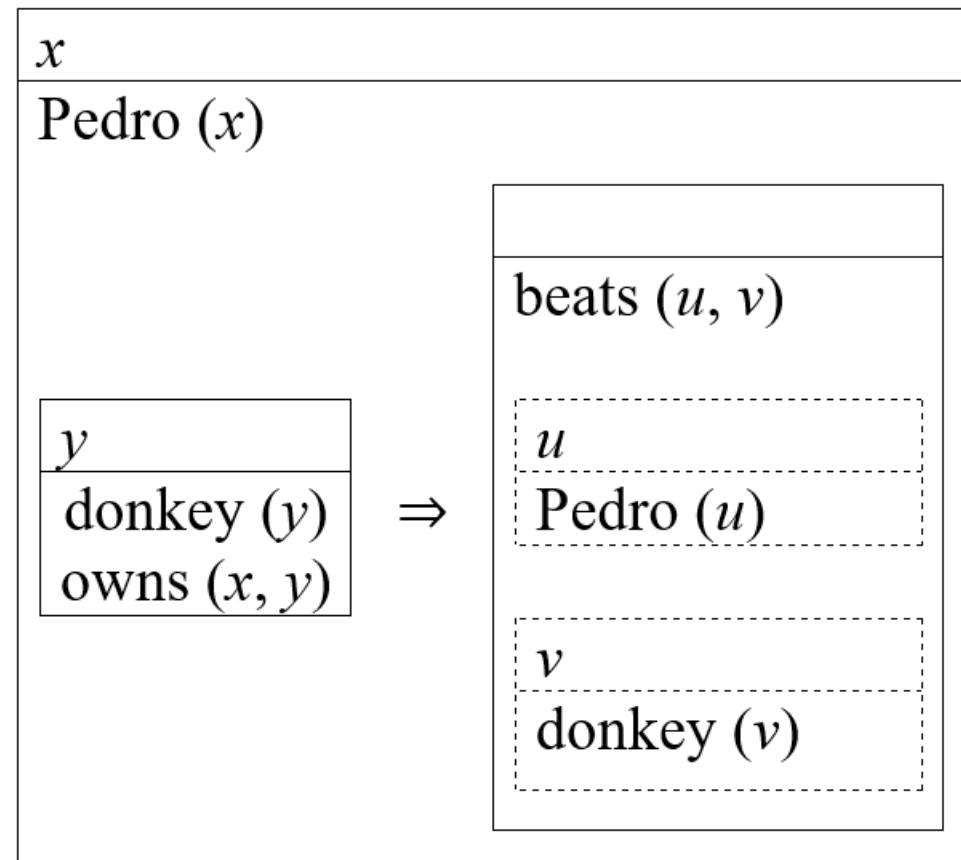
Presupposition projection in DRT

- First, a separate sentence DRS (preliminary DRS) is built, then it is merged into the main DRS and resolved

- Presuppositions are encoded separately in the DRS

  - Each presupposition is represented by an A-DRS, an embedded presuppositional DRS

  - A-DRSes can be embedded into one another

  - They float up through accessibility hierarchy looking for a suitable antecedent

  - If it is found the presupposition is bound to it, otherwise it can be accommodated

Specific indefinites

- Specific indefinites (van Geenhoven 1998)
  - Similar to presuppositions
  - They are interpreted not in the place they appear
  - But somewhere higher in the structure
  - They are normally accommodated rather than bound
- Are they a special type of presupposition?
- *Peter intends to visit **a museum** every day*
  - *Has at least three different interpretations*
  - *Depending on the level where 'a museum' is interpreted*

Backgrounding (Geurts 2010)

- Specific indefinites are not presuppositions
  - Accommodation is a repair strategy
  - It would be strange to use it normally as specifics do
- Different types of backgrounding:
  - Presuppositions
  - Specific indefinites
  - Conventional implicatures (as defined by Potts 2005)
- The Buoyancy Principle:
  - Backgrounded material tends to float up towards the main DRS.

DRSs as instructions

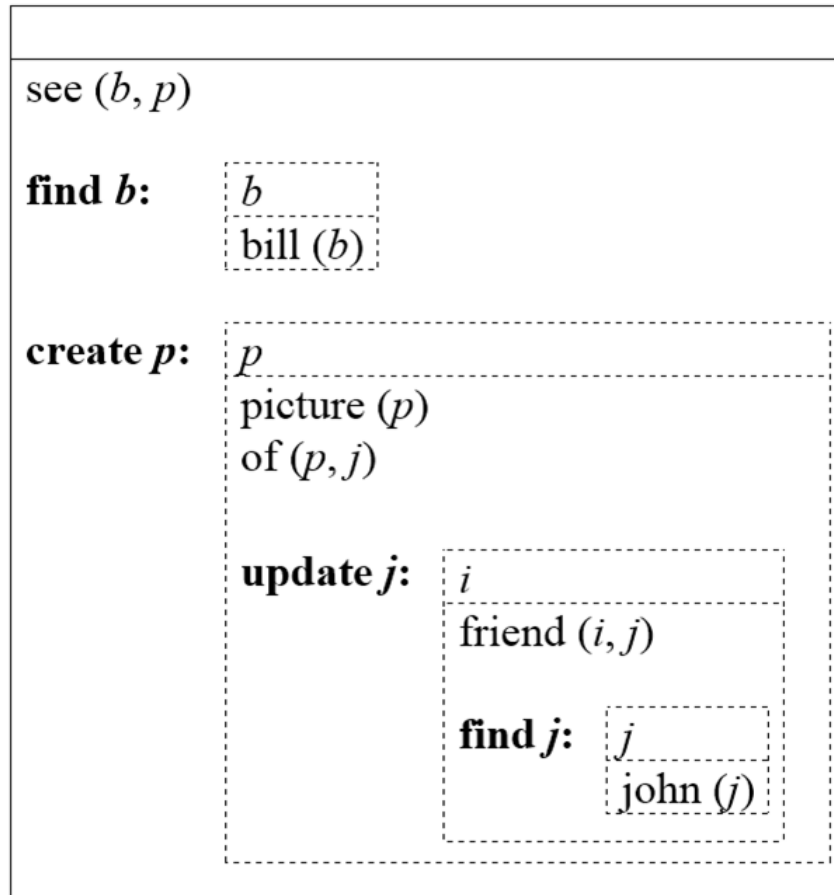- A-DRSes can represent all backgrounded expressions
- But they have to be marked with their function
    - Propositional A-DRS serves to *find* a discourse referent
    - Specificity A-DRS – to *create* a new discourse referent
    - Conventional implicature A-DRS – to *update* an existing one
- Now we can call them B-DRSs (backgrounded DRS)
- Main DRS is an instruction to update the topic referent

DRSs as instructions

- *Bill saw a certain picture of John, a friend of mine*

update b:

see (b, p)

find b: | b
bill (b)

create p: | p
picture (p)
of (p, j)

update j: | i
friend (i, j)

find j: | j
john (j)

b, p, j, i
bill (b)
see (b, p)
picture (p)
of (p, j)
john (j)
friend (i, j)

Syntactic structures

- The structure of a Preliminary DRS:
  - Each backgrounded constituent corresponds to a B-DRS
  - B-DRS hierarchy forms a tree
  - The tree mirrors the syntactic tree of the sentence

- Sentence production
  - The speaker intends to convey information to the hearer
  - He splits his mental Proper DRS into a set of instructions to find, create or update mental referents in the hearer's mind
  - Being dependent on one another they form a tree
  - The tree is then realized as a syntactic tree of the sentence

Communicative dependencies

- Communicative dependency [Melčuk 2001:30]:
  - *In a semantic configuration σ_1---σ_2, the semantic node σ_2 is said to depend communicatively on the semantic node σ_1 in a direct way, if this configuration can be reduced to σ_1 (rather than to σ_2) such that the meaning conveyed is simply reduced but not distorted, the referent of σ_1 remaining the same as that of the whole configuration σ_1---σ_2.*

    (grow) → (population)
    - [the] population's growth
    - [the] growing population

  - *The Comm-dominant node of a Comm-subnetwork is an analog of the top node of a syntactic subtree; Comm-dependency is, so to speak, a way of `foreseeing,' on the semantic level, the future syntactic dependencies.*

Utterances as programs

- Two steps of NLU (Davies & Isard 1972)
  - Compilation
  - Execution
  - Understanding an utterance vs carrying it out

- In our model
  - Compiling instructions = building a Preliminary DRS
  - Executing instructions = resolving B-DRSes to obtain a Proper DRS

- A book is not a knowledge base
  - It is a script to create the knowledge base

Two layers of representation

- Preliminary DRS is a representation of a sentence
    - A sequence of instructions
    - Context-independent
    - Yet context-sensitive
    - Captures information structure (to some extent)
    - Reflects the syntax on the semantic level
    - Obeys compositionality
- Proper DRS is a mental representation
    - Captures truth conditions
    - Has a model-theoretic interpretation

Application – syntactic islands

- Syntactic constructions which contain an element that cannot be extracted out of it (Newmeyer 2016):

    – ∗***What*** *did you take a class from [the chef that created ___]?*

    – *****What*** *[that Mary solved ___] is likely?*

    – ∗***What*** *were you happy [because John bought ___]?*

- Communicative approach:

    – Islands result from a clash in the information structure (Erteschik-Shir 1973)

    – Backgrounded constituents are islands (BCI) (Goldberg 2006)

Why BCI?

- Why are backgrounded constituents islands?

- A proposed explanation:

  - Each backgrounded constituent is a separate instruction

  - It is executed separately

  - All discourse referents it depends on must have already been found or created by other instructions

  - If that is not the case (e. g. there are vicious circles in the instruction dependencies) the set in not executable

  - Hence the sentence is uninterpretable

Challenges

- One syntax – different information structure

- *John bought an apple:*

  – *What did John do? [John]$_T$ [bought an apple]$_F$*

  – *What did John buy? [John bought]$_T$ [an apple]$_F$*

- Generative grammar allows for a hidden movement:

  – *[John bought ___$_i$]$_T$ [an apple$_i$]$_F$*

  – Cf. *[What John bought] is [an apple]*

- The present account generates it directly, without a movement

  – Preliminary DRS corresponds to the deep structure in syntax

Challenges

- Quantifier noun phrases:
  - If they could float up as well
  - That could explain quantifier scope ambiguity

- However:
  - Quantifiers representation in the DRS does not match their syntax in the sentence
  - They does not seem to fit well into the instructional paradigm

- To incorporate them is a topic for further research

Conclusions

- Proposed a unified account of backgrounded meaning within the DRT framework

  - Presupposition

  - Specific indefinites

  - Conventional implicatures

- Proposed how the syntactic tree of the sentence arises out of knowledge in our mind

- Proposed an explanation why backgrounded constituents are syntactic islands

References

1. Davies, D. J. M., & Isard, S. D. (1972). Utterances as programs. *Machine intelligence, 7*, 325-339.

2. Erteschik-Shir N. 1973. On the nature of island constraints. PhD thesis, Dep. Foreign Lang. Linguist., MIT, Cambridge. 175 pp.

3. Geurts, B. (2010). Specific Indefinites, Presupposition and Scope. *Presuppositions and Discourse: Essays Offered to Hans Kamp*, 21, 125.

4. Goldberg AE. 2006. Constructions at Work: The Nature of Generalization in Language. Oxford, UK: Oxford Univ. Press

5. Heim, I. (1982). The semantics of definite and indefinite noun phrases.

6. Kamp, H. (1981). A theory of truth and semantic representation. *Methods in the Study of Language Representation*.

References

7. Mel'čuk, I. (2001). Communicative organization in natural language. 1-405.

8. Newmeyer, F. J. (2016). Nonsyntactic explanations of island constraints. *Annual Review of Linguistics, 2*, 187-210.

9. Potts, C. (2005). The logic of conventional implicatures (Vol. 7). OUP Oxford.

10. van der Sandt, R. A. (1992). Presupposition projection as anaphora resolution. *Journal of semantics*, 9(4), 333-377.

11. van Geenhoven, V. (1998). Semantic incorporation and indefinite descriptions: *Semantic and syntactic aspects of noun incorporation in West Greenlandic*. CSLI publications.

Thanks for your attention! Questions?