Revisiting NLTK-DRT

DRT extension for NLTK updated and improved

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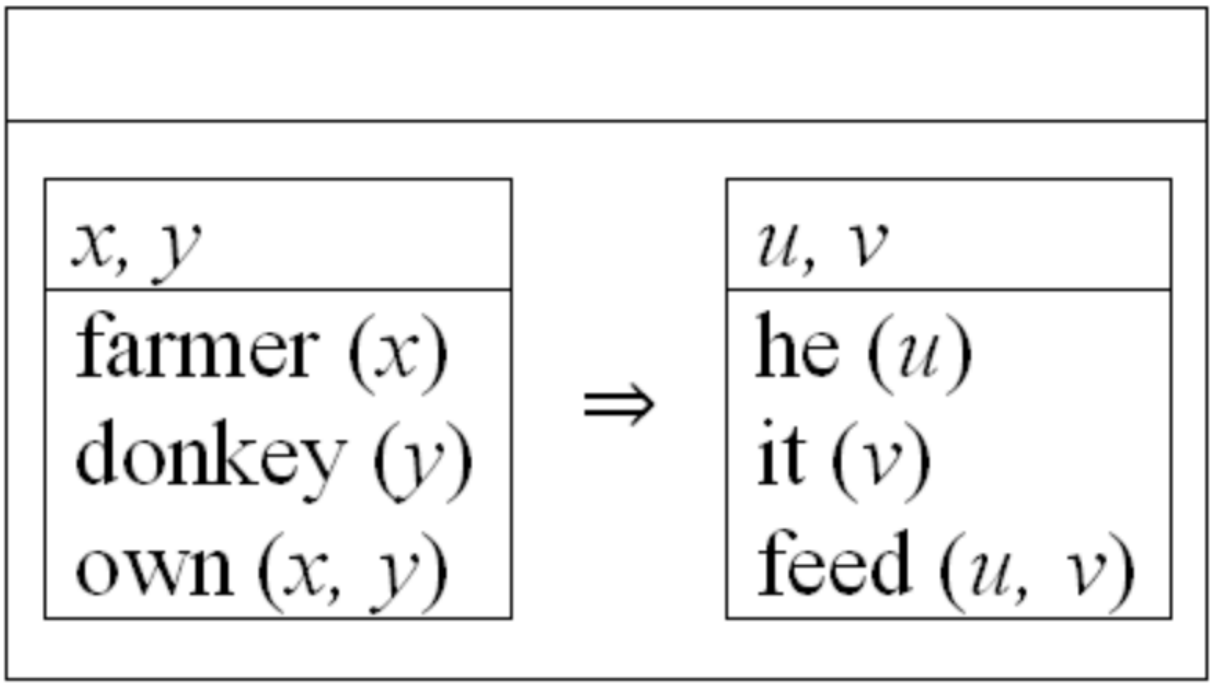
Discourse Representation Theory

- DRT is a dynamic semantic theory (Kamp 1981)
  - Employs a semantic representation called DRS (Discourse Representation Structure)
  - DRS consists of discourse referents and conditions
  - For complex sentences, a DRS can contain sub-DRSs
- *If a farmer owns a donkey, he feeds it*



Discourse Representation Theory: anaphora

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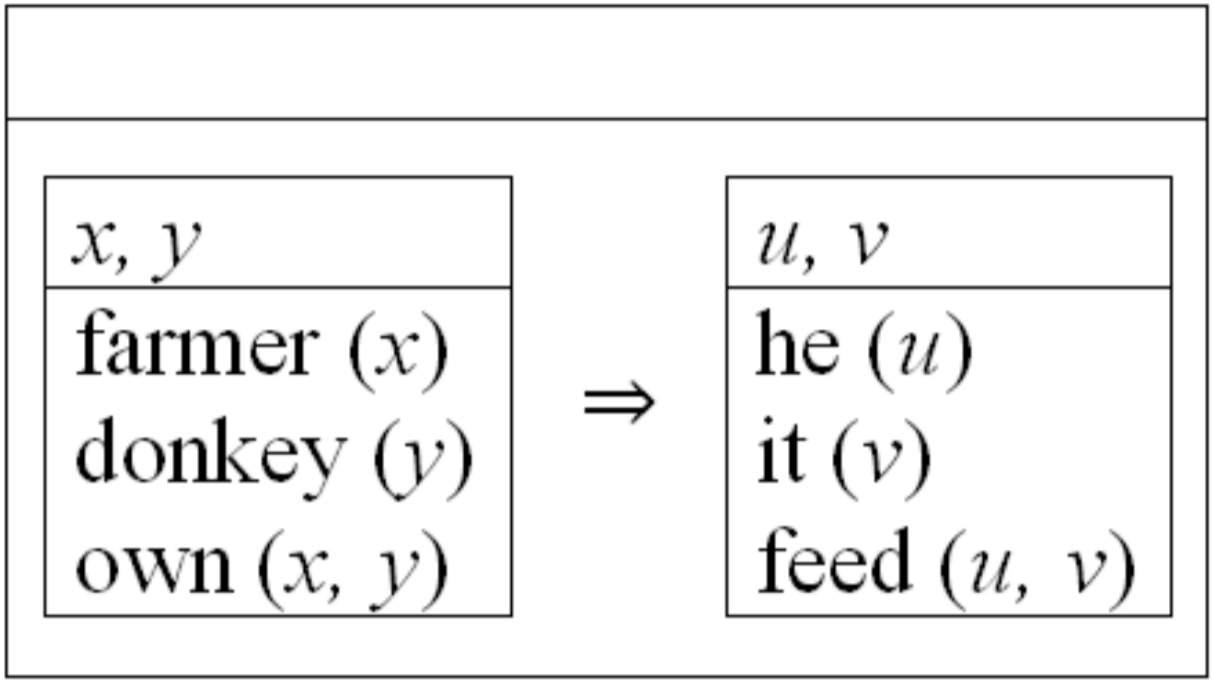
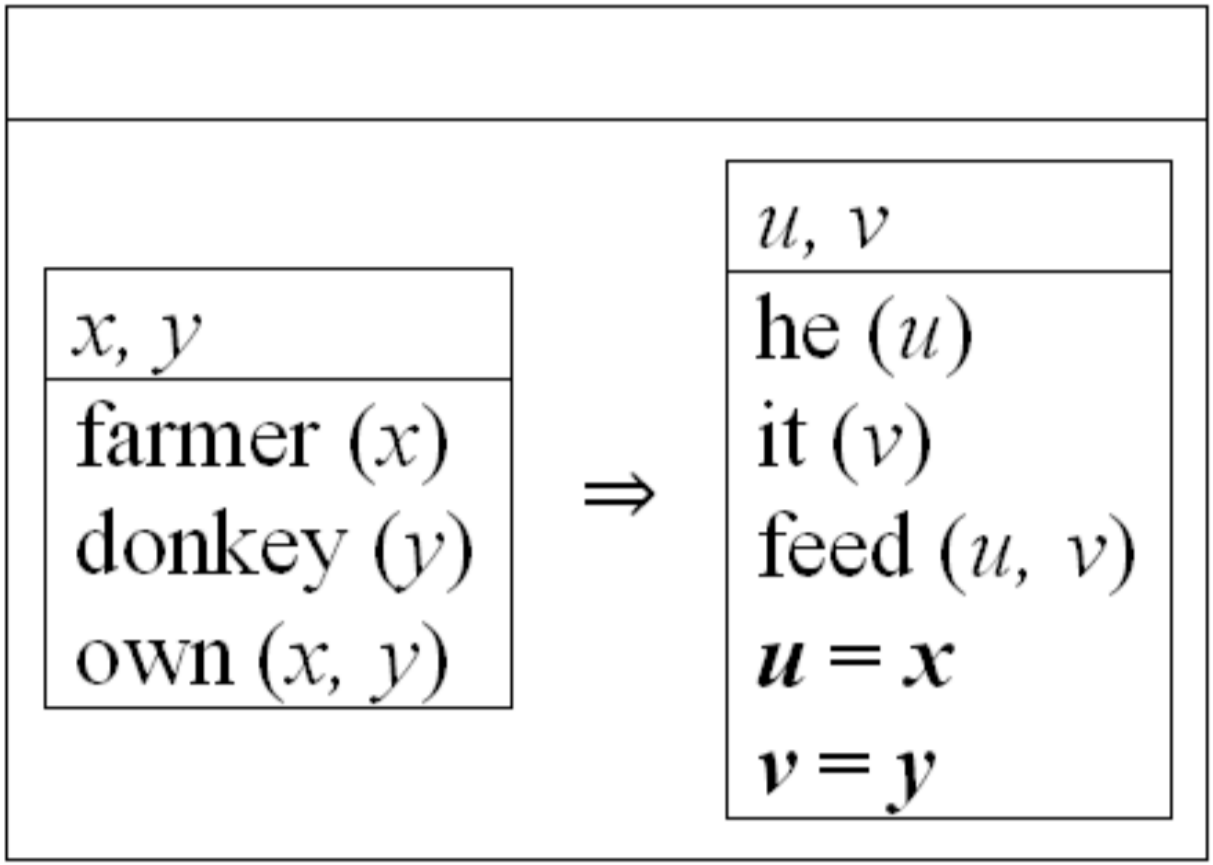
- Step **1** (sentence with a non-resolved anaphora):



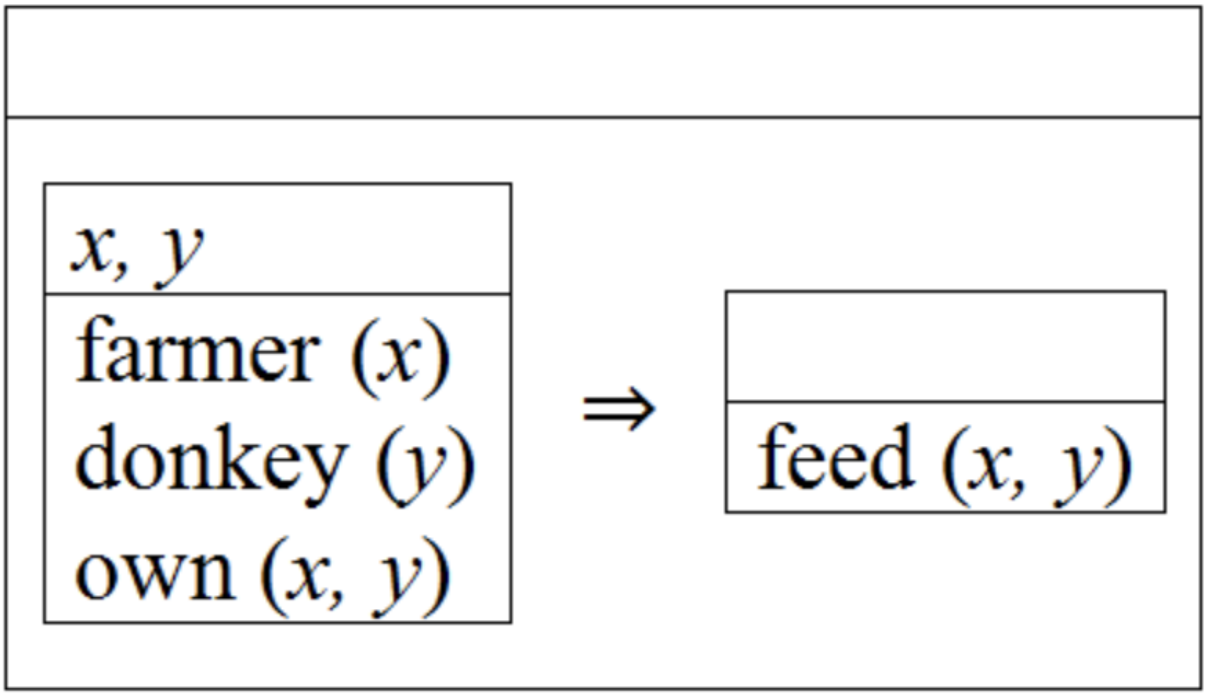
Discourse Representation Theory: anaphora

- DRT can be used for **anaphora** resolution
- Consider again the sentence *If a farmer owns a donkey, he feeds it*
- Step **2** (finding antecedents):



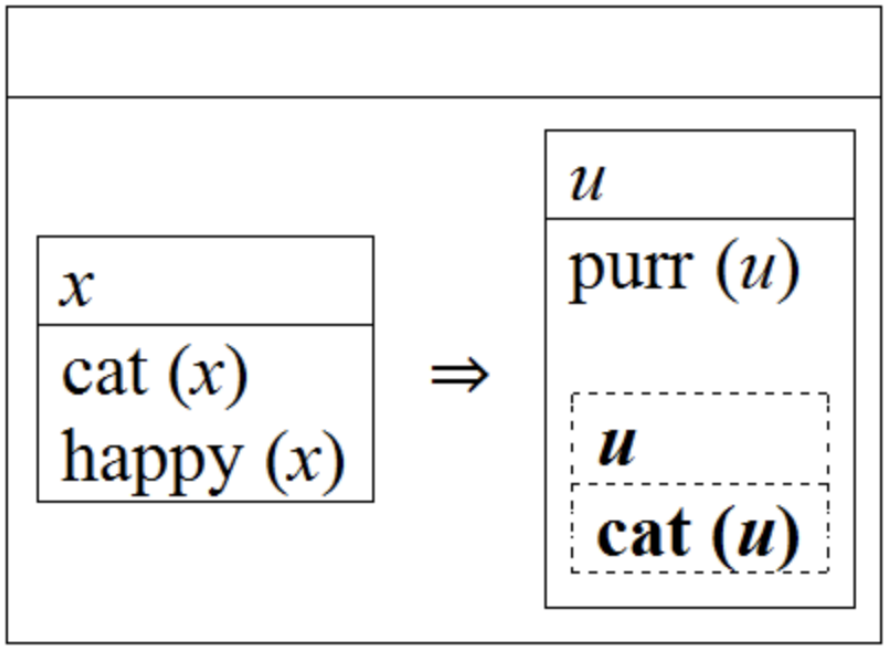
Discourse Representation Theory: anaphora

- DRT can be used for **anaphora** resolution
- Consider again the sentence *If a farmer owns a donkey, he feeds it*
- Step **3** (resolved):



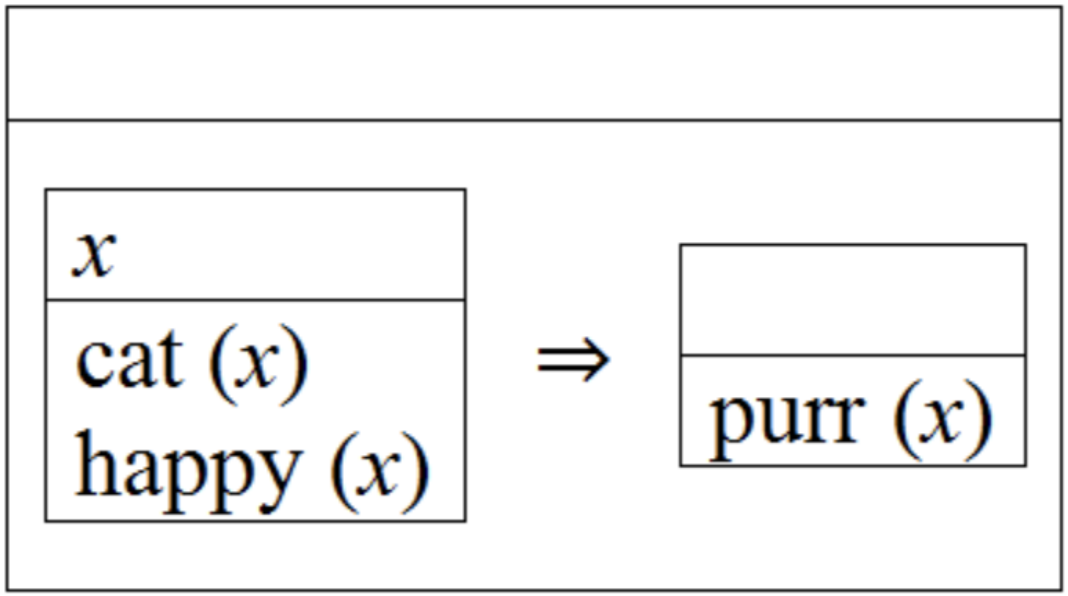
Discourse Representation Theory: presupposition

- Binding theory of presupposition was introduced in (van der Sandt 1992)
  - A special sub-DRS (A-DRS) stores the presupposition content
  - A Preliminary DRS is a DRS with non-empty A-DRSs
- **Presupposition projection can be viewed as anaphora resolution**
- *If a cat is happy*, **the cat** *purrs* (A-DRS is non-empty)



Discourse Representation Theory: presupposition

- Preliminary DRS vs. Proper DRS
  - A-DRSs must be resolved
  - Once they are resolved, Main DRS becomes a Proper DRS
- *If a cat is happy, the cat purrs* (A-DRS is resolved)



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DRT machinery in NLTK

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- It supports, among other things, semantic reasoning functionalities.
- NLTK has been supporting DRT since a long time ago; it contains a built-in basic anaphora resolution machinery
- However, it **does not support** presupposition projection as anaphora resolution as in (van der Sandt 1992)

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Previous work on extending DRT in NLTK

- (Kislev, Makarov, Li 2010) developed a third-party module **NLTK-DRT**, which added support of presupposition projection as anaphora resolution (van der Sandt 1992) and time semantics to the basic DRT module of NLTK

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- This third-party extension was not officially integrated into nltk codebase at the time of development
- Neither was it later maintained and updated
- As of today it was **no longer usable** due to multiple incompatibilities with nltk

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- Originally it was written in Python 2, which NLTK was also using at the time
- We have done work on migration of NLTK-DRT codebase to Python 3
- Also, since 2010, NLTK library has undergone many changes in structure of its submodules, which are imported by NLTK-DRT, and we had to take this into account when doing refactoring

Addressing issues in NLTK-DRT: implementation mistakes

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- Also, we migrated test suite itself (which contained 81 test) to the pytest framework

We define presupposition types based on FCFG

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  - definite descriptions
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- Each type of presupposition should handled somewhat differently
- However, there are other types of presupposition which are not supported yet, for example, factive verbs

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- Initially, the processing strategy for each type of presupposition was **hardcoded** inside the codebase

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- There are different types of presupposition supported by NLTK-DRT:
  - definite descriptions
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- Each type of presupposition should handled somewhat differently

- It would be difficult for contributors to add new types of presupposition without deep code analysis

We define presupposition types based on FCFG

- **Solution:** define presupposition types outside of the code using FCFG (Feature Context-Free Grammar)
- Therefore, we have added the ability to define processing schemes for various presupposition types using FCFG files

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Future work

- As mentioned before, NLTK-DRT still does not support some types of presupposition, for example:
  - it-clefts (**It** *was her mother that always came up with excuses.*)
  - factive verbs (*I* **realized** *that I need to improve my skills.*)

Future work

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  - it-clefts (**It** *was her mother that always came up with excuses.*)
  - factive verbs (*I* **realized** *that I need to improve my skills.*)
- In future, we would like to add support for these

Future work

- We have published our work on GitHub [2]
- At the moment, although we have made NLTK-DRT compatible with NLTK, this extension is still not officially included in NLTK module

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- Thank you for your attention!

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