A Corpus-based Syntactic Analysis of Two-termed Unlike Coordination

Julie Kallini and **Christiane Fellbaum**

Findings of EMNLP 2021

Part 1: Introduction

- Two-termed Coordination
- LCL
- Motivation and Goal

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Coordination groups two or more phrases together:

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[NP The chicken] and [NP the rice] go well together.

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Conjuncts

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Coordinating Conjunction

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Law of Coordination of Likes (LCL)

mandates like conjunct categories

(Prazmowska, 2015; Williams, 1981)

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Law of Coordination of Likes (LCL)

mandates like conjunct categories

What about unlike coordinations...

Pat is [NP a Republican] and [AP proud of it].

(Prazmowska, 2015; Williams, 1981)

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Motivation: the extent and limits of unlike coordination have not been defined

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Motivation: the extent and limits of unlike coordination have not been defined

Goal: analyze unlike coordination through a quantitative corpus analysis

Part 2: Background

- Linguistics
  Syntax
- Structure of
  Coordination

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- → Linguistics Syntax
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Syntax: the study of sentence structure

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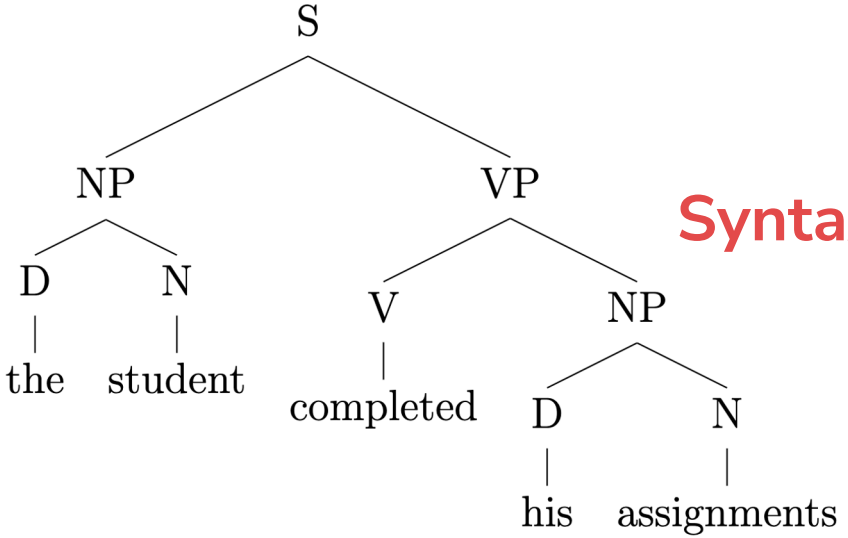


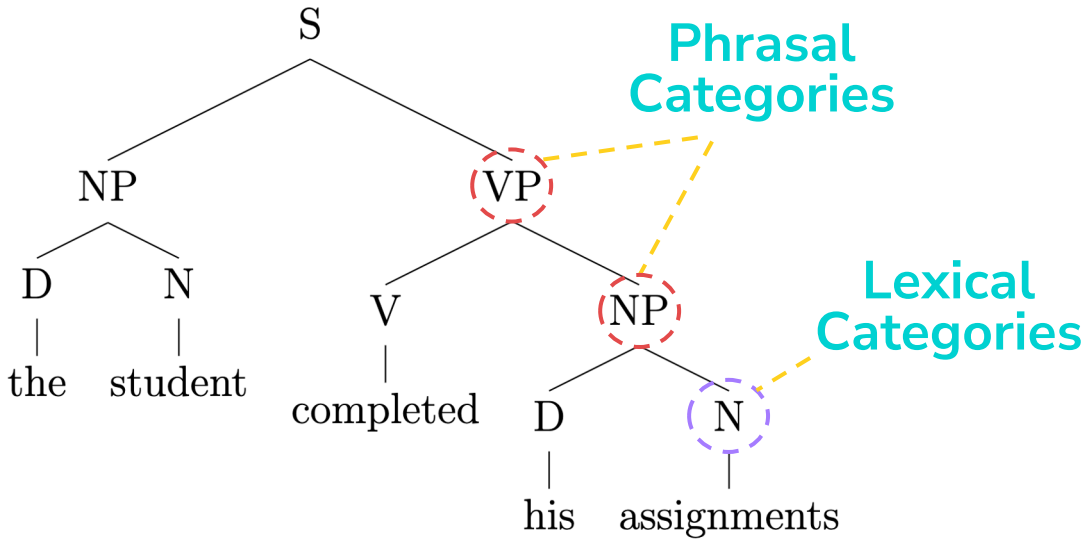
Syntax Trees

Part 2: Background

→ Linguistics Syntax

- Structure of Coordination

Syntax: the study of sentence structure



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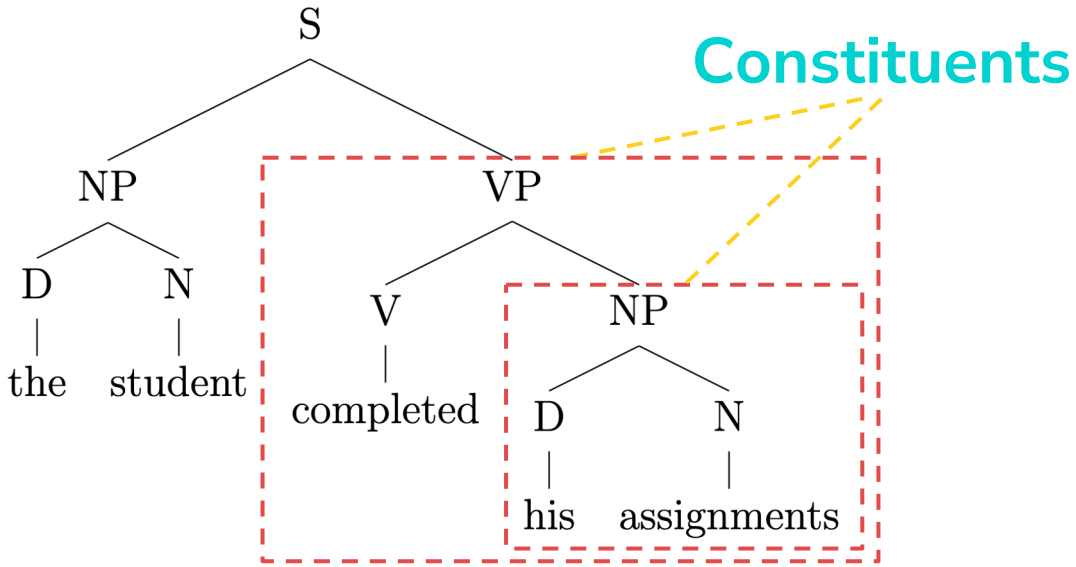

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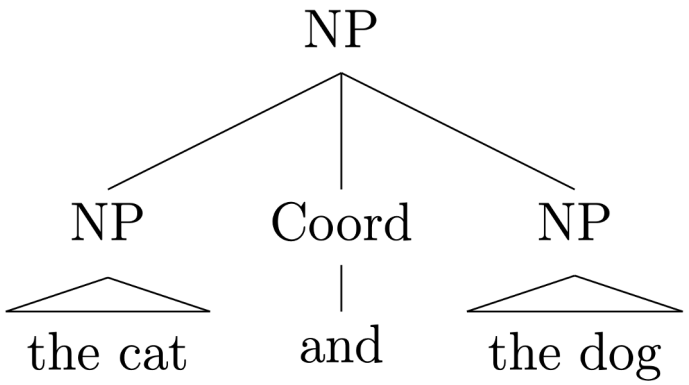
Structure of coordination

[NP the cat] and [NP the dog]



(Progovac, 1998a; Chomsky, 1981; Prazmowska, 2015)

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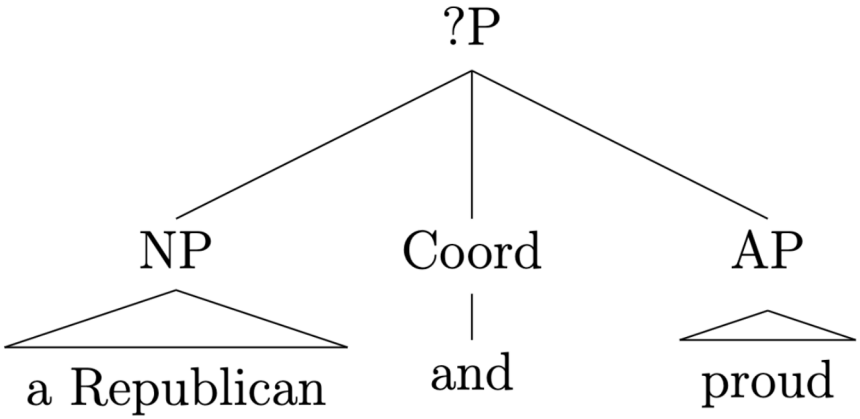
Structure of coordination

[NP a Republican] and [AP proud]



(Progovac, 1998a; Johannessen; 1998; Zoerner, 1995)

Part 3: Approach

- Key Idea
- Data
- Syntactic Analysis

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Key Idea: process and analyze corpus data to study the attested usage of unlike coordination in English

- Place emphasis on empirical rather than intuitive data
- Identify the constraints on coordination

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Two Data Sources

- **Corpus of Contemporary American English (COCA)**
  - >450 million words of text
  - Balanced data from five genres

(Davies, 2015; Ficler and Goldberg, 2016; Marcus et al., 1993)

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Two Data Sources

- **Corpus of Contemporary American English (COCA)**
  - >450 million words of text
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- **Penn Treebank (PTB)** with manual Coordination Annotation Extension

(Davies, 2015; Ficler and Goldberg, 2016; Marcus et al., 1993)

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Coordination Phrase Extraction

- Use Berkeley Neural Parser to produce trees of COCA sentences
- Search for coordination structures within parse trees
  - In both COCA and PTB

(Kitaev and Klein, 2018)

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Coordination Extraction from COCA

Three patterns of two-termed coordination…

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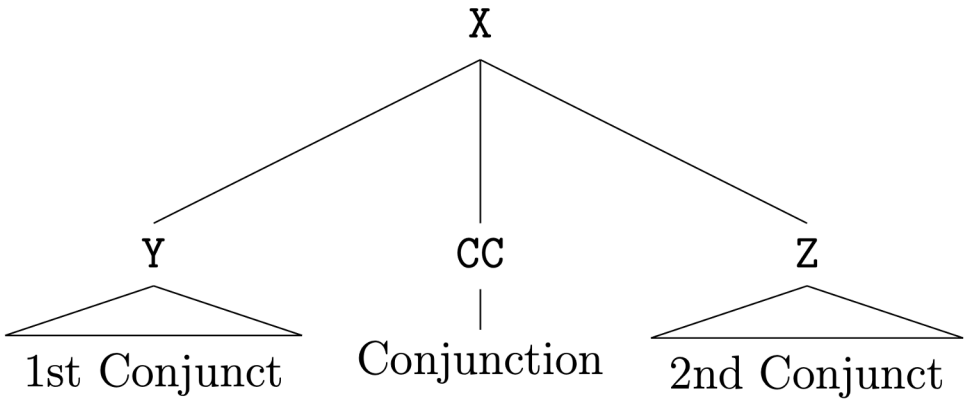
Coordination Extraction from COCA

Pattern 1: Simple Ternary-branching Tree



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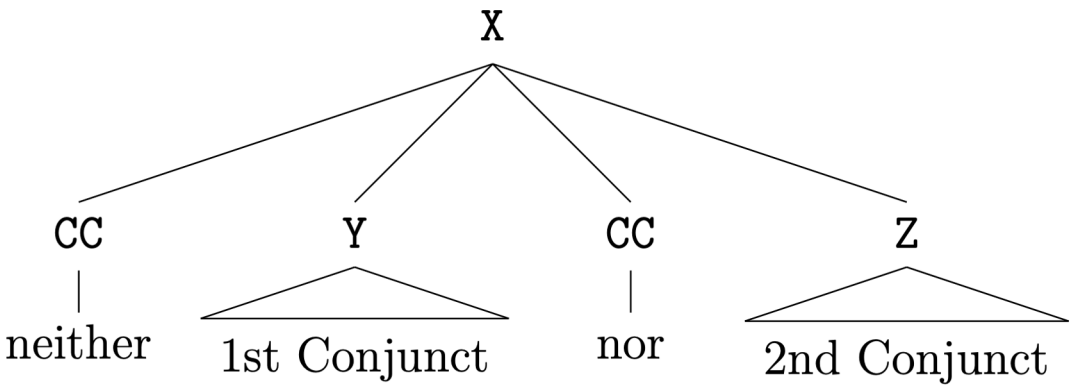
Coordination Extraction from COCA

Pattern 2: *Neither-Nor* Tree



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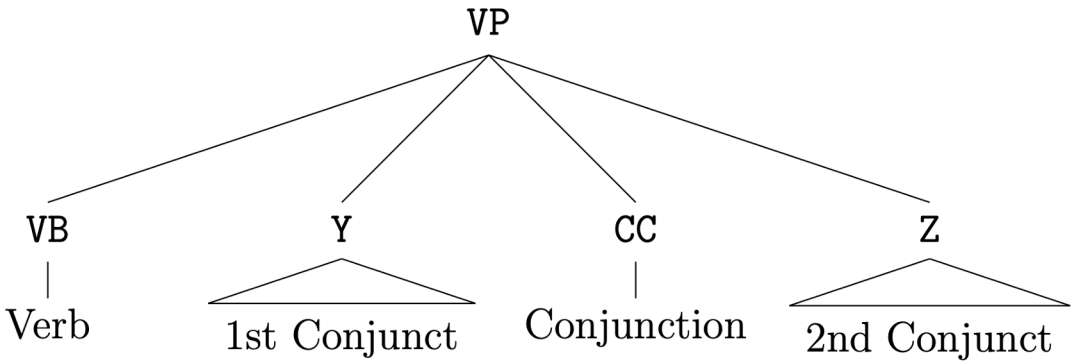
Pattern 3: Verb-Complement Tree



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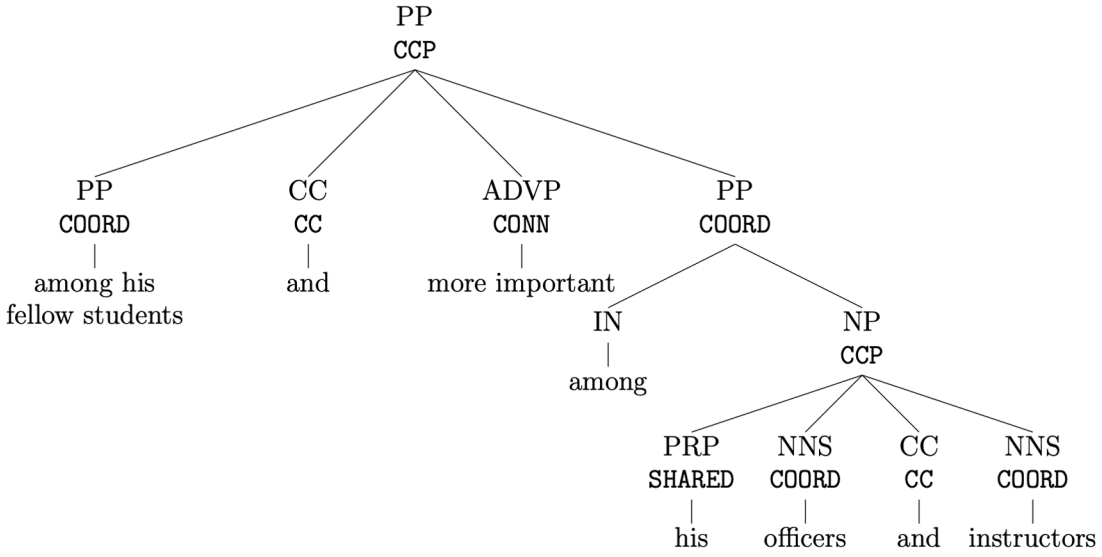
Coordination Extraction from PTB



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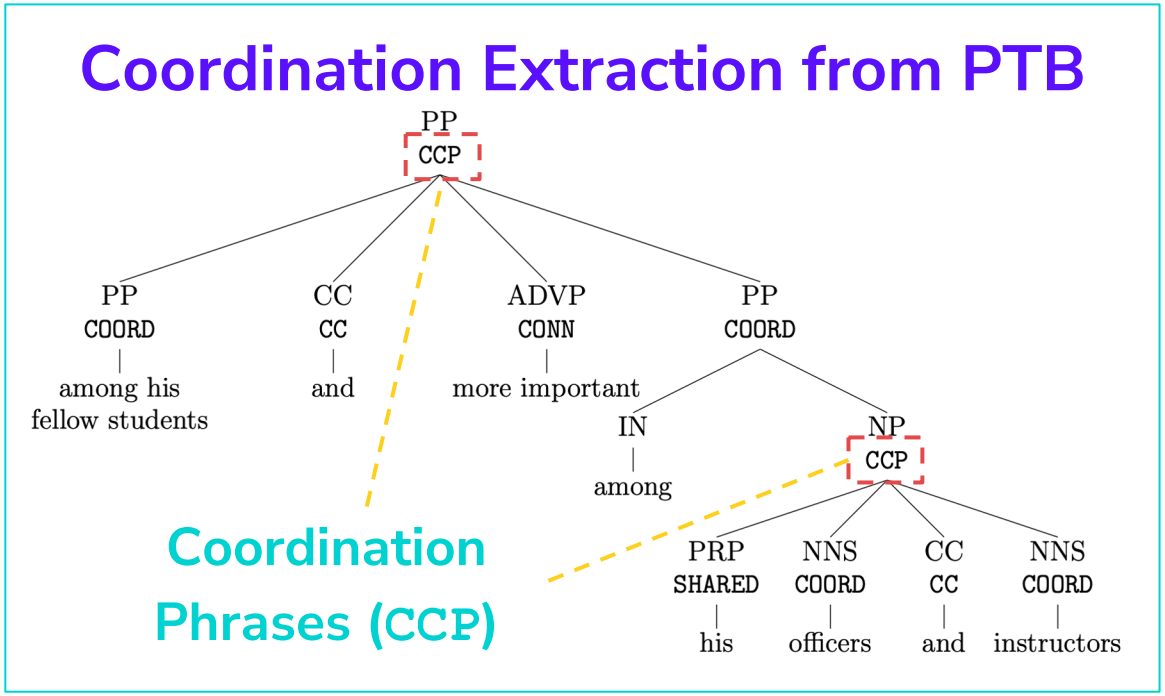

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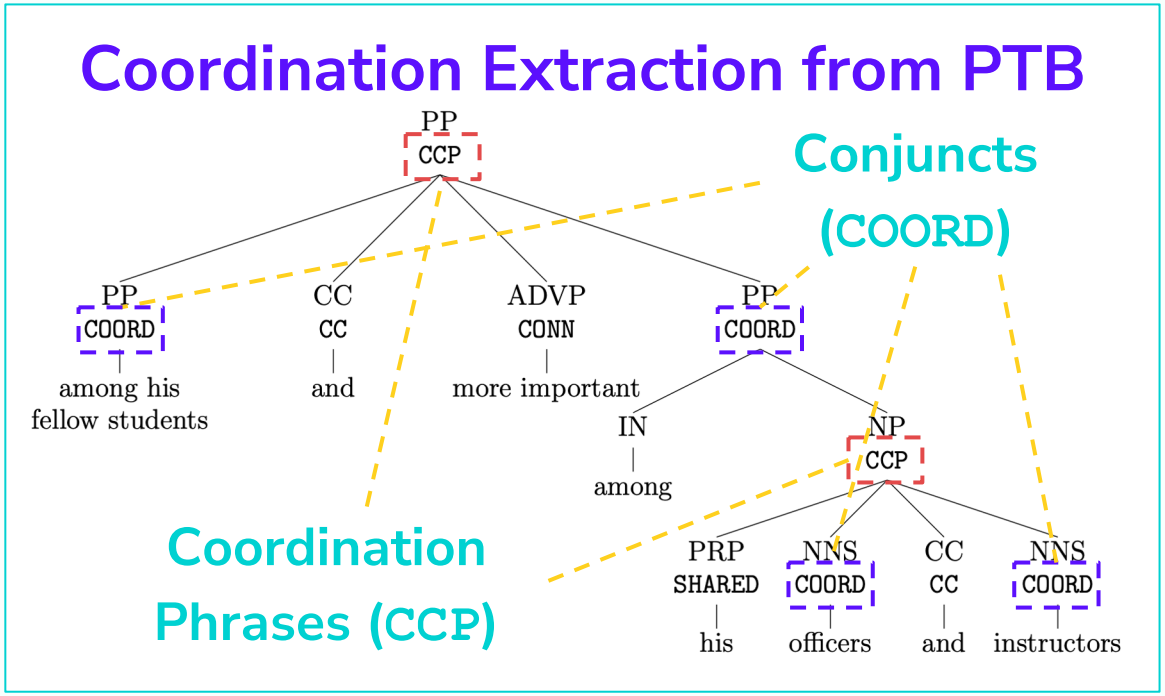

Part 4: Results

- Frequent Unlike Coordinations
- Differences from Position
- Evaluation

Results

- Presentation and discussion of most important results
- Consider $p < .05$ to be significant
- Include post-tests

(In the interest of time, this presentation includes a subset of all results)

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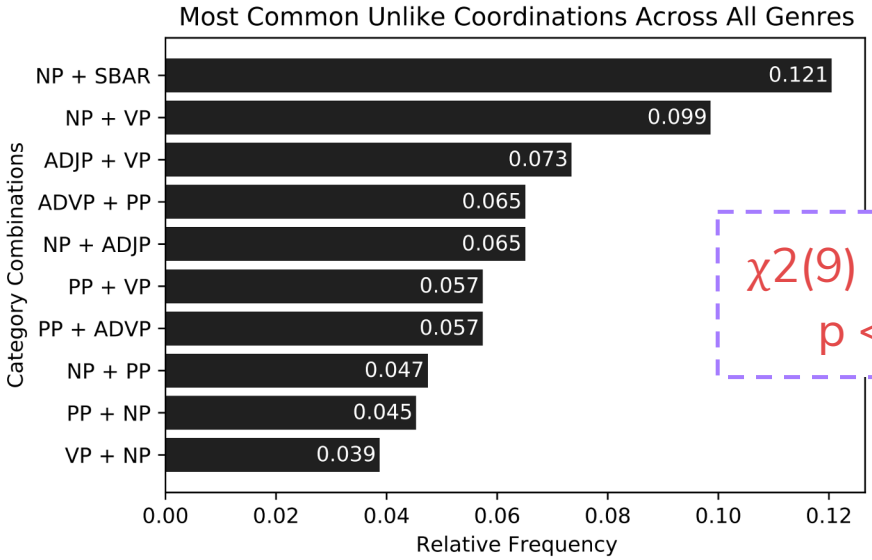
Most Frequent Unlike Coordinations



$\chi^2(9) = 3142.0$
$p < .001$

*SBAR = Subordinate Clause

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Most Frequent Unlike Coordinations

- High **NP+SBAR** frequency might be explained by sentential subjects

  We disliked [NP Mary's attitude] and [SBAR that she left early].

  [SBAR That Mary left] disappointed us.

- This is more evidence that clauses distribute like NPs

(Lohndal, 2014)

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Differences Between Conjunct Positions

Cat.	1st Conjunct (%)	2nd Conjunct (%)	χ2	N	V
NP	70.75	29.24	3200.7	18582	.415
VP	32.42	67.58	1764.4	14277	.352
PP	53.47	46.53	68.789	14248	.069
ADJP	55.73	44.27	125.57	9566	.114
ADVP	48.71	51.29	5.076	7645	.026
SBAR	23.97	76.03	2385.8	8800	.521

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Evaluation Plan

- Randomly sampled unlike coordinations
- 3 independent raters evaluated agreement with parser's labelings

```
If you 're [VP married] and [PP in uniform] , what have
you learned after a decade of war?
Coordination phrase: [VP married] and [PP in uniform]
Is this coordination phrase correctly labeled? (y/n)
```

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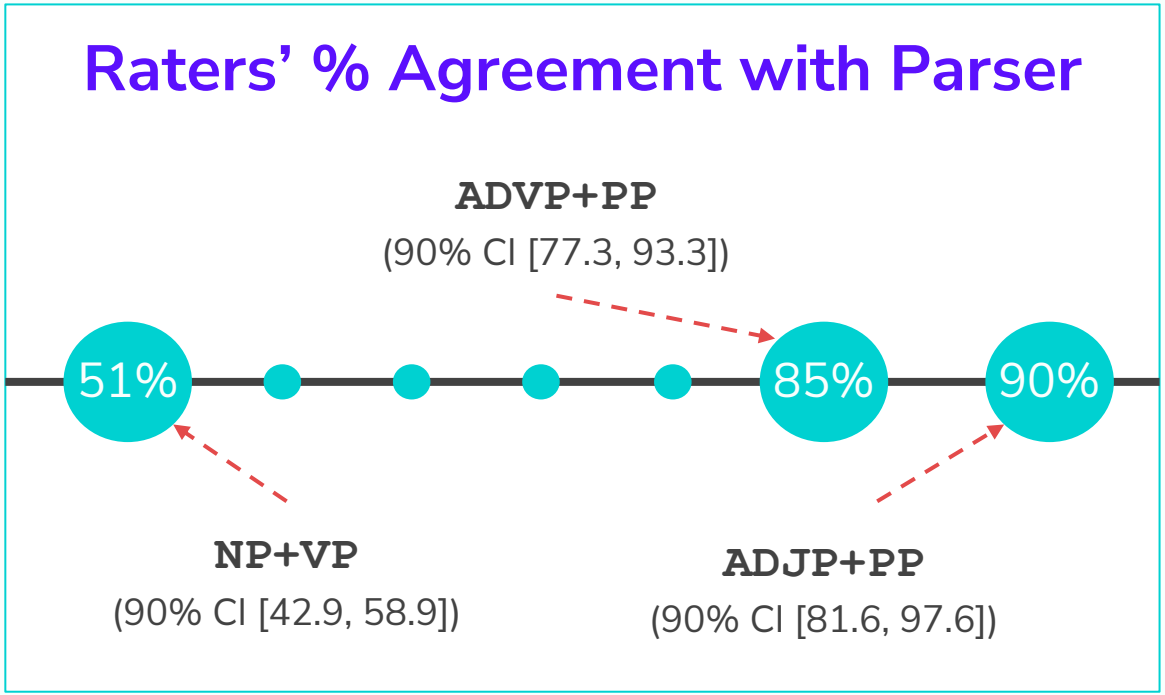

*For agreement between raters, Fleiss's Kappa K = 0.29 (fair) (McHugh, 2015)

Part 5: Conclusion

- Concluding Remarks
- Future Work

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Concluding Remarks

- **Constraints on unlike coordination** are still elusive to linguists
- We use a **computational syntactic analysis** to study coordination
- Our analysis provides new data and perspectives to **shape future theories**

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- **Semantic** constraints of coordination

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Future Work

- **Semantic** constraints of coordination
- Ungrammatical like coordinations…

  * John ate [PP with his mother] and [PP with good appetite].

Acknowledgments

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- Thank you to the **EMNLP reviewers** for their feedback and suggestions

Thank you!

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