Annotating Coordination in the Penn Treebank

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The LAW VI at ACL 2012
Jeju, Korea
July 13, 2012
Definitions

Coordination

- A syntactic structure consisting of two or more elements (conjuncts), with one or more conjuncts typically, but not always preceded by a coordinating conjunction (and, or, neither...nor, and but).

- Conjuncts typically of the same category, or unlike coordination
Definitions

Coordination

- A syntactic structure consisting of two or more elements (*conjuncts*), with one or more conjuncts typically, but not always preceded by a coordinating conjunction (*and, or, neither...nor, and but*).

- Conjuncts typically of the same category, or *unlike coordination*.

Conjunct

- Lexical or phrasal material of any kind

- Typically, but not necessarily, a complete constituent.
Examples

(1) a. Leslie and Sandy
Examples

(1) a. Leslie and Sandy
   b. Loch Ness is a lake in Scotland and famous for its monster (*unlike coordination*)
(1) a. Leslie and Sandy
b. Loch Ness is a lake in Scotland and famous for its monster (unlike coordination)
c. Sandy gave a record to Sue and a book to Leslie (non-constituent coordination)
Examples

(1) a. Leslie and Sandy
b. Loch Ness is a lake in Scotland and famous for its monster (unlike coordination)
c. Sandy gave a record to Sue and a book to Leslie (non-constituent coordination)
d. Leslie likes bagels and Sandy donuts (gapping structure with elliptical conjunct)
Coordination detection and scope identification

- Coordination information is important!
Coordination detection and scope identification

- Coordination information is important!
- Consider parsing:
  - Improved coordination parsing helps overall parse quality
  - Downstream NLP applications also benefit

Why coordination?
Annotation for coordination

Coordination detection is difficult
What do we do?
Previous work

- Coordinations of noun compounds ("oil and gas resources") [Nakov and Hearst, 2005],
- Coordinations of symmetrical NPs [Hogan, 2007, Shimbo and Hara, 2007],
- Coordinations of the form “A CC B” where A and B are conjuncts, and CC is an overt conjunction [Kübler et al., 2009].
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- Coordinations of the form “A CC B” where A and B are conjuncts, and CC is an overt conjunction [Kübler et al., 2009].

To our knowledge, no approach for all coordination types
The Penn Treebank annotation principles for coordination

- Annotated on lowest level possible
- One word conjuncts coordinated on word level
- In gapped structures, symmetrical elements in conjuncts marked by gap-coindexation
Why coordination?
Annotation for coordination

Co ordination detection is difficult
What do we do?

The Penn Treebank annotation principles for coordination

- Multiword conjunctions grouped into CONJP constituents

If you were especially helpful in a corrupt scheme you received not just cash in a bag, but equity.
The problem: Conjunct boundaries

- Special POS tag for coordinating conjunctions, but not for coordinating punctuation
- Handling > 2 conjuncts is difficult!
Our work

We present a proposal for an extended annotation of the Penn Treebank which facilitates the identification of coordination a variety of phenomena which must be taken into account for a thorough treatment of coordination.
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Consider a punctuation token $c$ with left and right neighbor tokens $l$ and $r$ (not considering intervening coordinating conjunctions).

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  - the phrases directly below $A$ which cover $r$, resp. $l$ have the same label, or
  - $A$ is labeled $UCP$ (unlike coordination)
Why no automatic annotation?

Some manual decisions are necessary!
Coordination vs. apposition (1)

- Appositions can look like conjuncts
- Often have same category as modified constituent and attached at the same level

(2) The last two months have been the whole ball game,” says [NP Steven Norwitz], [NP a vice president]. (PTB 15034)
Coordination vs. apposition (2)

Similar case: NP modification by temporal NP

(3) – : Letter from Eduard Shevardnadze to U.N. Secretary-General Perez de Cuellar, reported in \([NP \ Tass] , \ [NP_{-} \ TMP \ June \ 10, \ 1988] \) . (PTB 21148)
Coordination vs. apposition (3)

- Border cases difficult to decide, especially with negated second phrase
- In case of doubt, use *and* substitution test

(4) He is \([NP \text{ a mechanical engineer}]\), \([NP \text{ not an atmospheric chemist}]\). (PTB 7158)
Ambiguous punctuation

- Irregular usage of commas in the PTB
- One finds “A, B, and C”, “A, B and C” and even “A, and B”
- Covered by annotation guidelines
(5) a. Describing itself as “asset rich,” Sea Containers said it will move immediately to sell \([NP \text{ two ports}]\), \([NP \text{ various ferries}]\), \([NP \text{ ferry services}]\), \([NP \text{ containers}]\), and \([NP \text{ other investments}]\). (PTB 6105)
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b. Stocks closed higher in \([NP \text{ Hong Kong}], [NP \text{ Manila}], [NP \text{ Singapore}], [NP \text{ Sydney}]\) and \([NP \text{ Wellington}]\), but were lower in Seoul. (PTB 4369)
Ambiguous punctuation (2)

- Sometimes, the comma before a coordinating conjunction belongs to the preceding constituent.
- Handeled by our annotation guidelines, since in the PTB, the comma is attached low to preceding constituent (e.g., an apposition).
(6) a. Berthold \[_{VP} \text{is based in Wildbad, West Germany,}\] and \[_{VP} \text{also has operations in Belgium}\]. (PTB 4988)
(6) a. Berthold [VP is based in Wildbad, West Germany,] and [VP also has operations in Belgium]. (PTB 4988)
b. ... Gillette South Africa will sell [NP manufacturing facilities in Springs, South Africa,] and [NP its business in toiletries and plastic bags] to Twins Pharmaceuticals Ltd. ... (PTB 6154)
Ambiguous punctuation (2)

(6) a. Berthold \([VP\text{ is based in Wildbad, West Germany,}]\) and \([VP\text{ also has operations in Belgium}]\). (PTB 4988)

b. ... Gillette South Africa will sell \([NP\text{ manufacturing facilities in Springs, South Africa,}]\) and \([NP\text{ its business in toiletries and plastic bags}]\) to Twins Pharmaceuticals Ltd. ...

(PTB 6154)

c. \([S\text{ I want white America to talk about it, too,}]\) but \([S\text{ I’m convinced that the grapevine is what’s happening}]\). ”

(PTB 10130)
Ambiguous punctuation (3)

- Also ambiguous: Coordinate structures on clausal level
- Often only uses commas or semicolons (no overt conjunctions)
- Difficult to distinguish automatically from other types of parataxis
- Again in case of doubt, use *and* substitution test
Ambiguous punctuation (3)

Annotated as coordination

(7) a. \[ S \text{ In 1980, 18 \% of federal prosecutions concluded at trial} \; ; \; S \text{ in 1987, only 9 \% did} \] . (PTB 12113)
Ambiguous punctuation (3)

Annotated as coordination

(7) a. [s In 1980, 18 % of federal prosecutions concluded at trial] ; [s in 1987, only 9 % did] . (PTB 12113)

b. [s Various ministries decided the products businessmen could produce and how much] ; and [s government-owned banks controlled the financing of projects and monitored whether companies came through on promised plans] . (PTB 12355)
Ambiguous punctuation (3)

Not annotated as coordination

(8) a. \[S \text{ This doesn’t necessarily mean larger firms have an advantage}] ; \[S \text{ Mr. Pearce said GM works with a number of smaller firms it regards highly}] . (PTB 12108)
Ambiguous punctuation (3)

Not annotated as coordination

(8) a. \([S \text{ This does n’t necessarily mean larger firms have an advantage}]; [S \text{ Mr. Pearce said GM works with a number of smaller firms it regards highly}]. \) (PTB 12108)

b. \([S \text{ Senator Sasser of Tennessee is chairman of the Appropriations subcommittee on military construction}]; [S \text{ Mr. Bush ’s $ 87 million request for Tennessee increased to $ 109 million}]. \) (PTB 12223)
Non coordinative use of punctuation

- Some sentences show coordinating conjunctions in appositions.
- Example: Syntactic annotation/annotation guidelines make it look like coordination

(9) a. The NASD, which operates the Nasdaq computer system on which 5,200 OTC issues trade, compiles short interest data in $[_{NP} \text{two categories}]: [_{NP} \text{the approximately two-thirds} \ldots ; \text{and the one-third} \ldots ]$. (PTB 21080)
Non-coordinative use of punctuation

- Example: Syntactic annotation/annotation guidelines identify it as a non-coordination.
- Reason: Coordinating conjunction grouped under parenthetical node (PRN) or under fragment (FRAG).

(10) a. Martha was $[_{ADJP} \text{pleased}, [_{PRN} \text{but nowhere near as much as Mr. Engelken}]]$ . (PTB 14598)
Non-coordinative use of punctuation

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(10) a. Martha was \([_{ADJP} \text{pleased}, \text{PRN}] \text{but nowhere near as much as Mr. Engelken}]\) . (PTB 14598)

b. The HUD scandals will simply \([_{VP} \text{continue}, \text{FRAG}] \text{but under new mismanagement}\)] . (PTB 15629)
Coordination in NP premodification

- PTB annotation guidelines: Conjuncts project to phrase level
- Exception: NP premodifiers only project if longer than one word
- We treat all NP premodifiers as coordinating
Coordination in NP premodification

(11) a. Yesterday, it received a \([_{\text{ADJP}} $ 15 \text{ million}] \), \([_{\text{JJ}} \text{three-year}] \) contract from Drexel Burnham Lambert. (PTB 6485)
Coordination in NP premodification

(11) a. Yesterday, it received a $15 million, three-year contract from Drexel Burnham Lambert. (PTB 6485)

b. There’s nothing in the least contradictory in all this, and it would be nice to think that Washington could tolerate a reasonably sophisticated, complex view. (PTB 8018)
Coordination in NP premodification

(11) a. Yesterday, it received a \([\text{ADJP } $15 \text{ million}] , [\text{JJ } \text{three-year}]\) contract from Drexel Burnham Lambert. (PTB 6485)

b. There's nothing in the least contradictory in all this, and it would be nice to think that Washington could tolerate a \([\text{ADJP reasonably sophisticated}] , [\text{JJ complex}]\) view. (PTB 8018)

c. Perhaps the shock would have been less if they'd fixed to another \([\text{NN low-tax}] , [\text{VBN deregulated}] , [\text{JJ supply-side}]\) economy. (PTB 10463)
Data set

- A look at coordination statistics in the PTB
- Collected from 23,678 sentences (605,064 words), average sentence length 25.6 words

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<th>av. per sentence total</th>
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Annotation properties

- Statistics over noun phrases
- Without the annotation, a significant number of conjuncts is lost

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We have treated a wide variety of coordination phenomena in English. We have proposed an extension for the Penn Treebank annotation from which NLP applications will profit. We plan on making the annotation publicly available.
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Summary

1. We have treated a wide variety of coordination phenomena in English.
2. We have proposed an extension for the Penn Treebank annotation from which NLP applications will profit.
We have treated a wide variety of coordination phenomena in English.

2. We have proposed an extension for the Penn Treebank annotation from which NLP applications will profit.

3. We plan on making the annotation publicly available.
Thank you for your attention!

Questions?
Coordinate noun phrase disambiguation in a generative parsing model.
In Proceedings of the 45th Annual Meeting of the Association of Computational Linguistics, pages 680–687,
Prague, Czech Republic.

Parsing coordinations.
In Proceedings of the 12th Conference of the European Chapter of the ACL (EACL), pages 406–414,
Athens, Greece.

Using the web as an implicit training set: Application to structural ambiguity resolution.
In Proceedings of Human Language Technology Conference and Conference on Empirical Methods in
Natural Language Processing, pages 835–842, Vancouver, Canada.

A discriminative learning model for coordinate conjunctions.
In Proceedings of the 2007 Joint Conference on Empirical Methods in Natural Language Processing and
Computational Natural Language Learning (EMNLP-CoNLL), pages 610–619, Prague, Czech Republic.