Anaphoric Arguments of Discourse connectives

Creswell, Forbes, Miltsakaki, Prasad, Joshi, Webber
University of Pennsylvania
Connectives as predicates

- Predicate-argument relationships
- Predicate arguments derived from discourse units
- Types of arguments
  - Structural
  - Anaphoric
Connectives as predicates

- Predicate-argument relationships
- Arguments derived from discourse units
- Arguments
  - Structural
    1. [Lately, she raised the ire of her vegan friends] because [she nevertheless enjoys the occasional bacon cheeseburger.]
  - Anaphoric
Connectives as predicates

- Predicate-argument relationships
- Arguments derived from discourse units
- Arguments
  - Structural
  - Anaphoric
  2. [Sally rarely eats meat and subscribes to Vegetarian Times.]
  3. Lately, she raised the ire of her vegan friends because [she nevertheless enjoys the occasional bacon cheeseburger.]
Typology of connectives

- Subordinate conjunctions
- Coordinating conjunctions
- Adverbial
- Empty
Typology of connectives

- Subordinate conjunctions
  4. “Along with the fruit they did also fall under the power of death, because they did eat in disobedience.”

- Coordinating conjunctions

- Adverbial

- Empty
Typology of connectives

- Subordinate conjunctions
- Coordinating conjunctions
  5. “Their passions were genuine and the division between them and the abolitionists is clear-cut.”
- Adverbial
- Empty
Typology of connectives

- Subordinate conjunctions
- Coordinating conjunctions
- Adverbial
  6. Well, I followed you to your door, .... Then I, rather imprudently, wished you good-night, and started for the Temple to see my husband.
- Empty
Typology of connectives

- Subordinate conjunctions
- Coordinating conjunctions
- Adverbial
- Empty

7. As to the photograph, your client may rest in peace. I love and am loved by a better man than he.
Theoretical framework: DLTAG

- Webber and Joshi, 1998; Webber et al, 2000
  - Basic elements of a discourse are structures which are anchored by discourse connectives
  - Parallel with sentence level grammar
  - Decoupling of the semantics explicitly provided by the text from inferentially derived semantics
D-LTAG structures and semantics

- Initial Trees

8. John failed his exam because he was lazy
9. Mary saw John but she decided to ignore him.
10. Mary saw John. She decided to ignore him.
11. On the one hand, John loves Barolo.
12. So he ordered three cases of the '97.
13. On the other hand, he had to cancel the order
14. because he then found that he was broke.
System Architecture

Input Discourse → LEM (Sentence Parsing) → Discourse Unit Extractor → Connectives and their Sentence-level structures → Structural Mapping of Connectives from syntax to discourse → Clausal Derivations/Derived trees → Tree Selection → Reorganized Input Discourse → LEM (Discourse Parsing) → Derivation Structure for Discourse
Example Discourse

15. Mary was amazed.
16. While she was eating lunch, she saw a dog.
17. She’d seen a lot of dogs, but this one was amazing.
18. The dog barked and Mary smiled.
19. Then, she gave it a sandwich.
Derived and Derivation trees

**Derived Tree**

**Derivation Structure**

mary was unusual

while

she was eating lunch

she saw a dog

she'd seen a lot of dogs

this dog was amazing

the dog backed

Mary smiled

then

she gave it a sandwich

she should have a lot of dogs

but

this dog was amazing

the dog backed

and

Mary smiled

then

she gave it a sandwich
Presuppositional semantics

- Presuppositional semantics (Knott et al, 1996):
  - Defeasible rule: When people go to the zoo, they leave their work behind.

20. John went to the zoo. *However*, he took his cell phone with him.
Towards resolving anaphoric arguments

- Corpus annotation of:
  - [As a result, therefore, so], [nevertheless, yet, whereas], [also, in addition, moreover].

- Annotation tags
  - Argument
    - Size and position (e.g., previous sentence/paragraph)
    - Type of clause (e.g., relative/complement clause)
    - Contiguity
  - Connective
    - Combinability with other connectives/punctuation (e.g., with ‘and’, but’)
    - Position in the sentence (initial, medial, final)
Example

- As a result
- Nevertheless
- In addition
Example

- As a result

21. <s> <ARG REF=1 TYPE=MAIN LOC=PS> Moritz was bothered during the first two games this year by a pulled muscle in the thigh of his right (kicking) leg </ARG> and, <CONN REF=1 COMB=AND+COMMA POS=INIT> as a result, several of his successful conversions have gone barely far enough </CONN>.

- Nevertheless

- In addition
Example

- As a result

- Nevertheless

22. *<ARG REF=11 TYPE=MAIN-MULT>And, you see, Cohen was in a very anomalous position. He was a loose nut so far as organization was concerned. I don't think I had him on the staff of Bureau of Research and Statistics. He was adviser to me directly. </ARG>*

*<CONN REF=11 COMB=BUT POS=INIT> But nevertheless he had to work with Falk, taking the results of the Research and Statistics Bureau and using them in the development of programs. </CONN>*

- In addition
Example

- As a result
- Nevertheless
- In addition

23. Mrs. Reavey's is written for the stage -- it is mentioned for an off-Broadway production in the fall -- and in addition, employs an avant-garde structure that particularly needs to be seen if comprehension is to be encouraged.
Inter-annotator agreement

- Connectives (75 tokens total)
  - As a result, nevertheless, in addition

- Results (3-4 annotators)
  - As a result: 21/25
  - Nevertheless: 10/25
  - In addition: 19/25
The Discourse Penn Treebank

- Goals
  - Build large scale, reliable corpus
  - Mark coherence relations associated with discourse connectives
  - Mark argument structure
  - Identify Anaphoric links
  - Annotate on top of Penn Treebank and Prop Bank

- Semantics of connectives...