

# Syntactic Parsing & Its Applications

CS 490A, Fall 2021

Applications of Natural Language Processing

[https://people.cs.umass.edu/~brenocon/cs490a\\_f21](https://people.cs.umass.edu/~brenocon/cs490a_f21)

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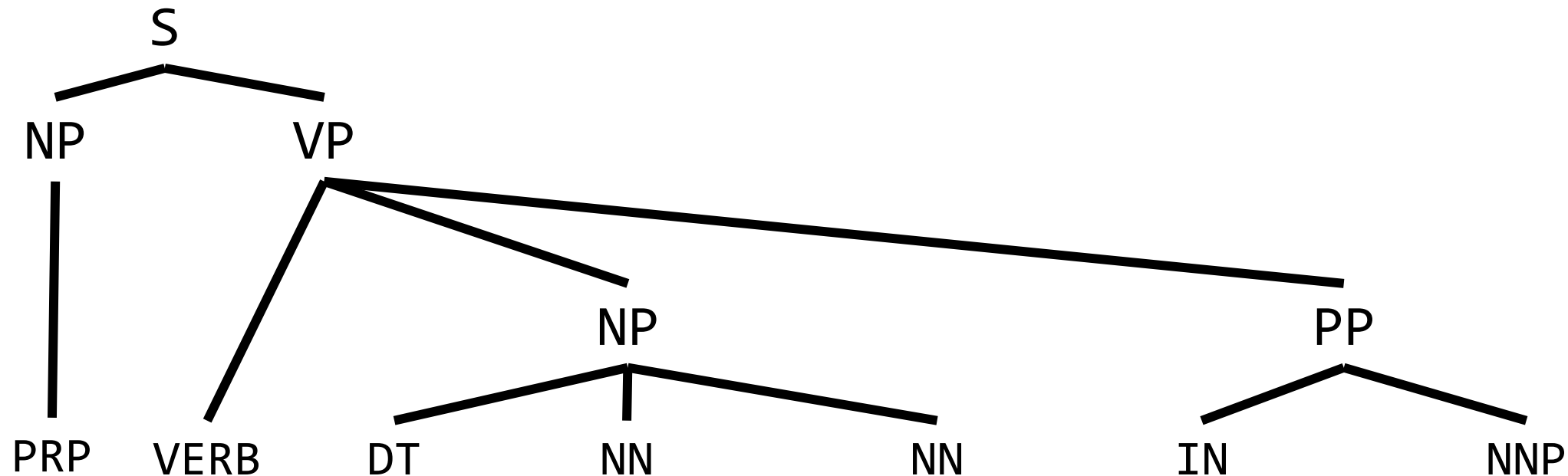
# Administrivia

- HW3 due Friday 10/29
- Doing a PhD in CSS/NLP office hour

# Syntactic Parsing

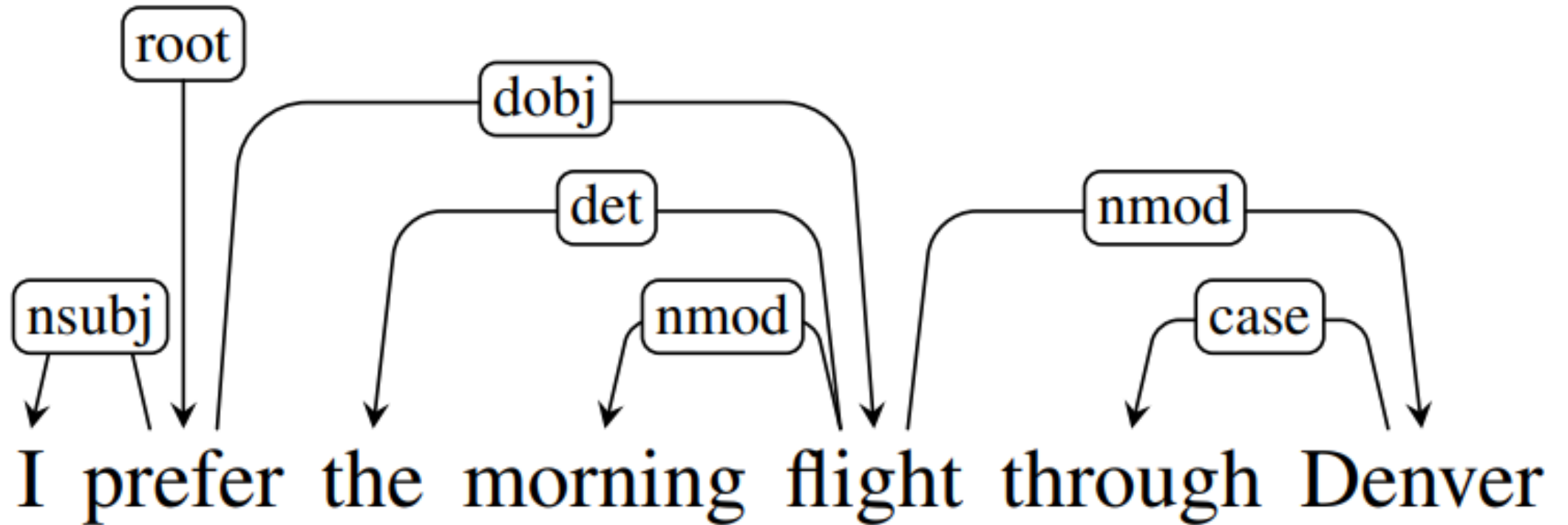
I prefer the morning flight through Denver

# Constituency Parse Tree

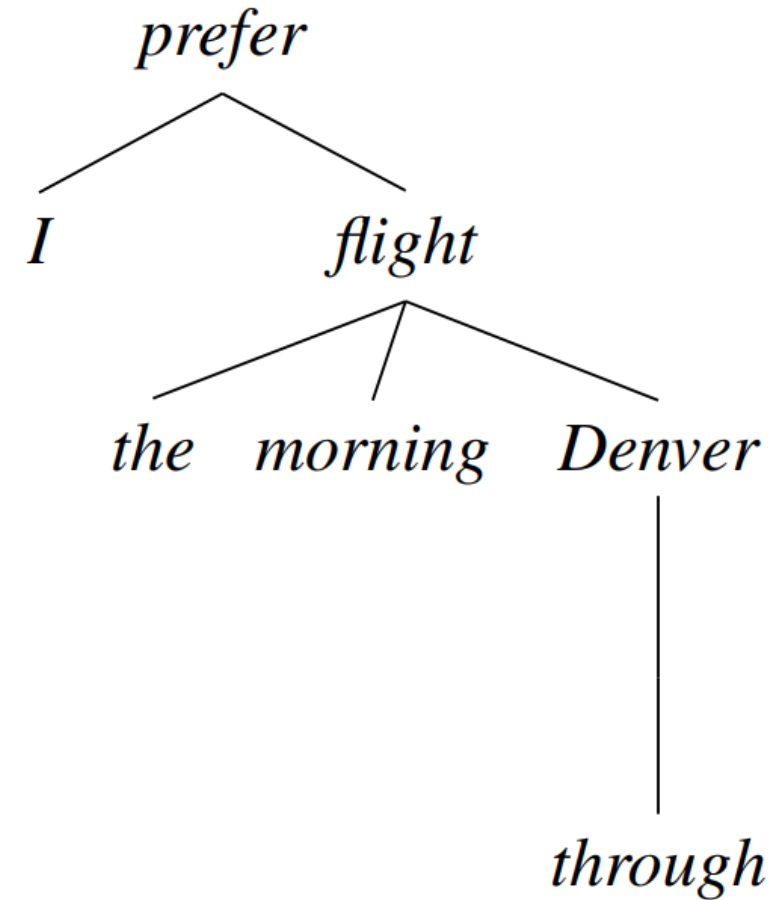
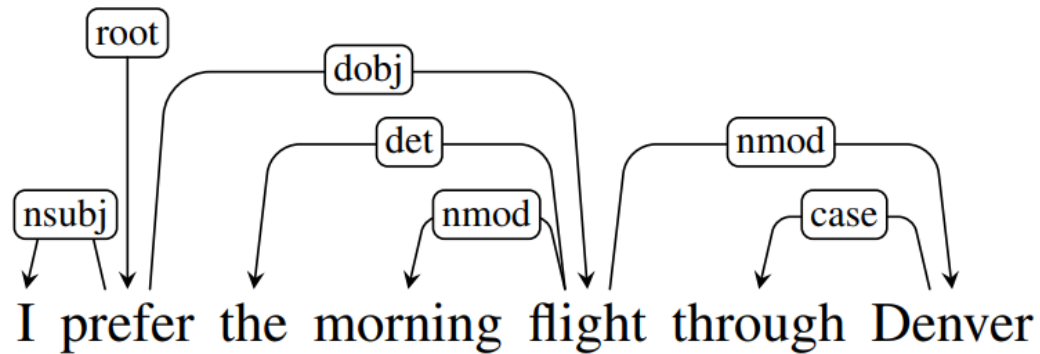


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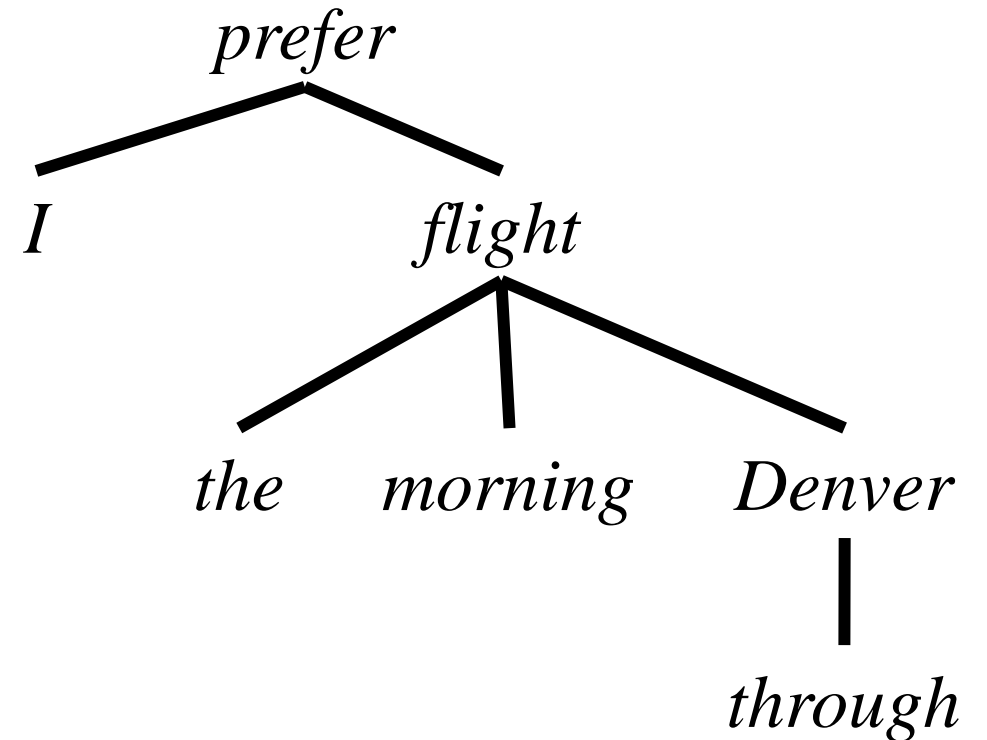
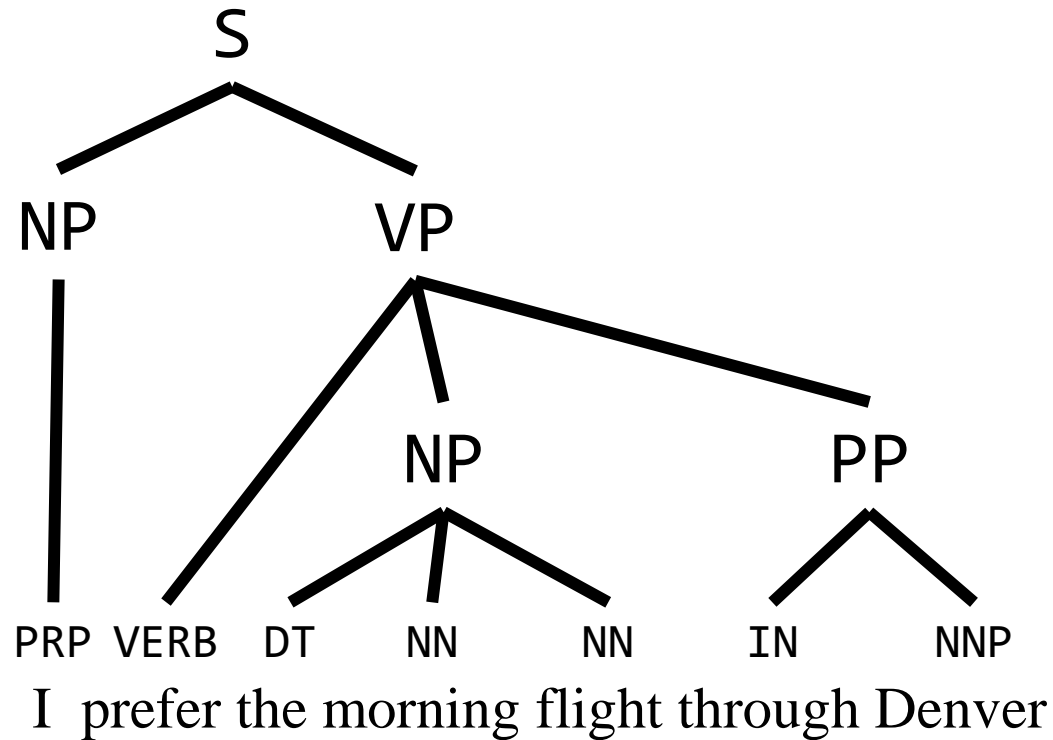
# Dependency Parse Tree



# Dependency Parse Tree



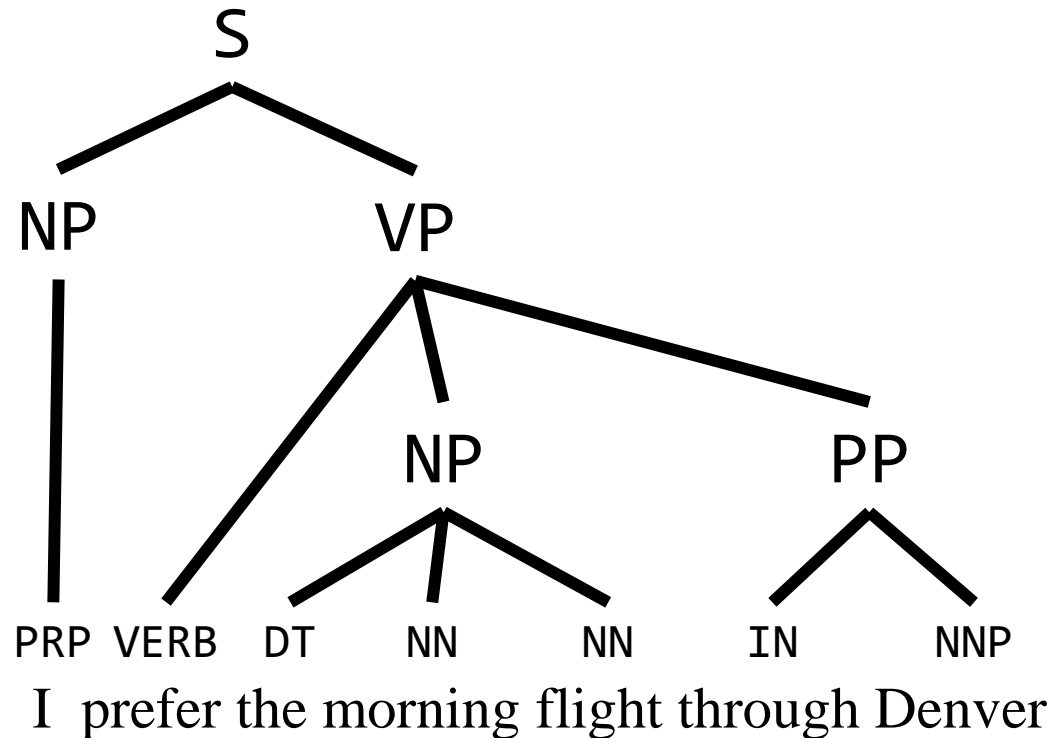
# Q: How do constituency and dependency parse trees differ?



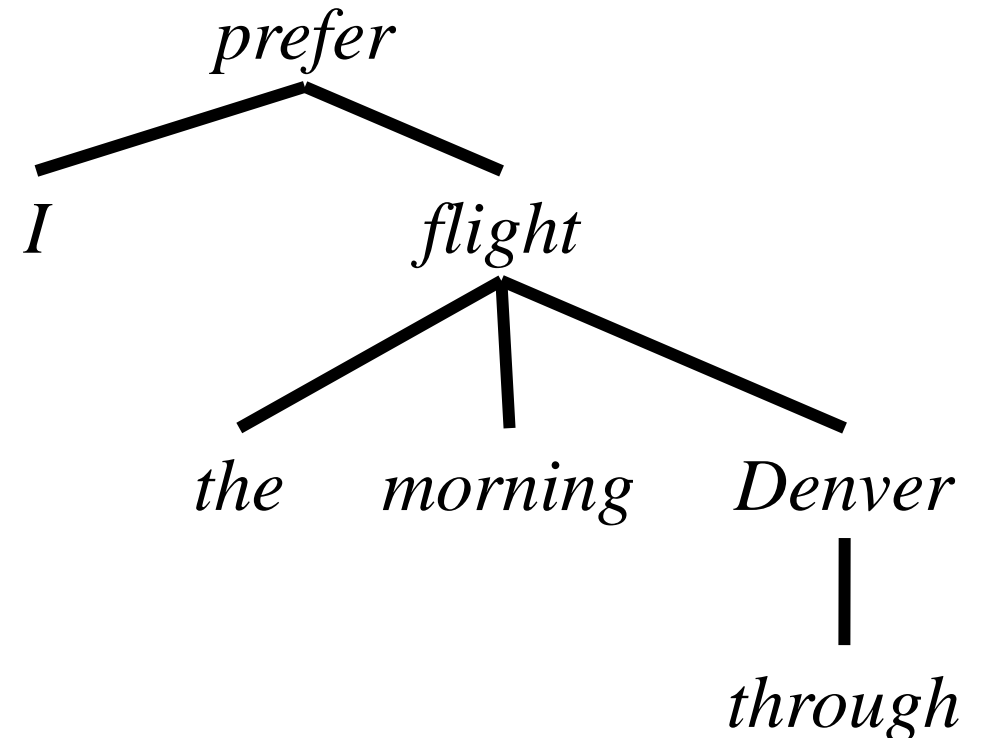


# Q: How do constituency and dependency parse trees differ?

Focuses on *phrases*

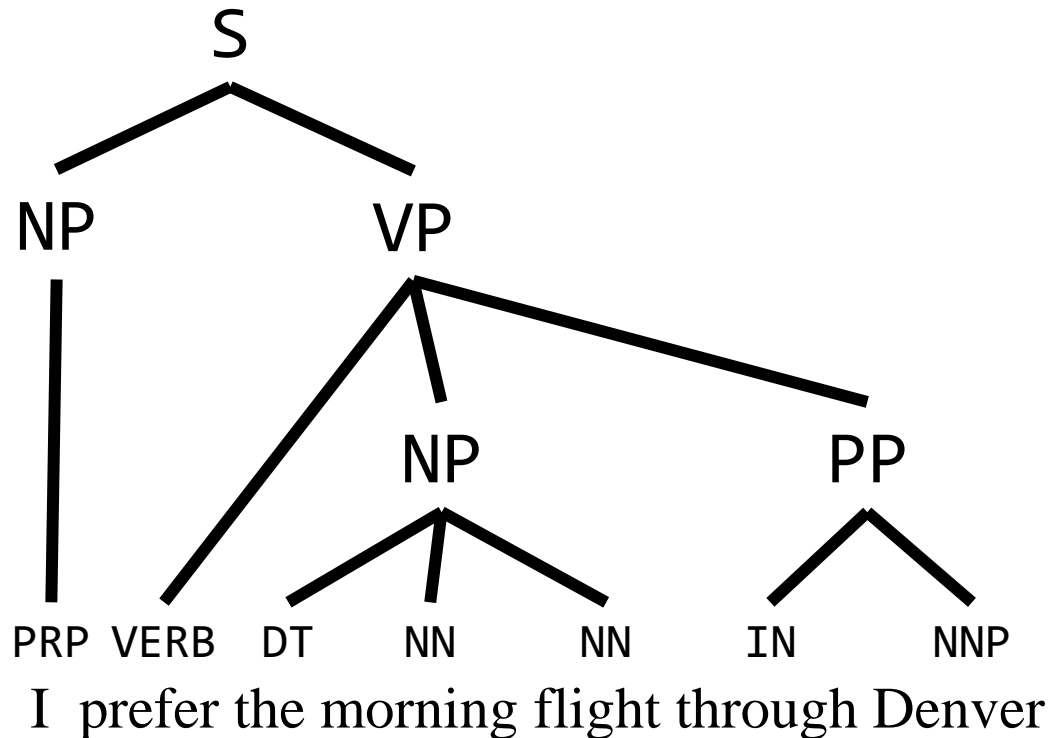


Focuses on *relations*

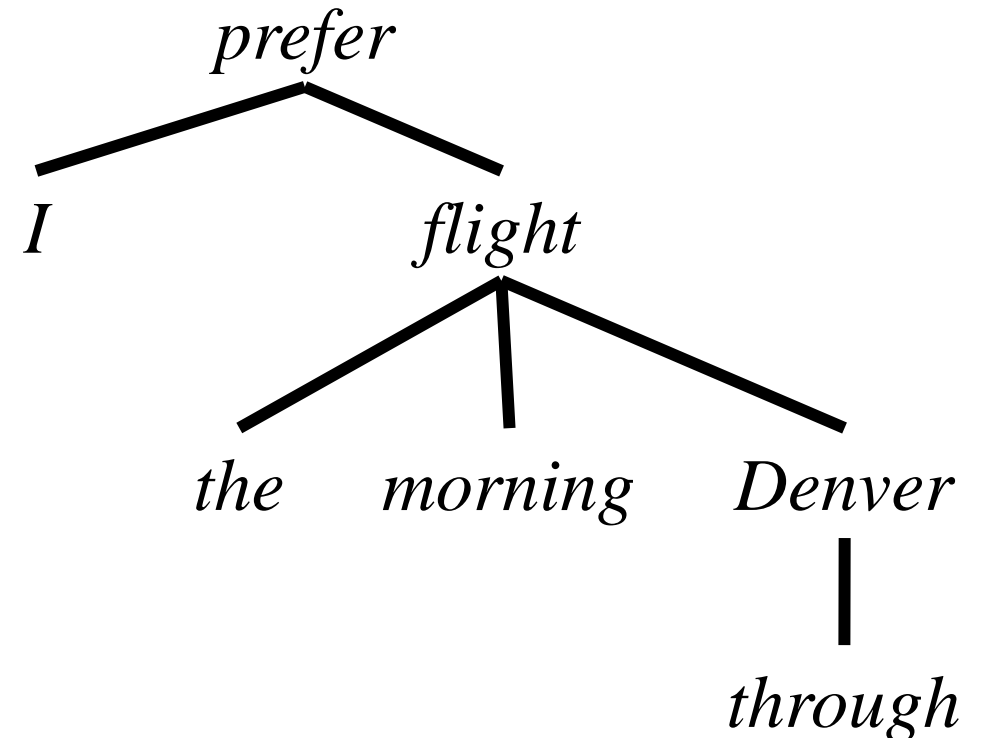


# Q: How do constituency and dependency parse trees differ?

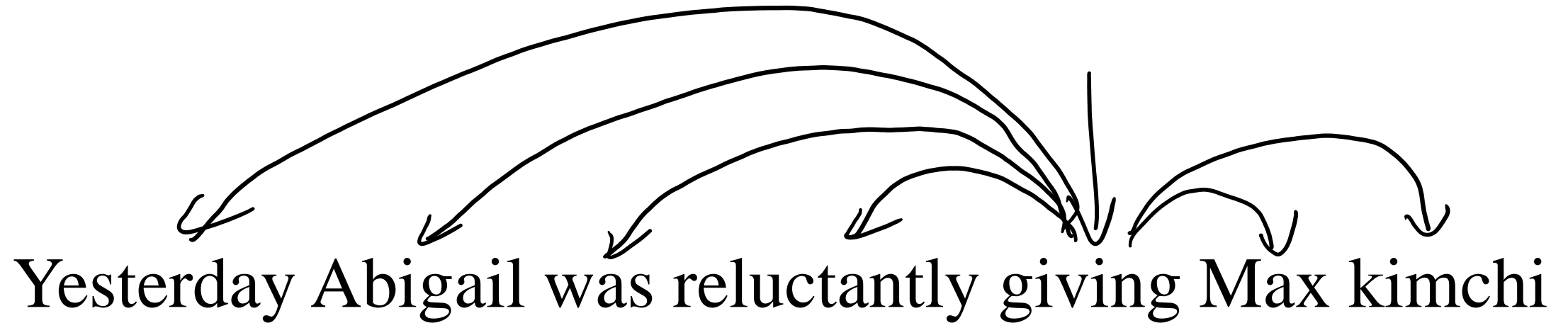
Constituents are *sequences*



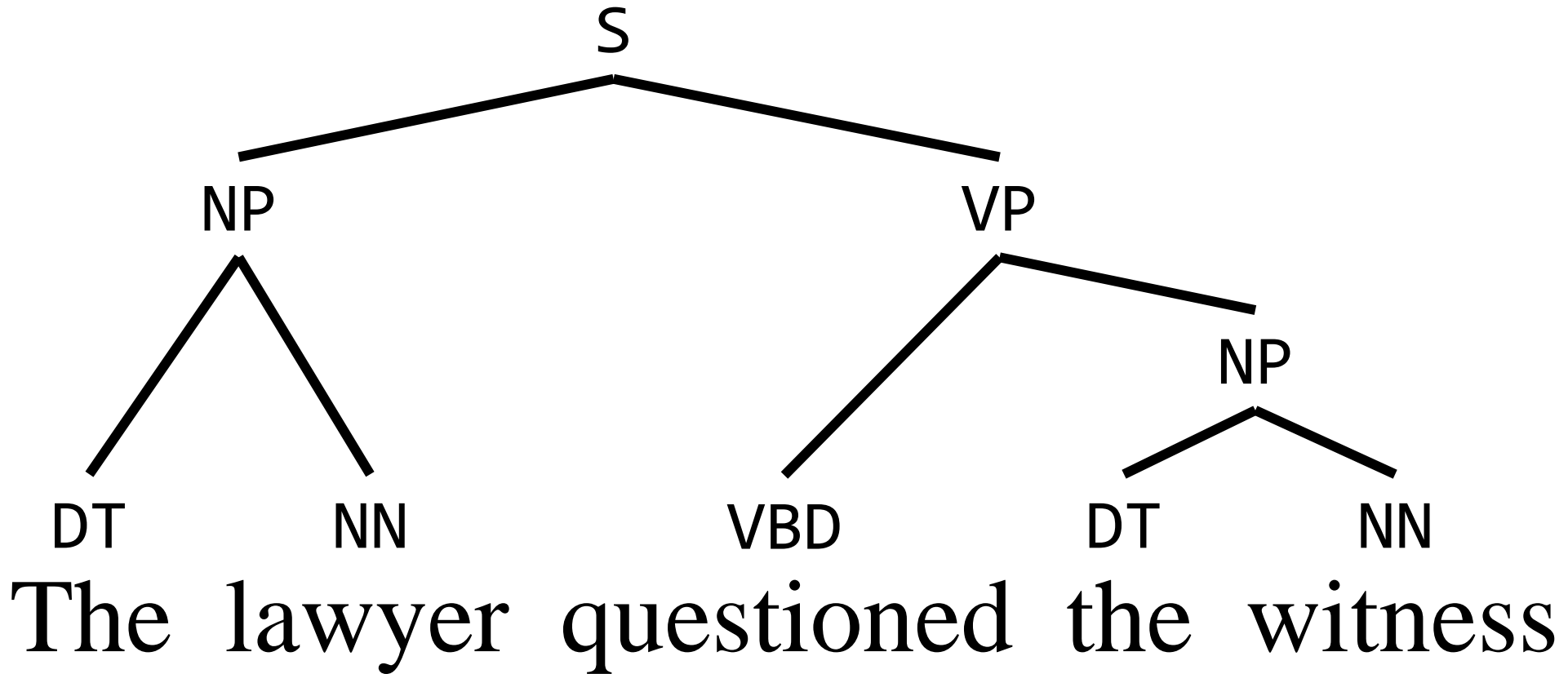
Relations *not restricted* by word order



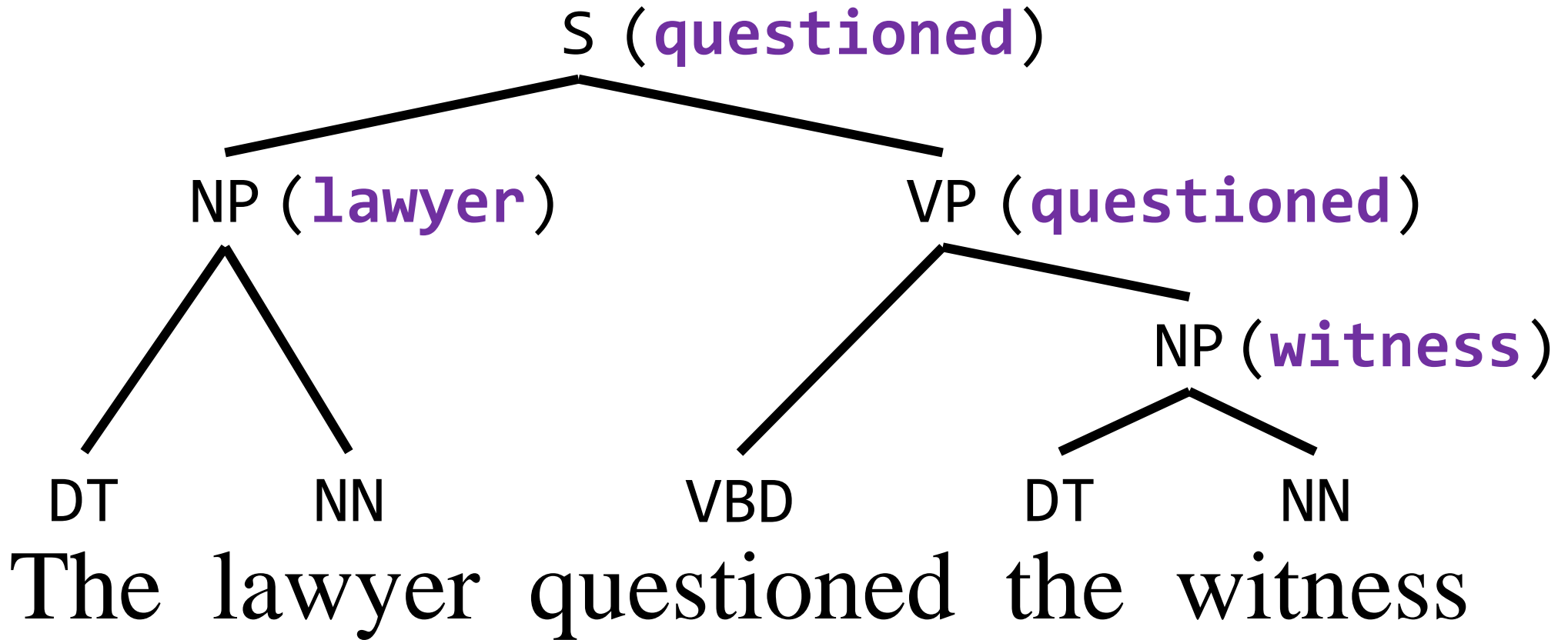
# Dependency trees can be very flat



# From Constituents to Dependencies



# I. Identify head of each constituent



# Determining heads of constituents

Idea: Every phrase has a head word

A *head rule* determines which of a tree's children will be its “head”

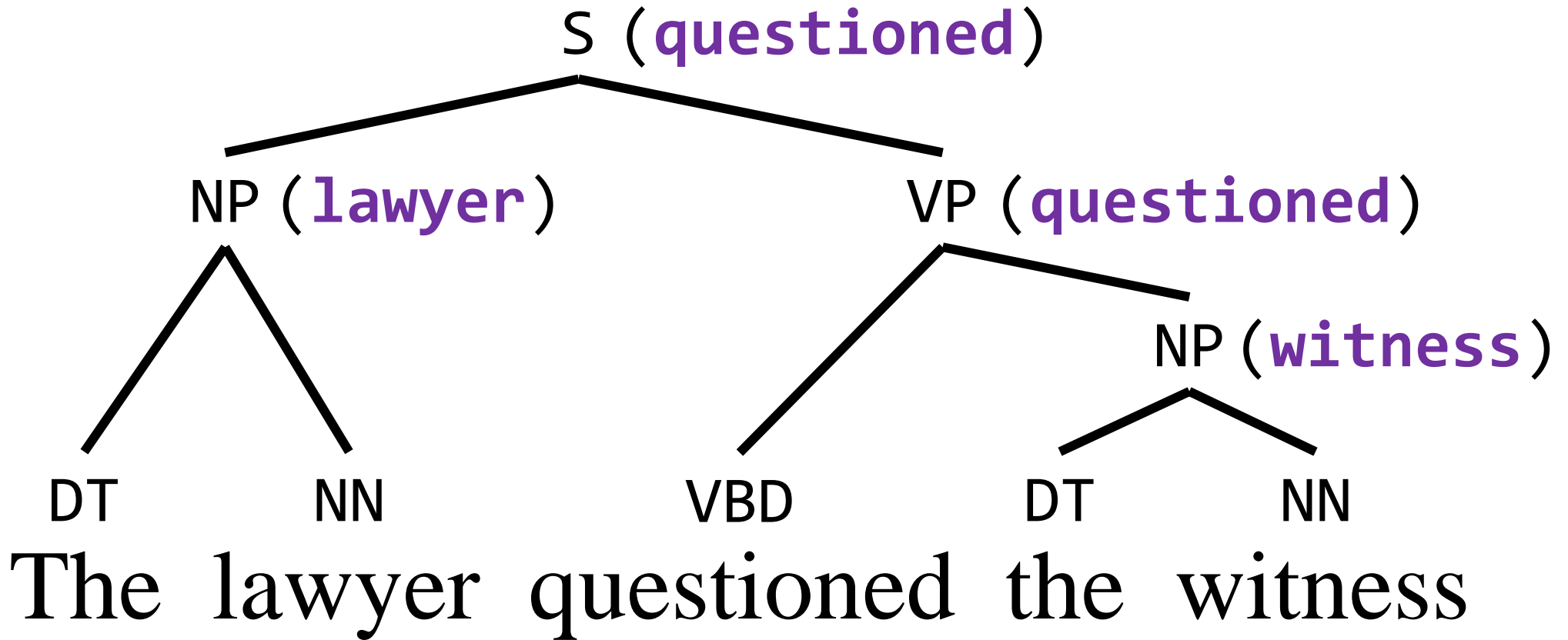
Example rule from Collins (1997):

If parent is NP:

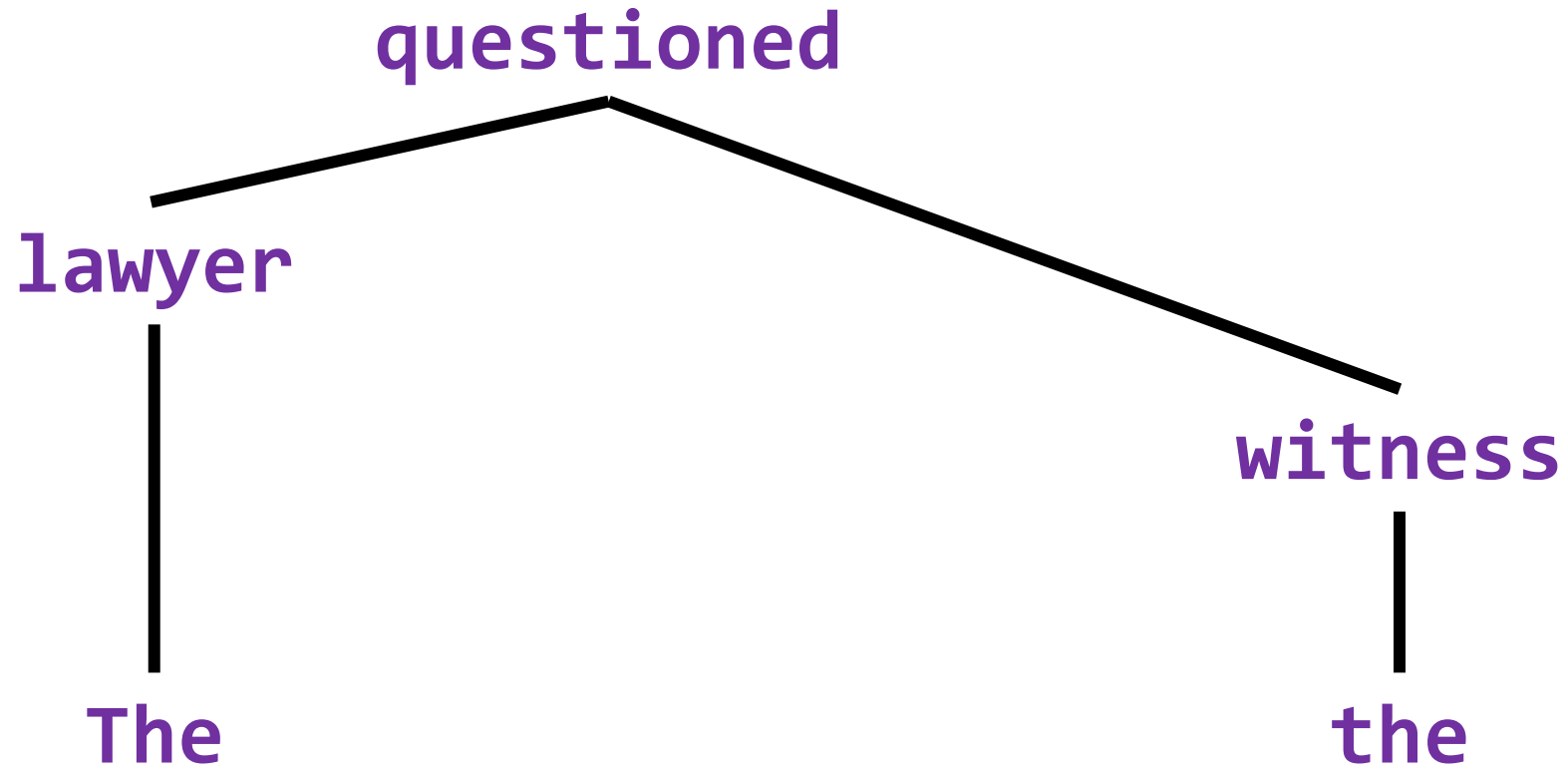
Then: Search from right-to-left for first child  
that's NN, NNP, NNPS, NNS, NX, JJR

ELSE: Search from left-to-right for first child  
which is NP

## II. Set other children to depend on head



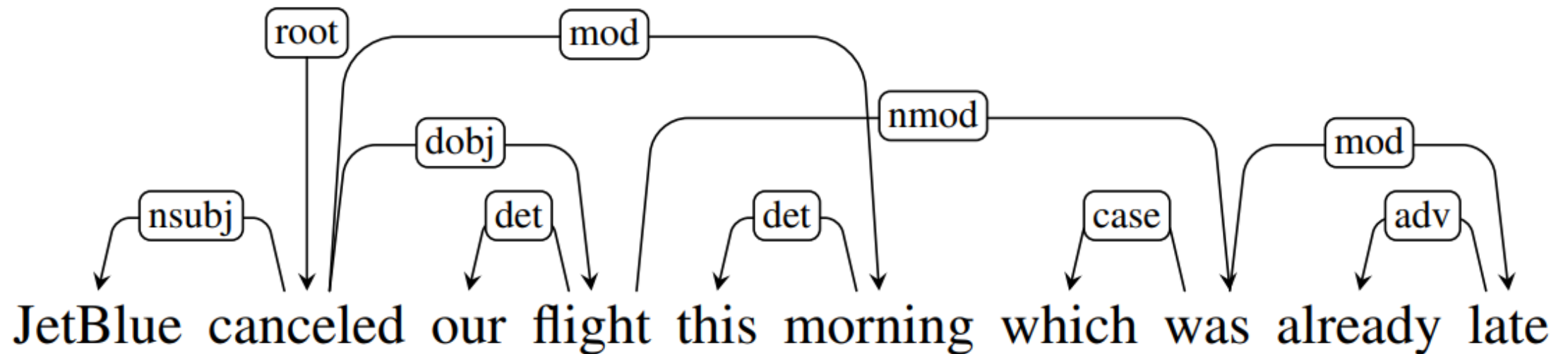
## II. Set other children to depend on head





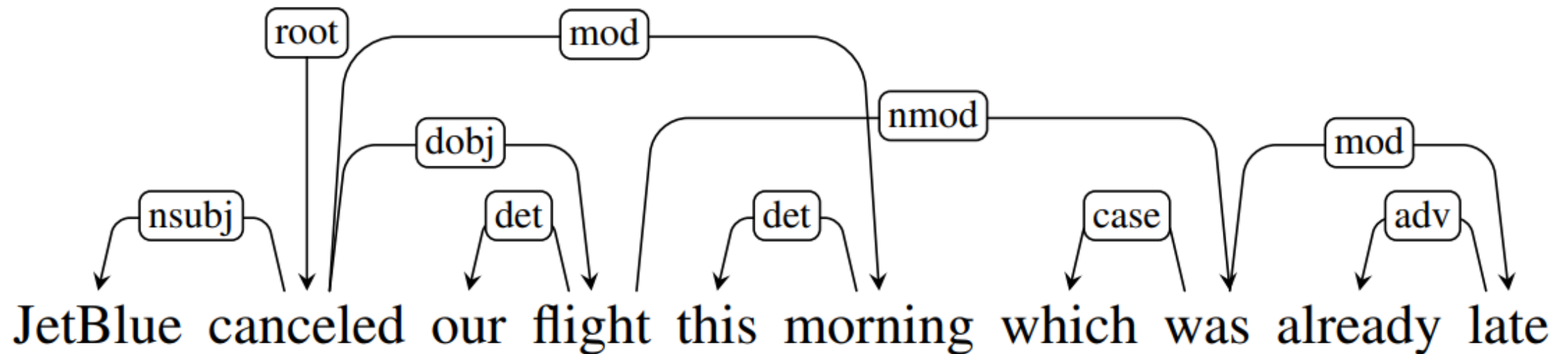
# Projectivity

Not all dependency parses have corresponding constituency parses!



# Projectivity

Non-projective dependency trees are *not* context-free! So, they cannot be described by a context free grammar.



# Applications

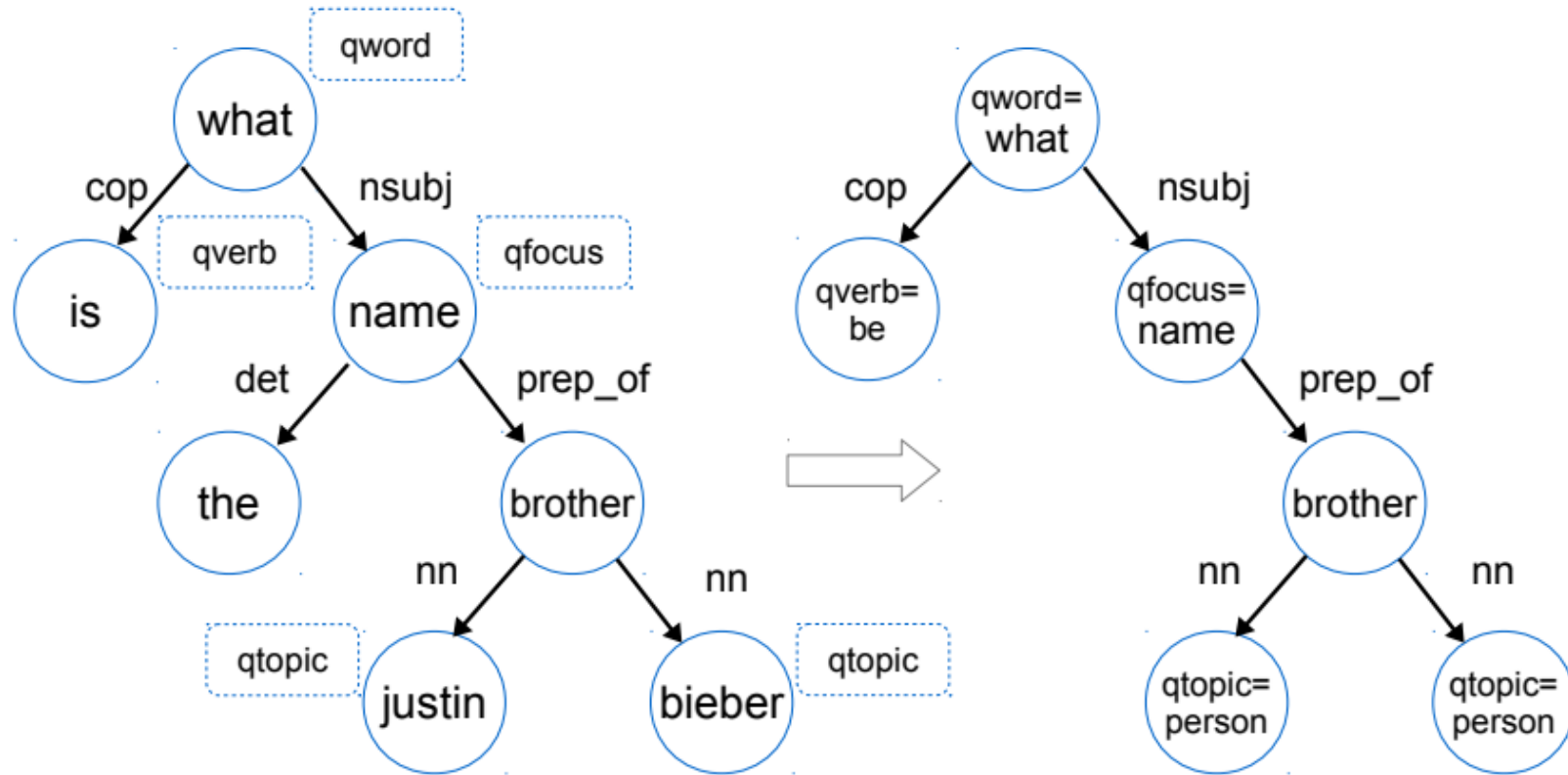
# I. Parse Trees as Features

# Information Extraction over Structured Data: Question Answering with Freebase

## Core Question:

Can answering natural language questions with Freebase be improved by pairing Freebase with “modest” information extraction methods?

# Information Extraction over Structured Data: Question Answering with Freebase



(a) Dependence parse with annotated question features in dashed boxes (left) and converted feature graph (right) with only relevant and general information about the original question kept. Note that the left is a real but incorrect parse.

# Asking too much? The Rhetorical Role of Questions in Political Discourse

Core Question:

What are the rhetorical roles of questions in political discourse?

# Questions serve informational roles

# Questions?

Who is the Prime Minister of the United Kingdom? |



...but they also serve many rhetorical roles



<https://www.bbc.com/news/av/uk-politics-21444663>

“The Prime Minister is rightly shocked by revelations that many food products contain 100% horse. Does he share my concern that, that if tested, many of his answers may contain 100% bull?”

Zhang et al. 2017 (slides)

# Goal: Identify rhetorical role of questions

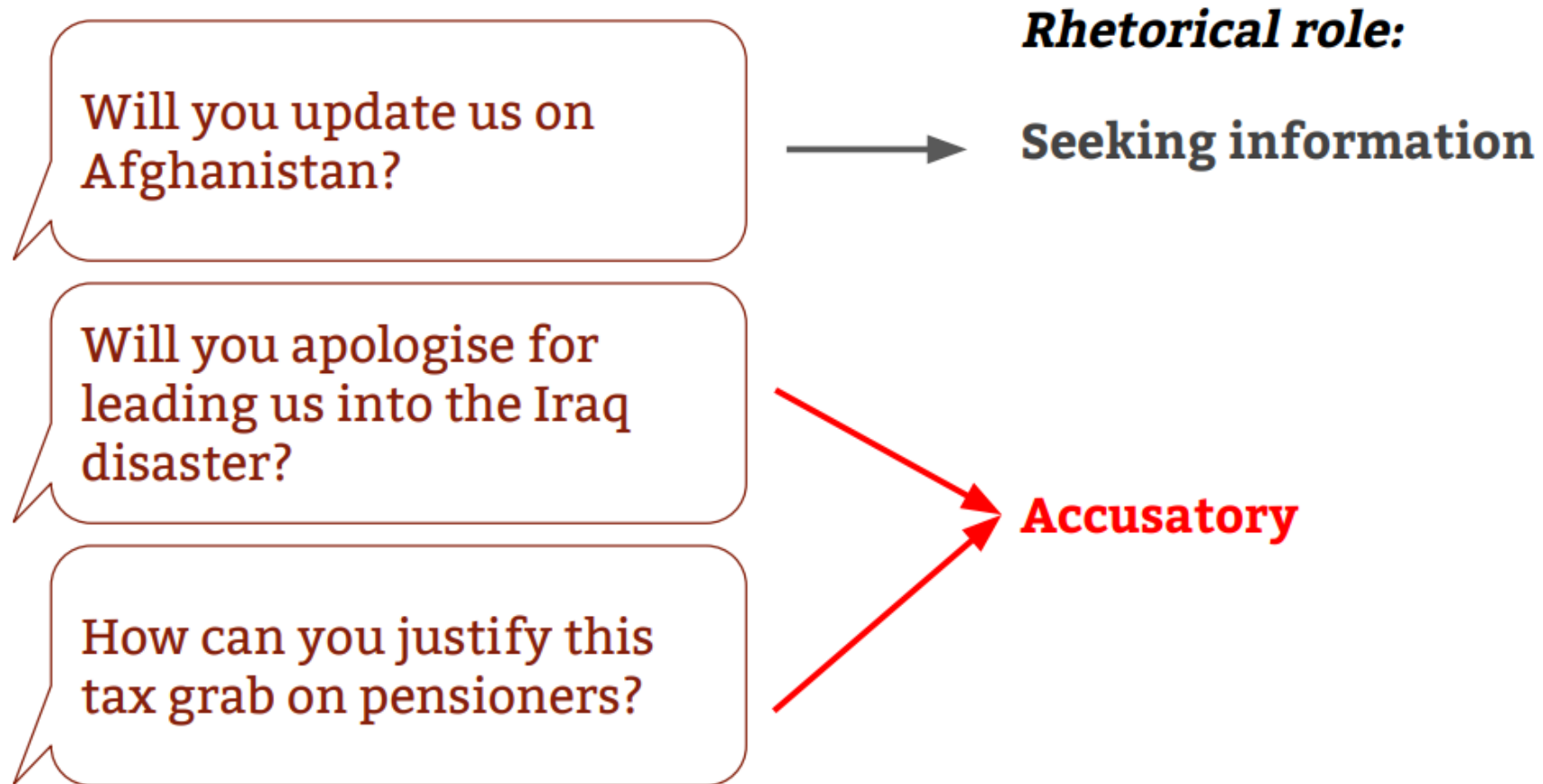
## ***Rhetorical role:***

Will you update us on  
Afghanistan?

Will you apologise for  
leading us into the Iraq  
disaster?

How can you justify this  
tax grab on pensioners?

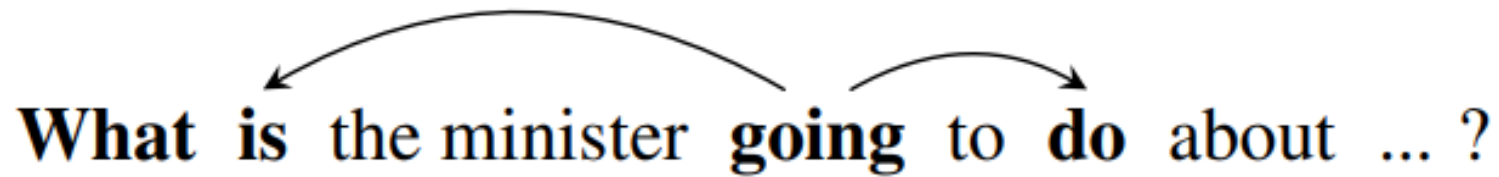
# Goal: Identify rhetorical role of questions



# Question Motifs

*Question motifs* are “lexico-syntactic patterns recurring in a collection of questions”

I. Extract relevant fragments from **dependency parse trees** of questions



**What** **is** the minister **going** to **do** about ... ?

5 Fragments: what, what is, going→\*, is←going and going→do

Zhang et al. 2017 (slides)

# Question Motifs

- I. Extract relevant fragments from dependency parse trees of questions
- II. Group fragments into motifs based on how they cooccur



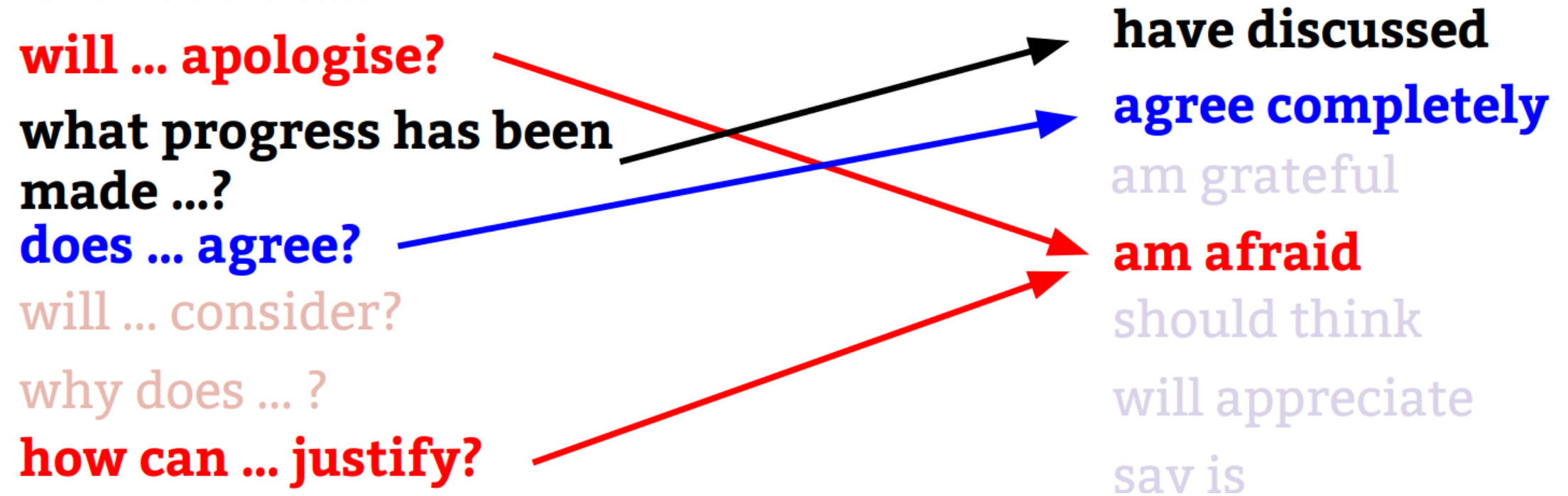
Will you **update** us on  
Afghanistan?

Will you **apologise** for  
leading us into the Iraq  
disaster?

How can you **justify** this  
tax grab on pensioners?

# How to identify rhetorical roles?

Questions with similar rhetorical functions will map to similar answers



# Some of the rhetorical types

## 4: Agreement

Airing a laudatory remark about a policy that the minister and MP clearly already agree on. Often these questions effectively serve as attempts to curry favor with the minister and bolster their (mutual) party.

Q: **Is** it not **important** that the Department continues its excellent work [in] building flood defences?

Q: **Does** [the Secretary of State] **agree with** me that part of protecting Britain's national interests is that Britain should develop relationships with emerging economies?

Q: **Does** the Minister **agree** that UK taxpayers **need** to be considered at every single step of the way when it comes to our aid spending?

Question motifs: {does←agree, agree→is}, {is→important}, {does←agree, agree→with}, {does←agree, agree→need}

# Some of the rhetorical types

## 6: Concede, accept

Aggressive demand for minister to concede to, or accept, a fault. The premise of such questions is that the minister has been incompetent, or that the government has the wrong policy; these questions do not constitute a genuine attempt to obtain information.

Q: **Is** it **not** now completely **true** that the Labour Government are out of touch with gut British instincts?

Q: **Will** [the Secretary] **acknowledge** the importance of not completely abandoning the research on sustainable biofuels?

Q: **Will** [the Deputy Prime Minister] now **concede** to the House that the Royal Mail was sold off too cheaply?

Question motifs: {will←accept}, {is→not, is→true}, {will←acknowledge}, {will←concede}



## II. Relation Extraction

# Relation Extraction

*Who did what to whom?*

Clinton defeated Dole

# Relation Extraction

*Who did what to whom?*

Clinton defeated Dole

(Clinton; defeated; Dole)

# Relation Extraction

*Who did what to whom?*

Dole was defeated by Clinton

# Relation Extraction

*Who did what to whom?*

Dole was defeated by Clinton

(Clinton; defeated; Dole)

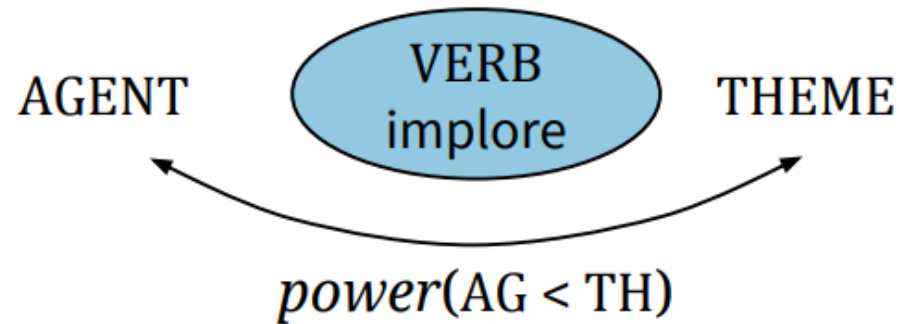
# Connotation Frames of Power and Agency in Modern Films

## Core Question:

Can the power and agency dynamics reflected in verbs be used to measure the gender bias prevalent in films? How do these measures of power and agency compare to the Bechdel test?

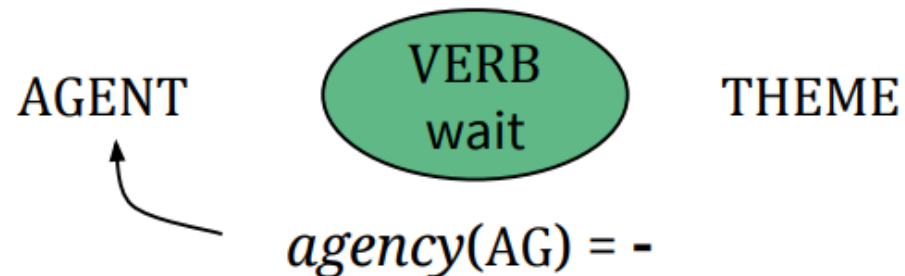
# Connotation Frames of Power & Agency

He **implored** the tribunal to show mercy.



---

The princess **waited** for her prince.



# Crowdsourced Predicate Annotations

**Task Description:** For each verb, determine whether the subject or the object seems to have more authority (higher status) relative to each other.

**Examples:**

- **X has more authority:**
  - "X vetoes Y" --> X is clearly presumed to outrank Y.
- X and Y have similar authority:
  - "X loves Y" --> X and Y are mutually involved and appear to be similar status
- **Y has more authority:**
  - "X idolizes Y" --> Y is presumed to have some power over X.

**More Examples:**

**X has more authority**  
X overrules Y, X vetoes Y

X and Y have similar authority  
X fights Y, X marries Y

**Y has more authority**  
X idolizes Y, X salutes Y

**For the following verbs, which has higher authority:**

- 1) X rescues Y:      ☐ **X has more authority**    ☐ similar    ☐ **Y has more authority**
- 2) X serves Y:      ☐ **X has more authority**    ☐ similar    ☐ **Y has more authority**



# Crowdsourced Predicate Labels

$$power(AG < TH)$$
$$power(AG > TH)$$

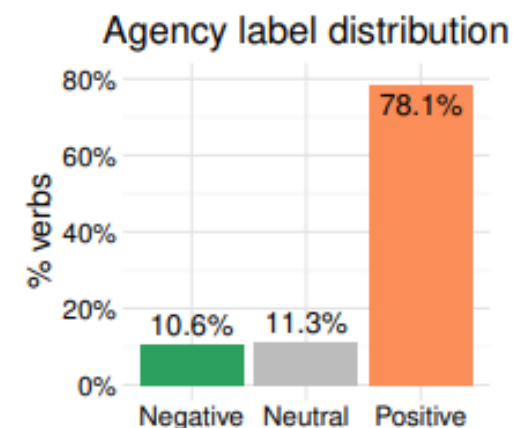
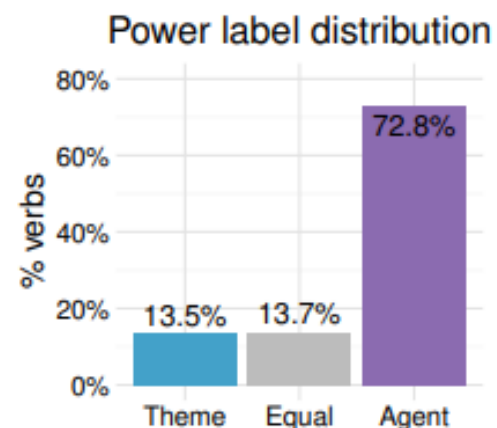
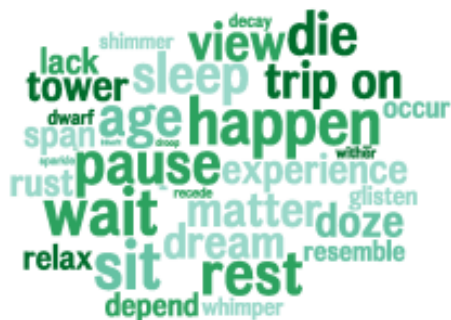
$$agency(AG) = -$$
$$agency(AG)=+$$


Figure 4: Label distributions for *power* and *agency* based on the crowdsourced annotations.

# Power, Agency, and Gender

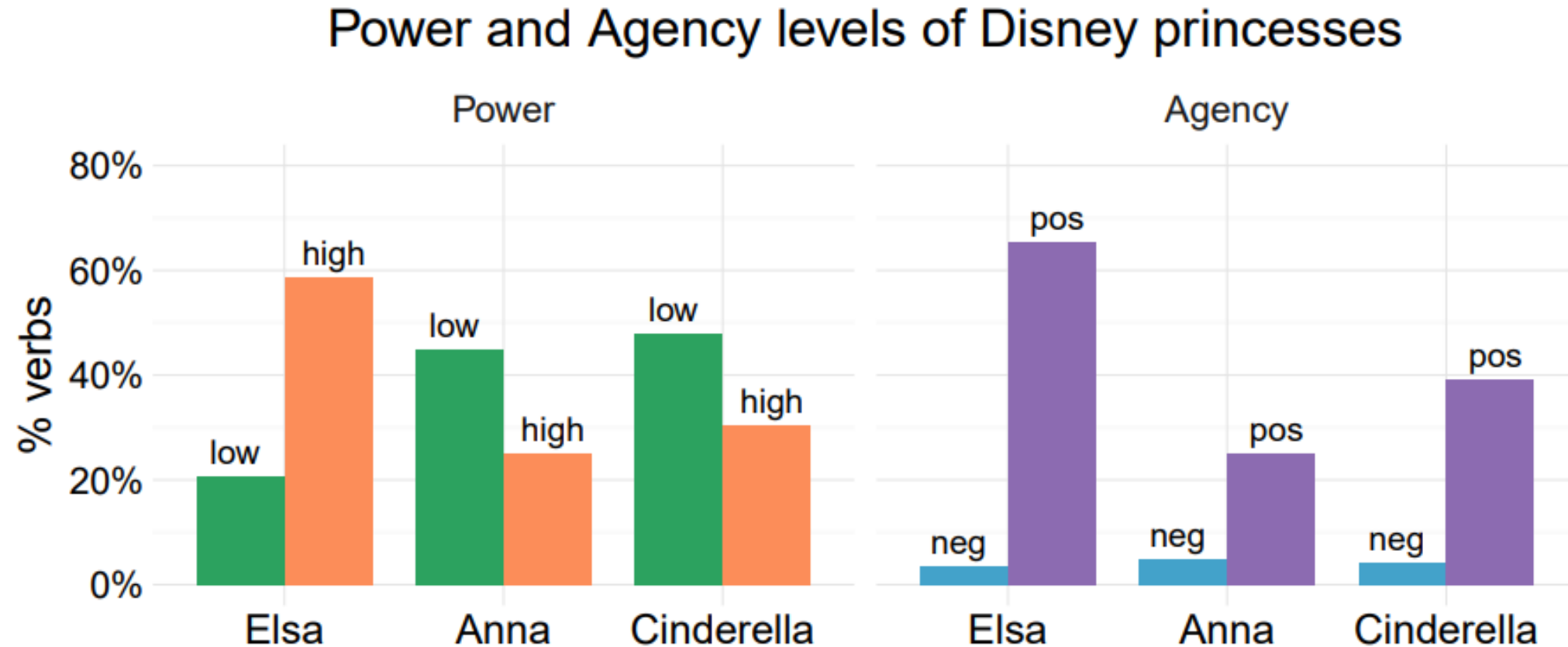
Frame	$\beta$	gender
<i>agency</i> (AG)=+	-0.951	<b>M**</b>
<i>power</i> (AG>TH)	-0.468	<b>M**</b>
<i>agency</i> (AG)=-	0.277	<b>F**</b>
<i>power</i> (AG<TH)	<i>not sig.</i>	

Table 1: Power and agency connotation frames for male and female narratives, controlled for length of narrative text.  $\beta$  represents the change in log-odds of a character being male/female were the corresponding frame to change by one unit. Significant results (\*\* :  $p < .001$ ) are in bold. “Male” was coded as 0, “Female” as 1.

Metric/Frame	$\beta$	P/F
<i>F dial.</i> # Words	10.02	pass**
<i>F dial.</i> <i>agency</i> (AG)=+	-9.65	fail**
<i>F dial.</i> <i>power</i> (AG>TH)	2.05	pass*
<i>F narr.</i> <i>power</i> (AG>TH)	-1.19	fail*

Table 3: Significant correlates of passing the Bechdel test. *F*: metric for female characters, computed on the dialogues (*dial.*) or on the narratives (*narr.*). \* :  $p < .05$ ; \*\* :  $p < .001$ .

# Passing the Bechdel test is not enough



# Narrative Paths and Negotiation of Power in Birth Stories

## Core Question:

What are the narrative structures and persona hierarchies expressed across birth stories posted online?

# Measuring power via connotation frames

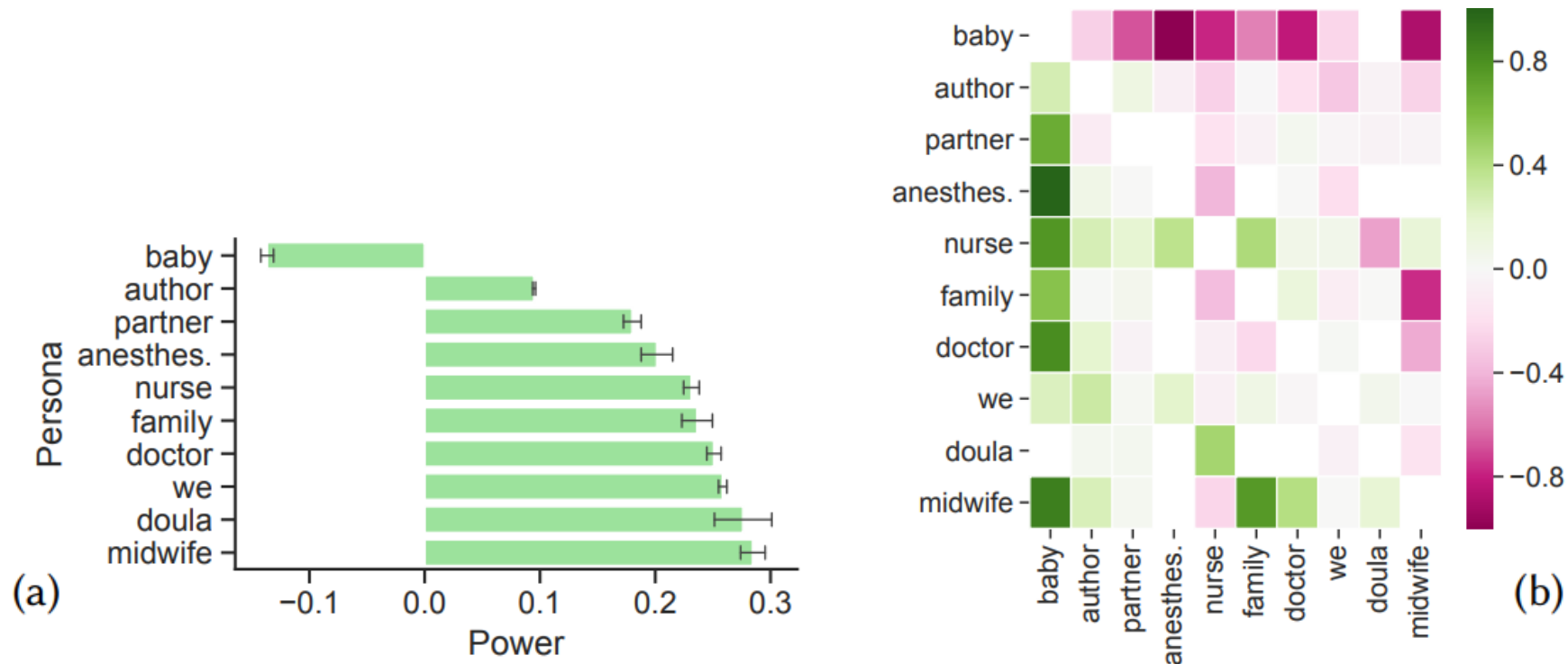


Fig. 7. (a) Power scores for each persona. Error bars show standard deviation over 20 bootstrap samples of the collection. (b) Estimated power of personas (rows) over other personas (columns). The NURSE is consistently framed as more powerful than the other personas, except for the DOULA.

