



University of Colorado
Boulder



Apple



Tutorial

Meaning Representations for Natural Languages: Design, Models and Applications



Julia
Bonn



Jeffrey
Flanigan



Jan
Hajič



Ishan
Jindal



Nianwen
Xue

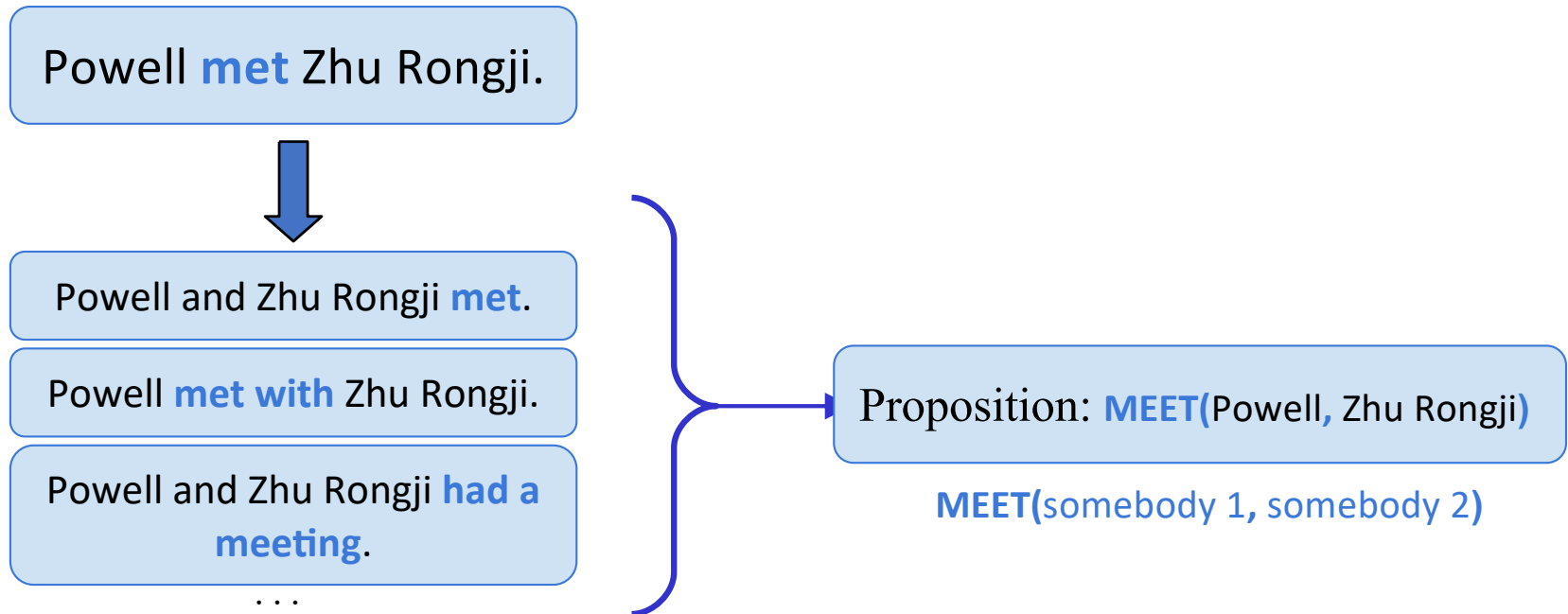


IJCAI/2023 MACAO

What should be in a Meaning
Representation?

Motivation: From Sentences to Propositions

Who did what to whom, when, where and how?



*“When Powell met Zhu Rongji on Thursday they **discussed** the **return** of the spy plane.”*

MEET(Powell, Zhu)

DISCUSS([Powell, Zhu], **RETURN**(X, plane))

Capturing Semantic Roles

Breaker - AGENT

- *[Tim] broke [the window]*.

Thing broken - PATIENT

- *[The window] was broken [by the hurricane]*.

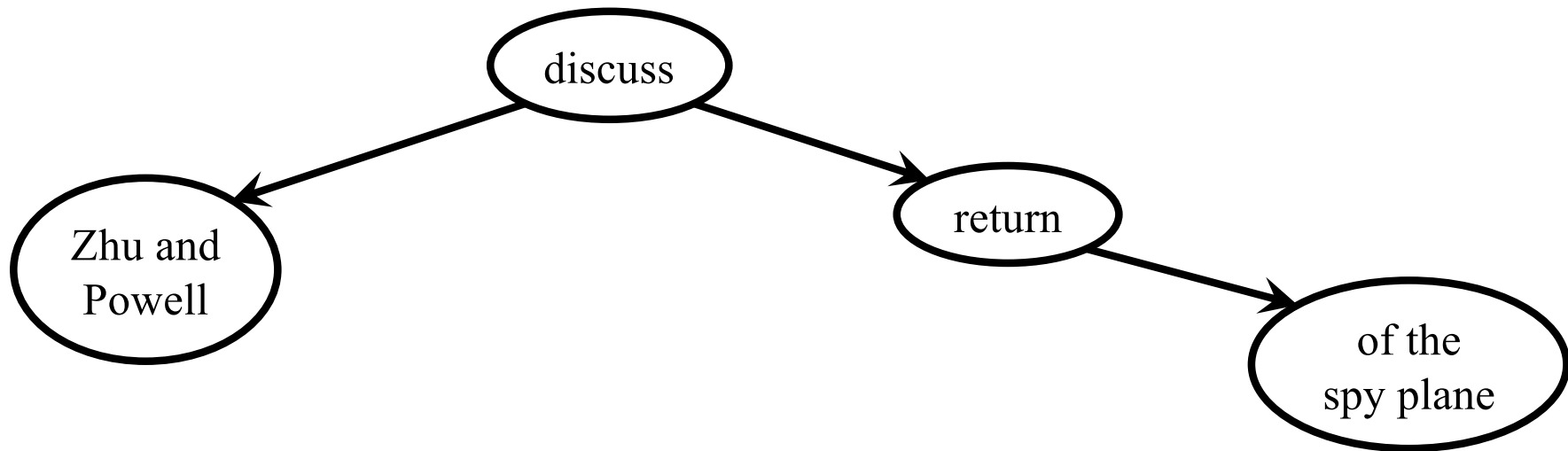
Thing broken - PATIENT

- *[The window] broke [into pieces] [when it slammed shut]*.

A Proposition as a Tree

“Zhu and Powell discussed the return of the spy plane.”

DISCUSS([Powell, Zhu], **return**(X, plane))



Semantic Role Labeling: PropBank Frame Files

11,500+ roletes

VALENCY LEXICON

discuss.01 - *talk about*

ALIASES: discuss (VERB)

discussion (NOUN)

have_discussion (LIGHT VERB CONSTRUCTION)

ROLES:

ARG0: *discussant*

ARG1: *topic*

ARG2: *conversation partner, if explicit*

see Kingsbury & Palmer (LREC 2002) – Pradhan et. al. (*SEM 2022)

PropBank Frame Files

“Zhu and Powell discussed the return of the spy plane.”

discuss.01

ARG0: Zhu and Powell

ARG1: return-02

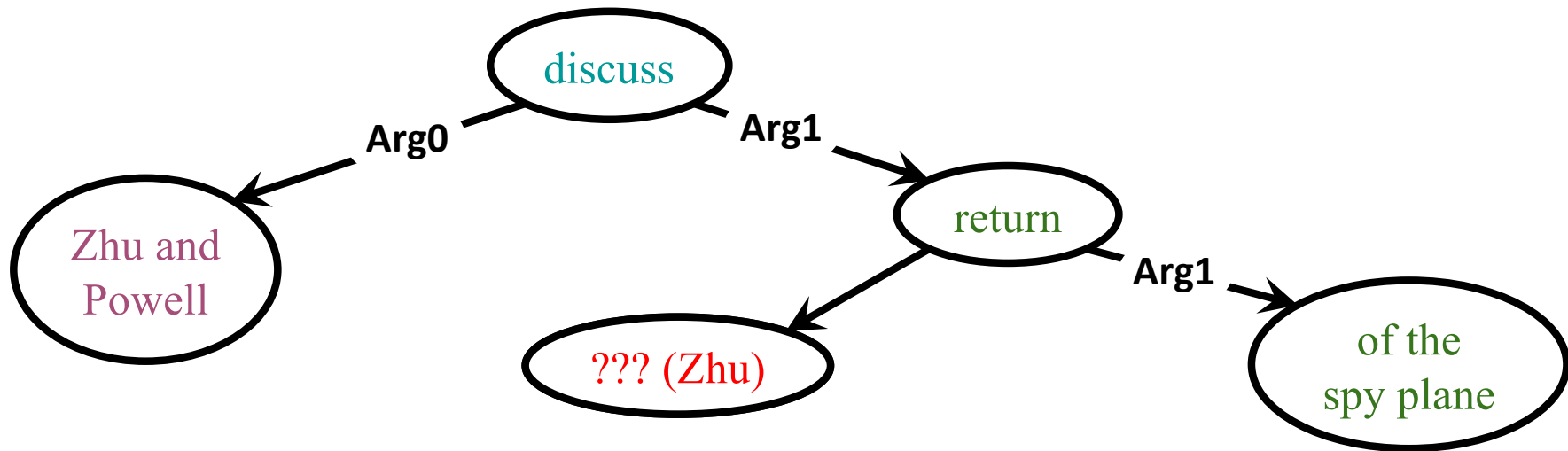
ARG1: of the spy plane

DISCUSS([Powell, Zhu], **RETURN**(X, plane))

A Proposition as a Tree

“Zhu and Powell discussed the return of the spy plane.”

DISCUSS([Powell, Zhu], **return**(X, plane))



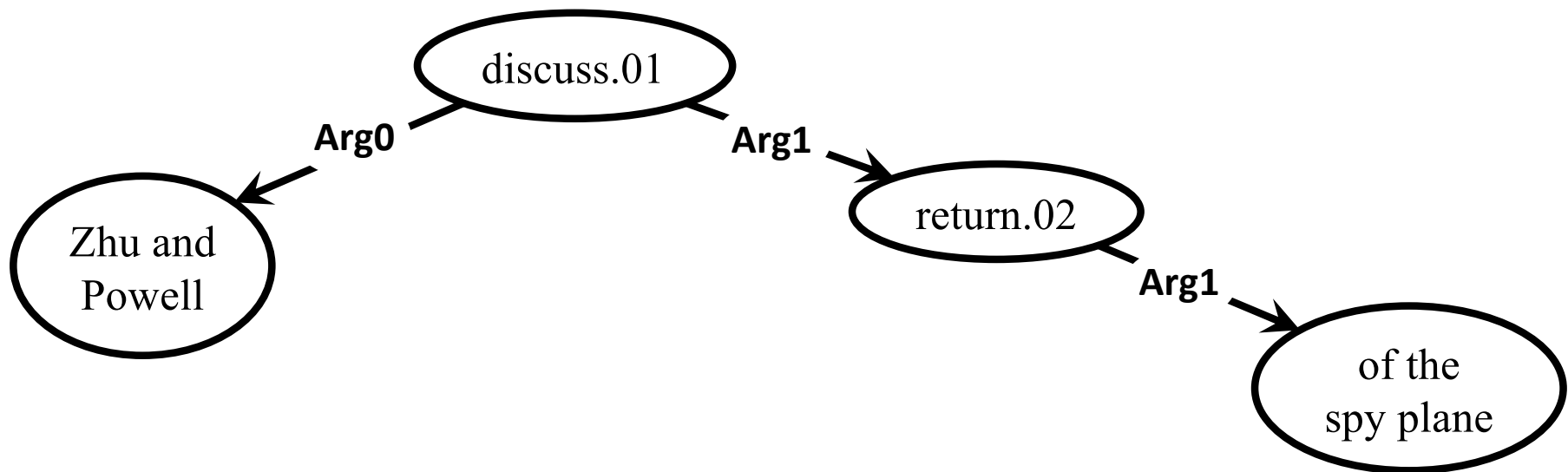
Proposition Bank

- Hand annotated predicate argument structures for Penn Treebank
 - Standoff XML, points directly to syntactic parse tree nodes
 - Doubly annotated and adjudicated
 - (*Kingsbury & Palmer, 2002, Palmer, Gildea, Xue, 2004, ...*).
- Based on PropBank Frame Files
 - English valency lexicon: ~4K verb entries (2004) → ~11K v,n, adj, prep (2022)
 - Core arguments – Arg0-Arg5
 - ArgM's for modifiers and adjuncts
 - Mappings to VerbNet and FrameNet
- Annotated PropBank Corpora
 - [English 2M+](#), Chinese 1M+, Arabic .5M, Hindi/Urdu .6K, Korean, ...

An Abstract Meaning Representation as a Graph

“Zhu and Powell discussed the return of the spy plane.”

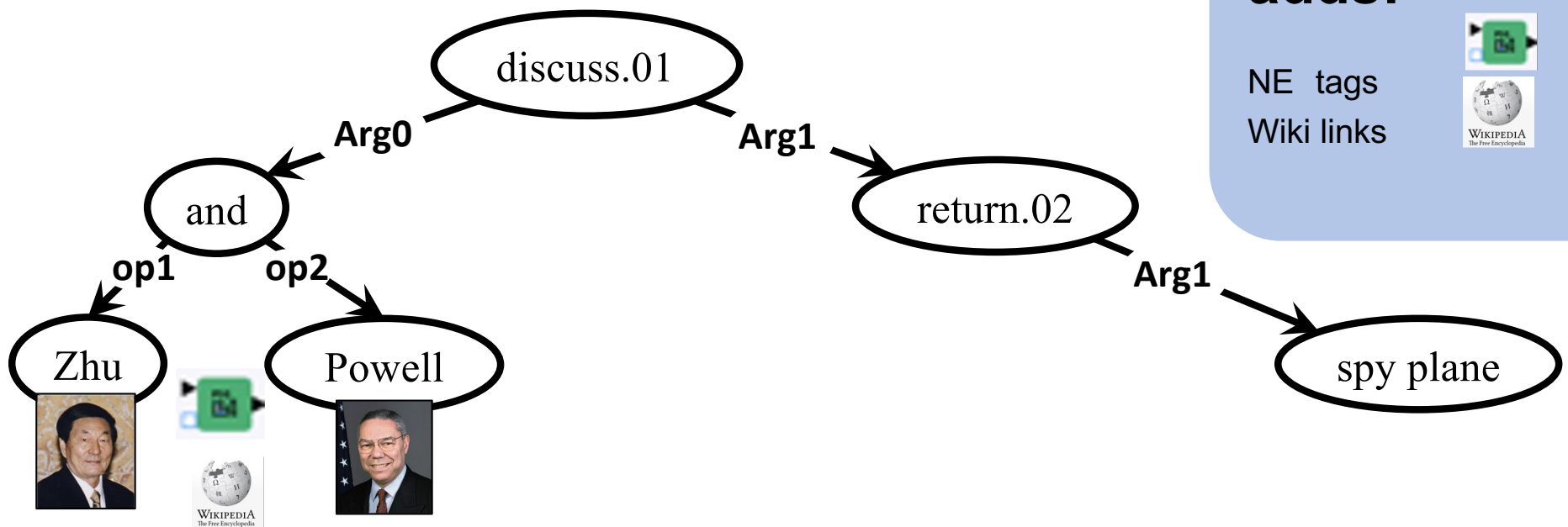
DISCUSS([Powell, Zhu], **return**(X, plane))



An Abstract Meaning Representation as a Graph

"Zhu and Powell discussed the return of the spy plane."

DISCUSS([Powell, Zhu], **return**(X, plane))



AMR drops:

Determiners
Function words

adds:

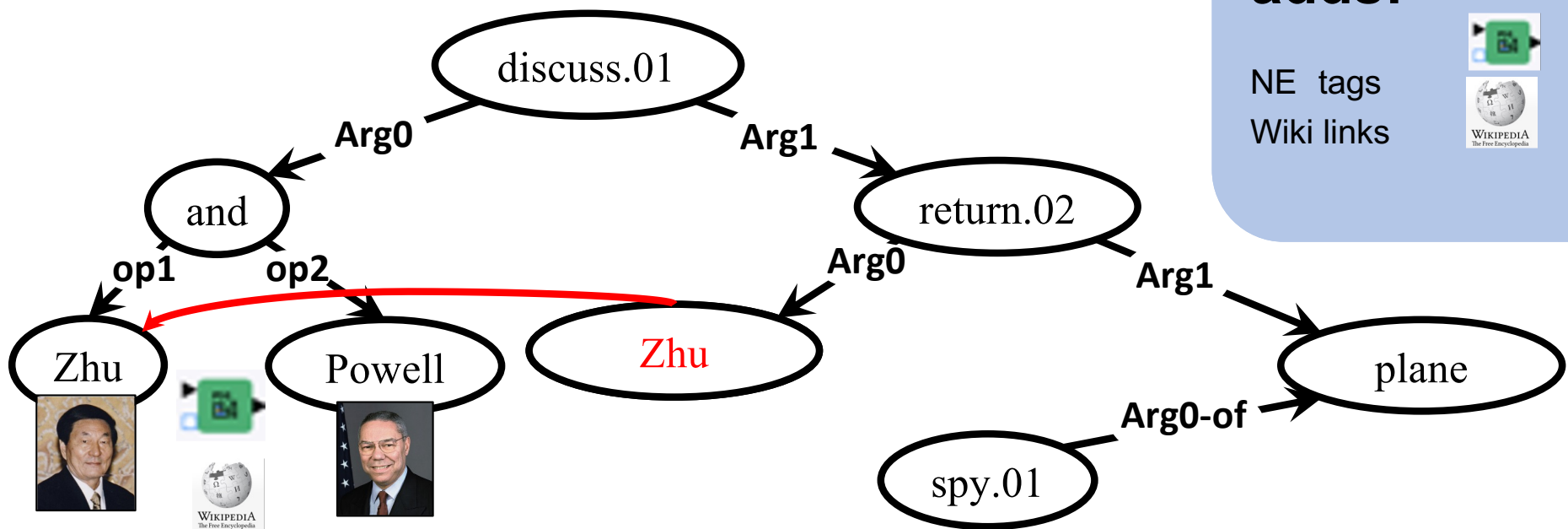
NE tags
Wiki links



An Abstract Meaning Representation as a Graph

"Zhu and Powell discussed the return of the spy plane."

DISCUSS([Powell, Zhu], **return**(X, plane))



AMR drops:

Determiners
Function words

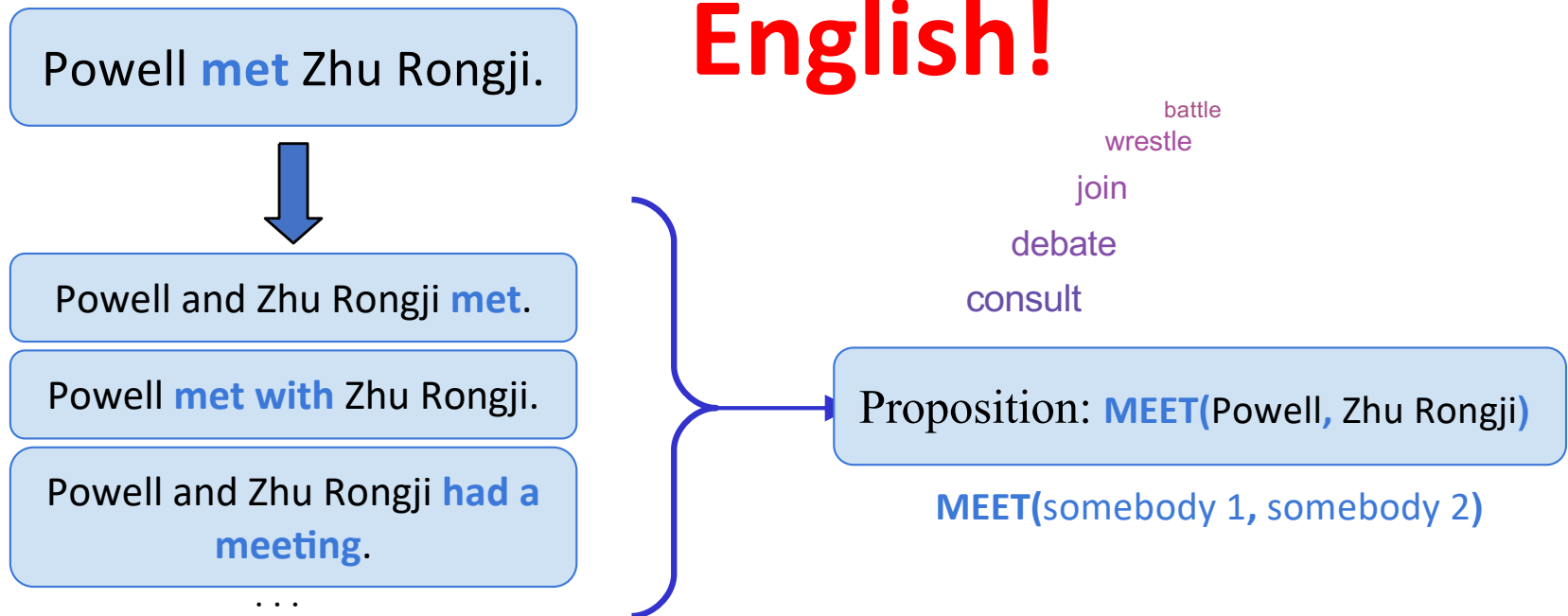
adds:

NE tags
Wiki links



Motivation: From Sentences to Propositions

Who did what to whom, when, where and how?



“When Powell met Zhu Rongji on Thursday they discussed the return of the spy plane.”

MEET(Powell, Zhu)

DISCUSS([Powell, Zhu], RETURN(X, plane))

Motivation: From Sentences to Propositions

Who did what to whom, when, where and how?

Spanish

Powell **reunió** Zhu Rongji.



Powell y Zhu Rongji **reunió**.

Powell **reunió con** Zhu Rongji.

Powell y Zhu Rongji
tuvo una reunión.

...

Other languages?

Thai

พญ

Hindi

मुलाकात की
遇见

Chinese

Ukrainian

зустріч

Arabic

التقى

Proposition: **REUNIR**(Powell, Zhu Rongji)

REUNIR(somebody 1, somebody 2)

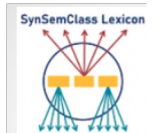
“Powell se reunió con Zhu Rongji el jueves y hablaron sobre el regreso del avión espía.”

REUNIR(Powell, Zhu)

HABLAR([Powell, Zhu], **REGRESAR**(X, avión))

How do we cover thousands of languages?

- Several languages already have valency lexicons
 - Chinese, Arabic, Hindi/Urdu, Korean PropBanks,
 - Czech Tectogrammatical SynSemClass , <https://ufal.mff.cuni.cz/synsemclass>
 - VerbNets, FrameNets: Spanish, Basque, Catalan, Portuguese, Japanese, ...
 - Linguistic valency lexicons: Arapaho, Lakota, Turkish, Farsi, Japanese, ...
- For those without, follow EuroWordNet approach: project from English?
 - [Universal Proposition Banks for Multilingual Semantic Role Labeling](#)
 - See Ishan Jindal in Part 3
- Can AMR be applied universally to build language specific AMRs?
 - Uniform Meaning Representation
 - See Nianwen Xue after the AM break



Tutorial Outline

Morning Session

- Part 1: Introduction – [Julia Bonn](#)
- Part 2a: Common Meaning Representations:
 - AMR – [Julia Bonn](#)
 - Other Meaning Representations – [Jan Hajič](#)
- **Break**
- Part 2b: Common Meaning Representations
 - UMR – [Nianwen Xue](#)



Tutorial Outline

Afternoon Session

- Part 3: Modeling Meaning Representation:
 - SRL – [Ishan Jindal](#)
 - AMR – [Jeff Flanigan](#)
- **Break**
- Part 4: Applying Meaning Representations
 - [Jeff Flanigan](#)
- Part 5: Open Questions and Future Work
 - [Nianwen Xue](#)

