Universal Dependencies and the Slavic Languages

FACULTY
OF MATHEMATICS
AND PHYSICS
Charles University

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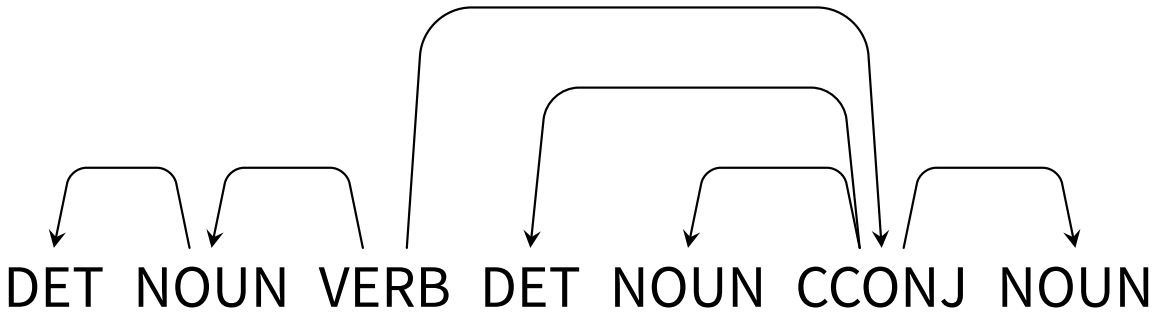
http://universaldependencies.org/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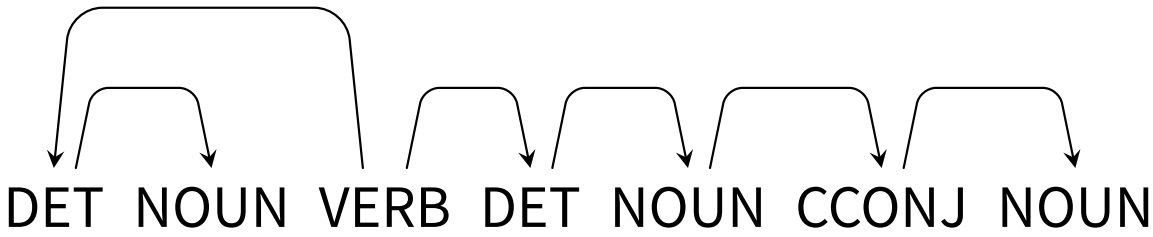
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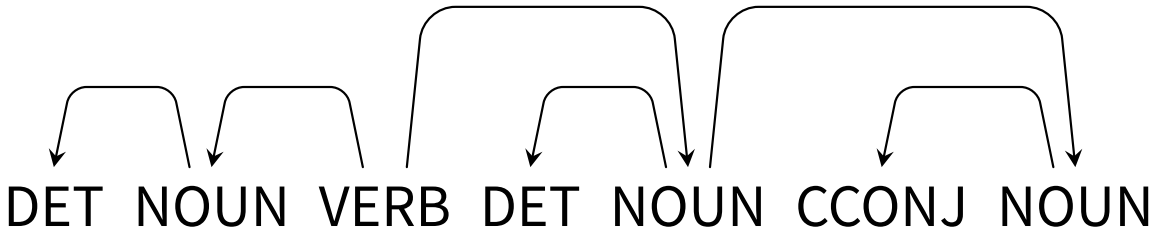
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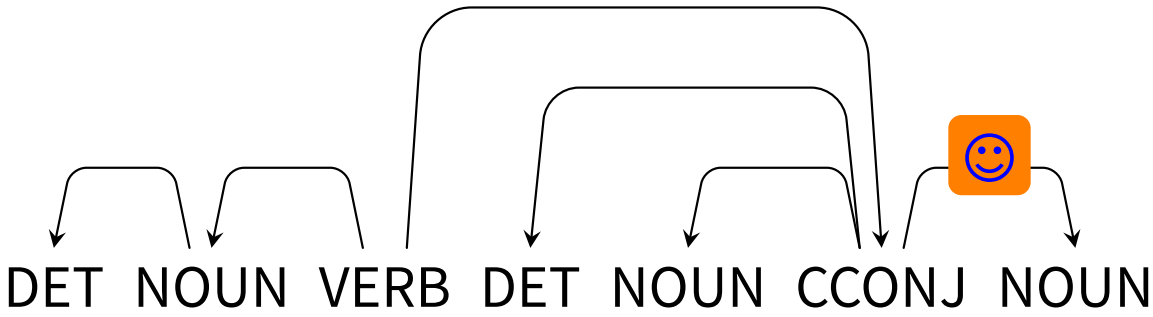
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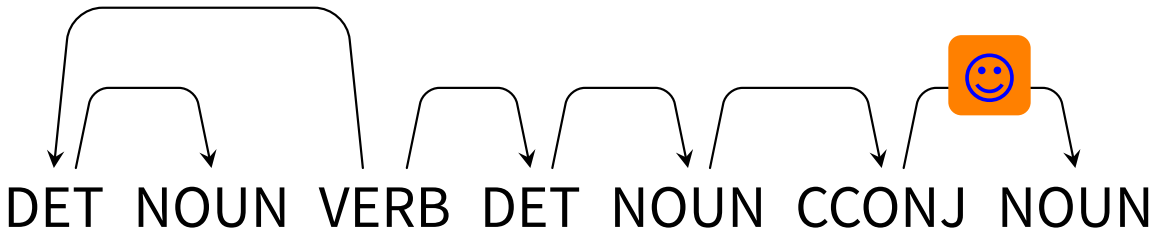
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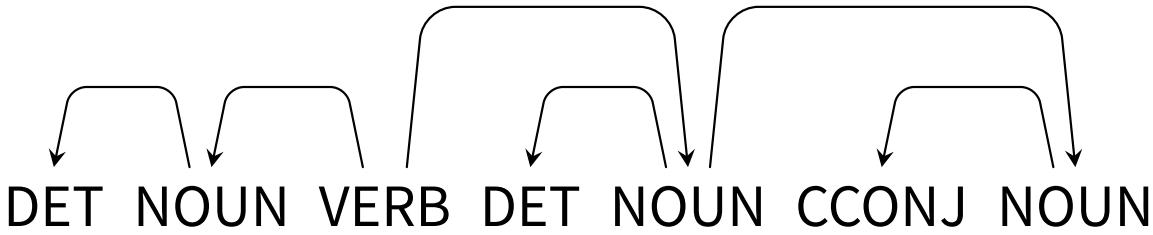
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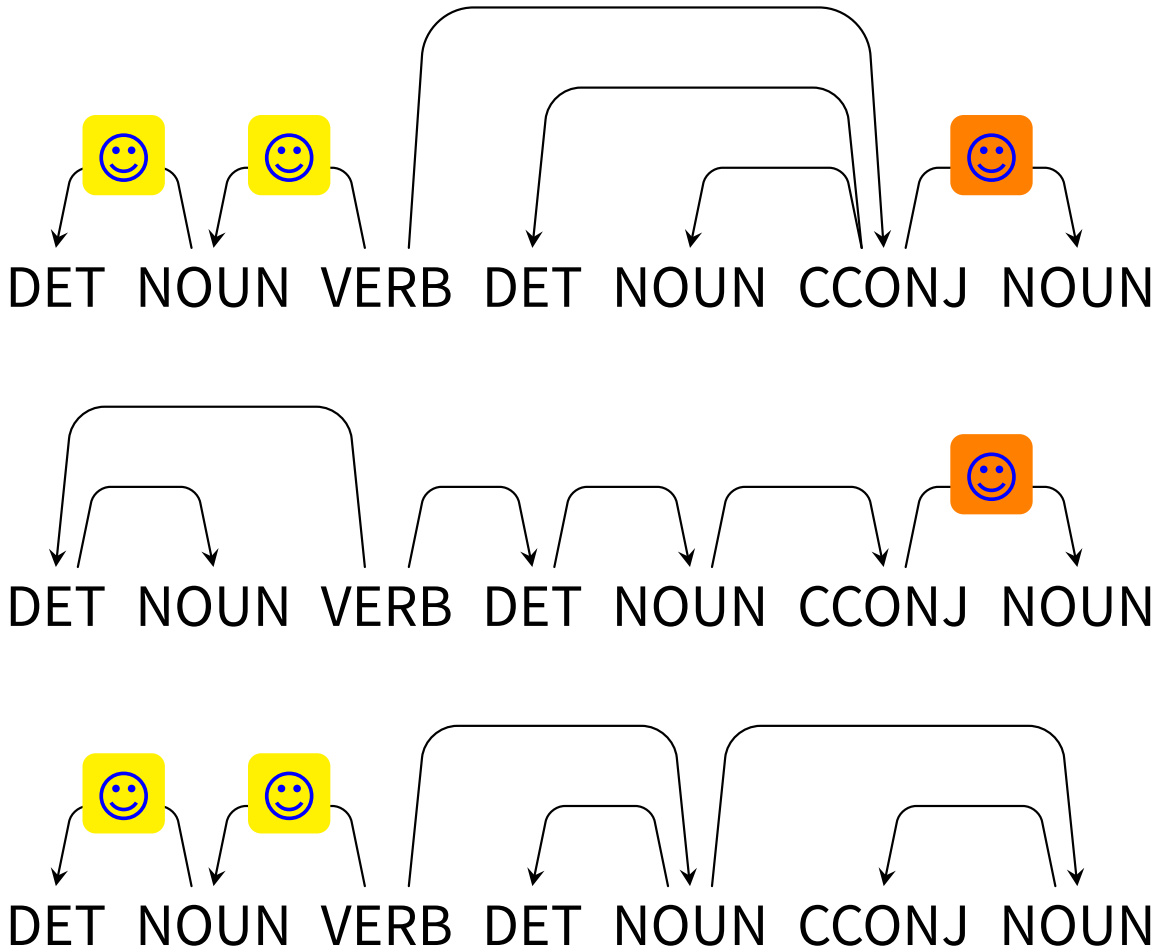
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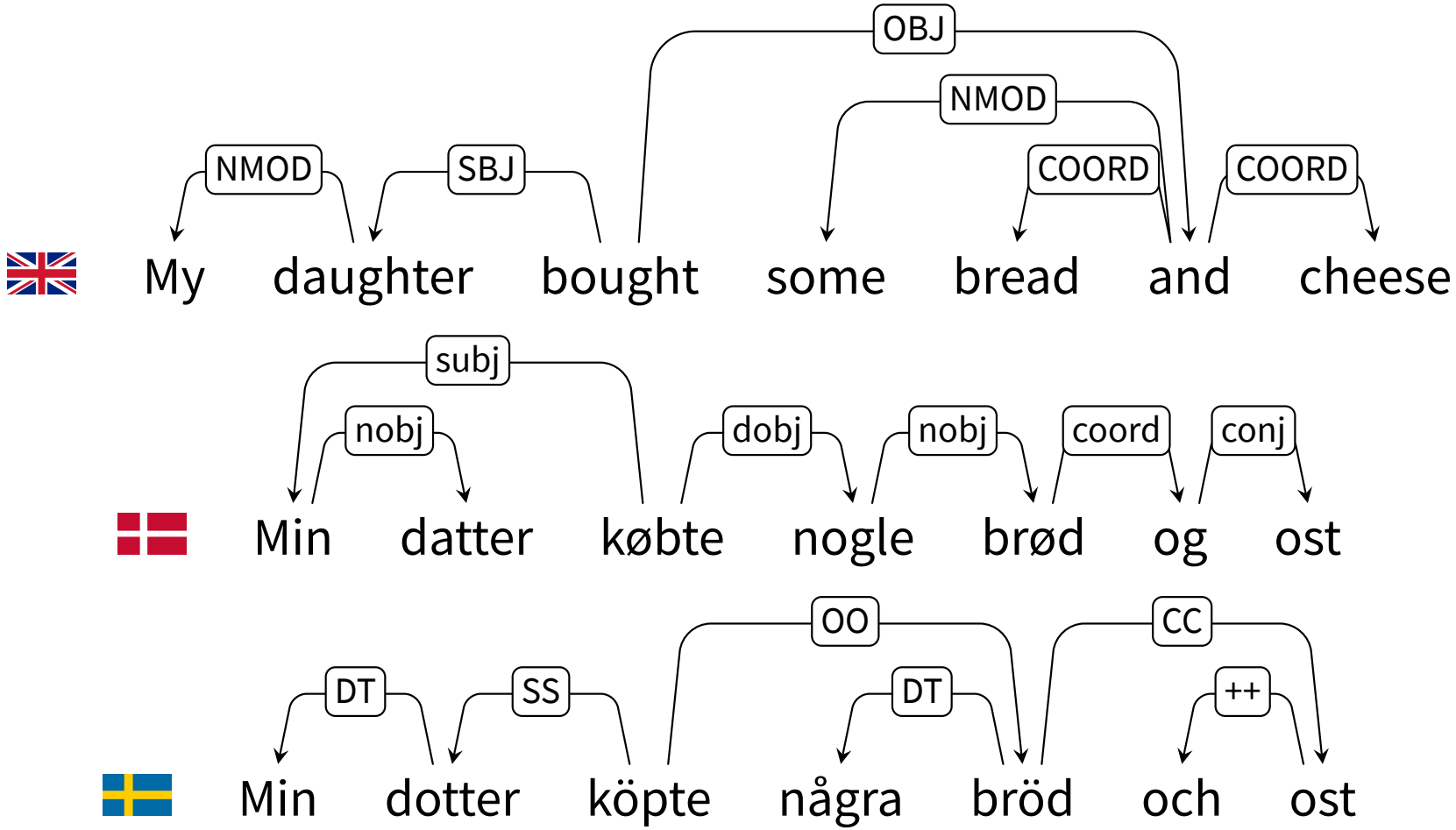
OBJ
NMOD
NMOD
SBJ
COORD
COORD
My daughter bought some bread and cheese
subj
nobj
dobj
nobj
coord
conj
Min datter købte nogle brød og ost
OO
CC
DT
SS
DT
++
Min dotter köpte några bröd och ost

Universal Dependencies

- Same things annotated same way across languages…
- … while highlighting different coding strategies

Manning's Law

The secret to understanding UD is to realize that the design is a very subtle compromise between approximately 6 things:

1. UD must be satisfactory on linguistic analysis grounds for individual languages.

It's easy to come up with a proposal that improves UD on one of these dimensions. The interesting and difficult part is to improve UD while remaining sensitive to all these dimensions.

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4. UD must be easily comprehended and used by a non-linguist, whether a language learner or an engineer with prosaic needs for language processing. … it leads us to favor traditional grammar notions and terminology.

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5. UD must be suitable for computer parsing with high accuracy.
6. UD must support well downstream language understanding tasks (relation extraction, reading comprehension, machine translation, …)

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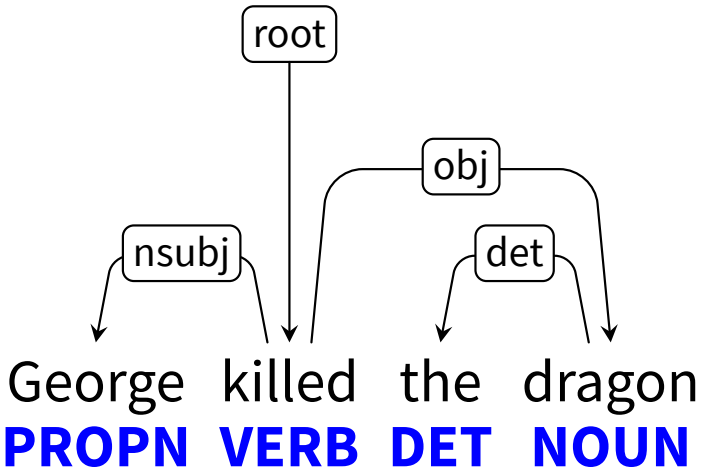
Same Thing Same Way



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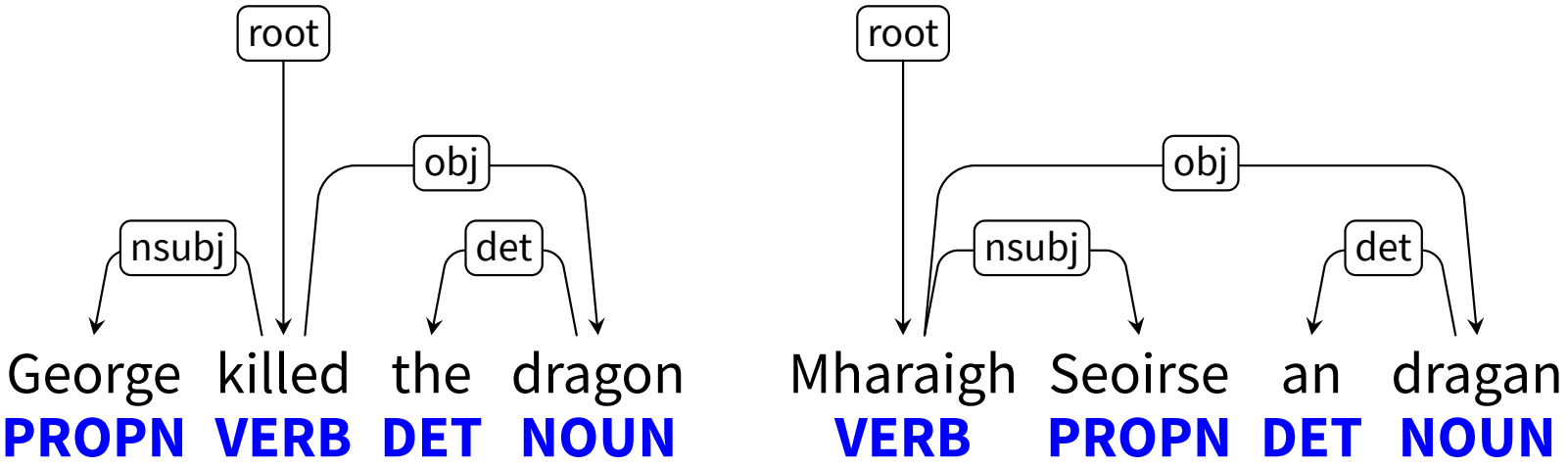

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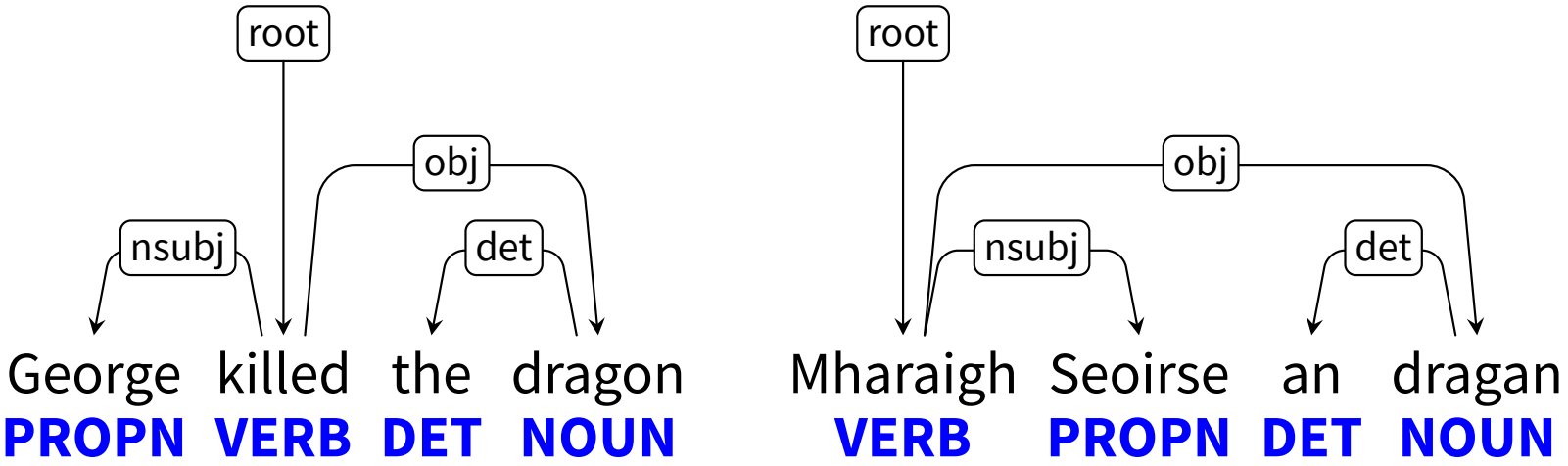

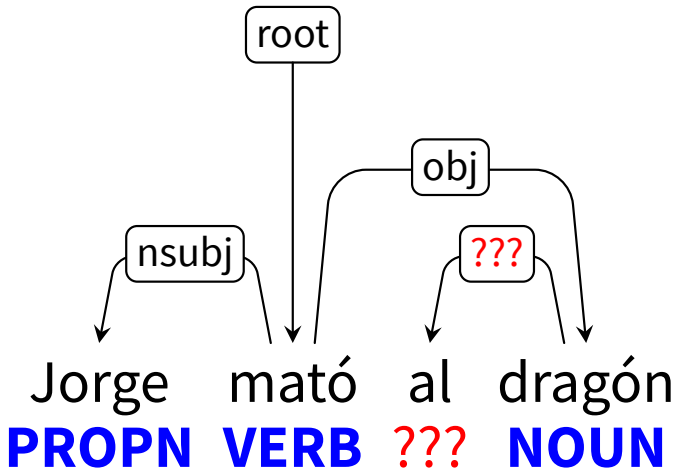

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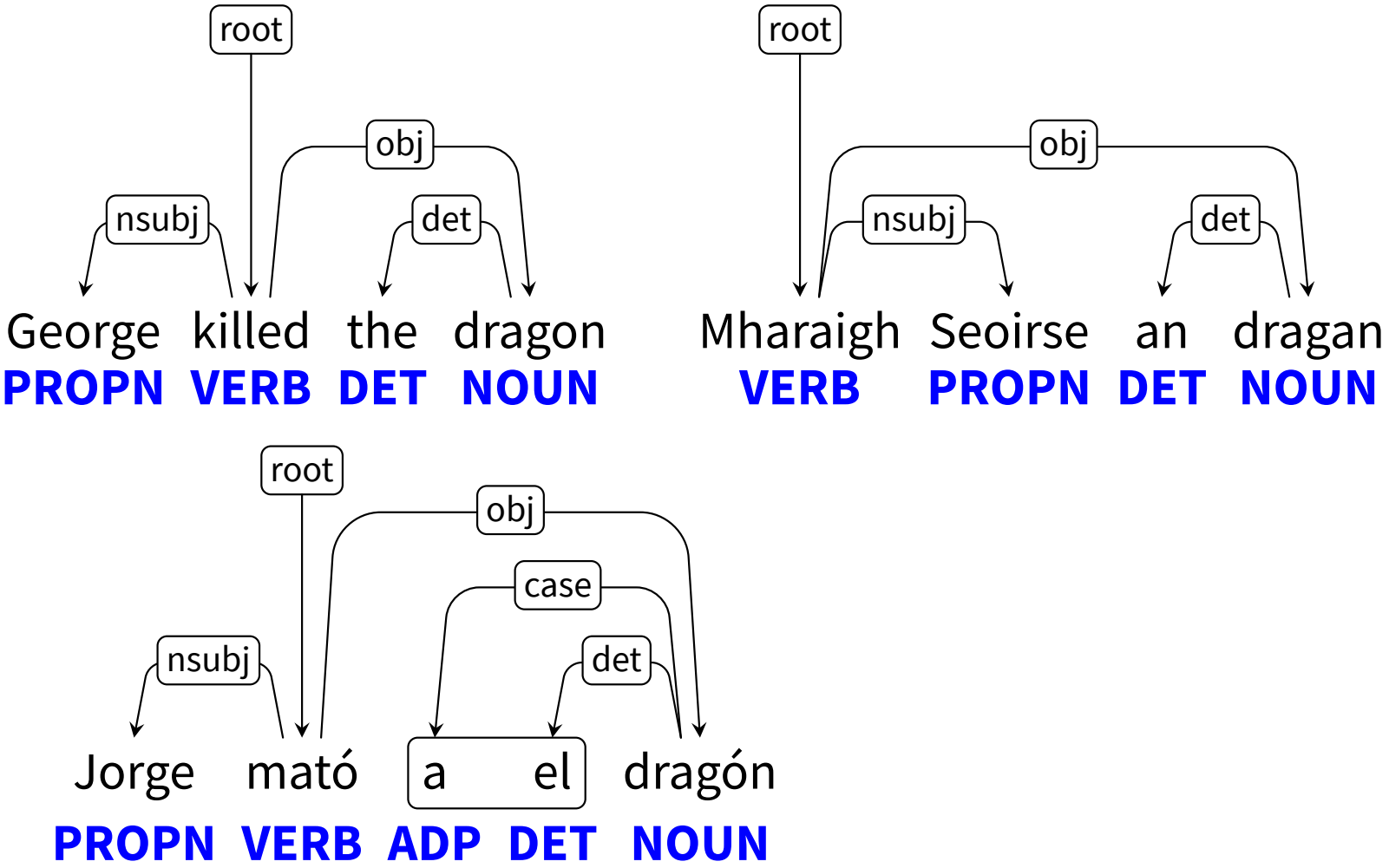

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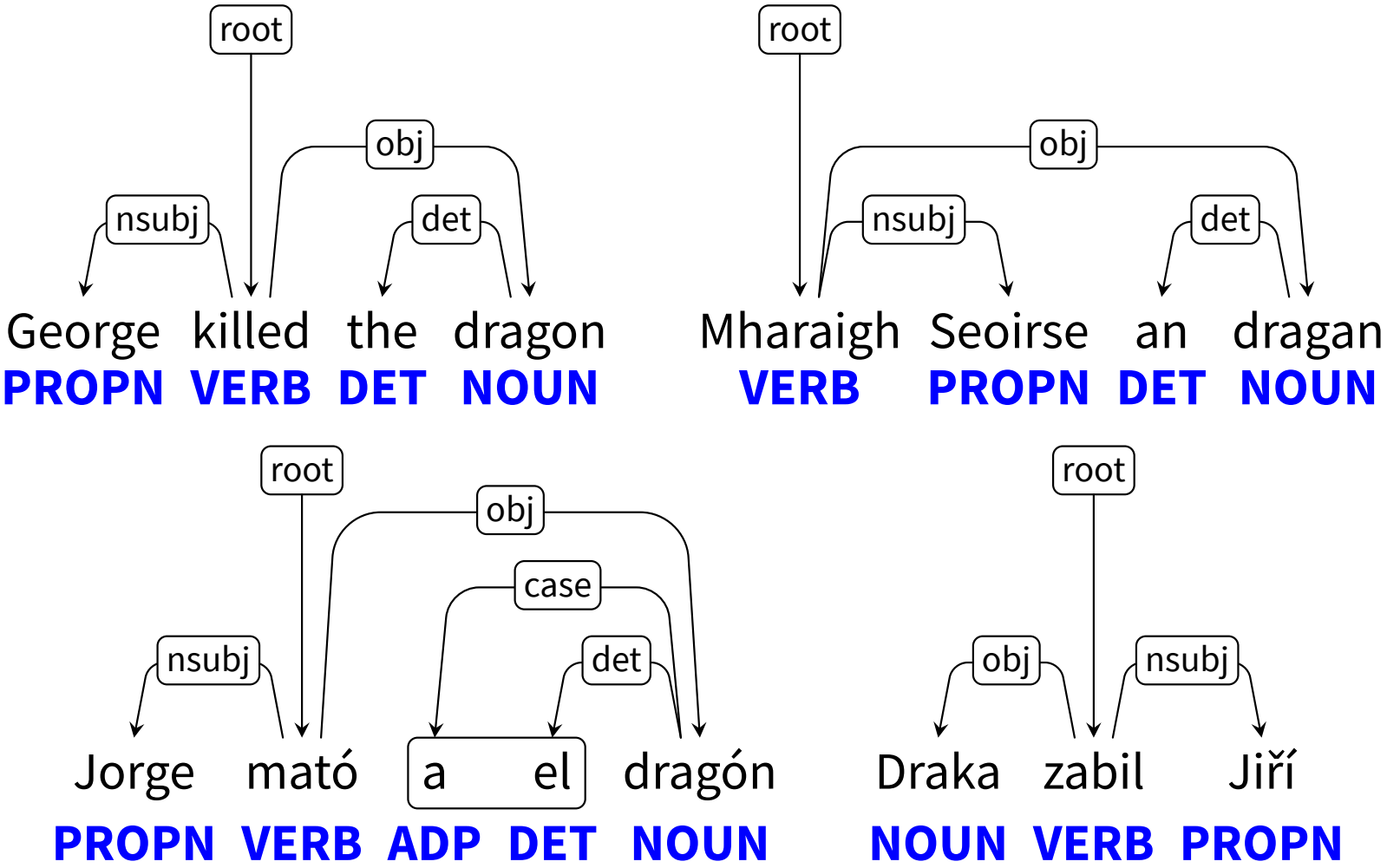
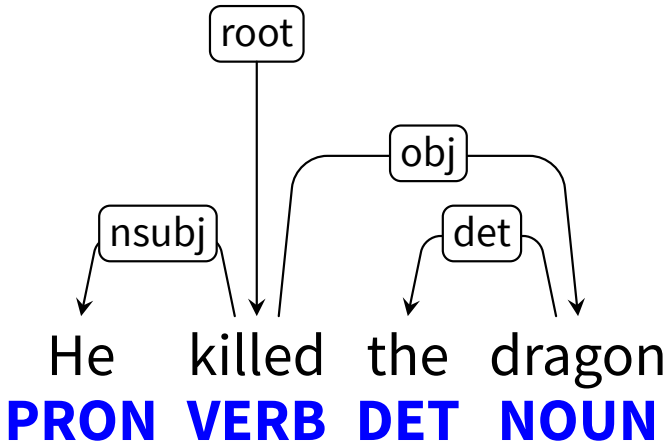


Same Meaning ≠ Same Construction!



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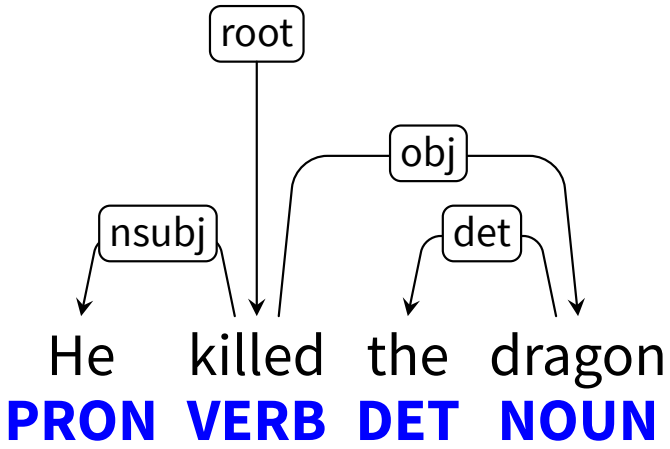

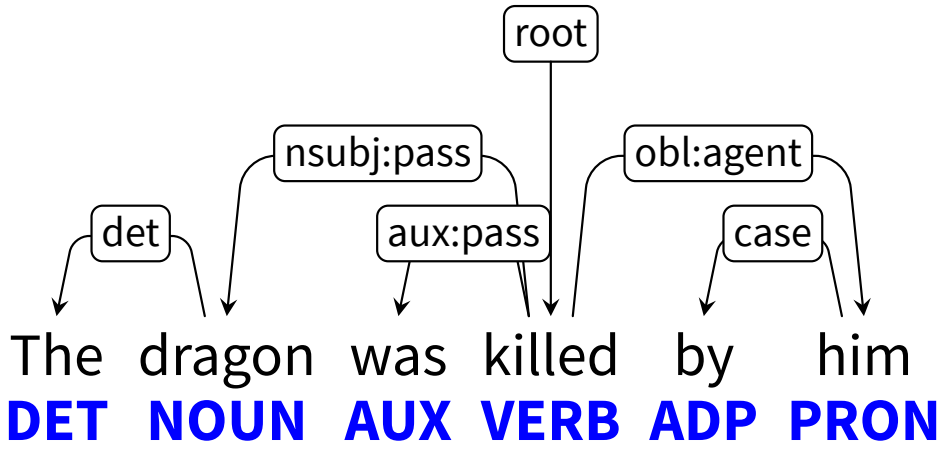

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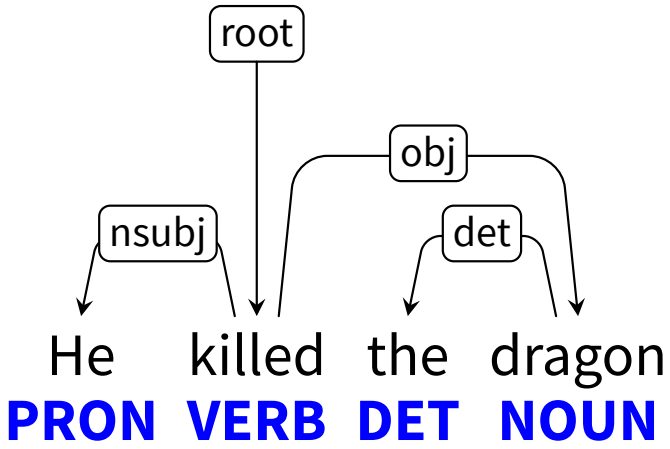

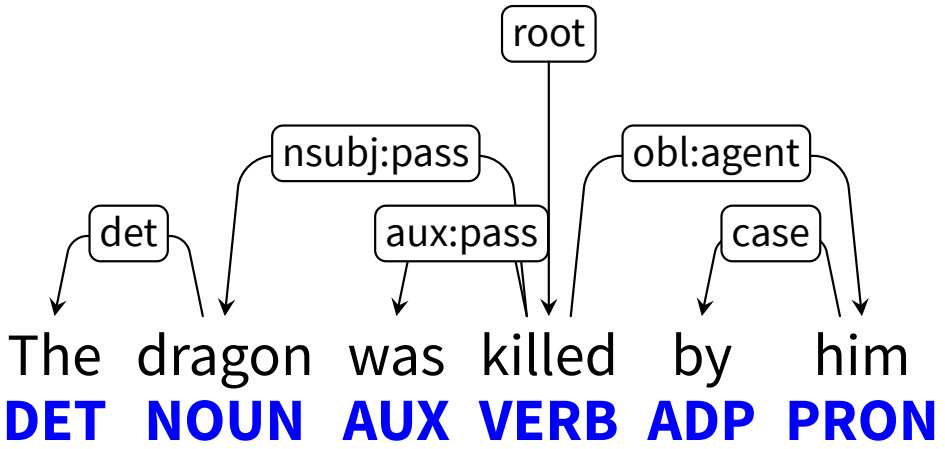

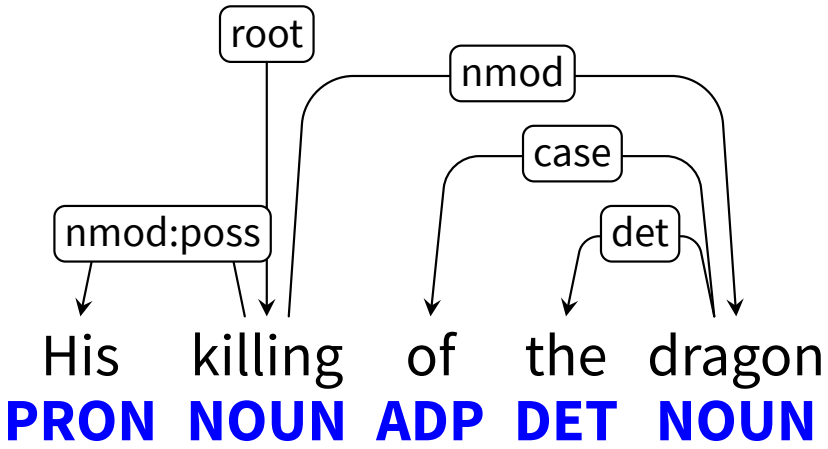

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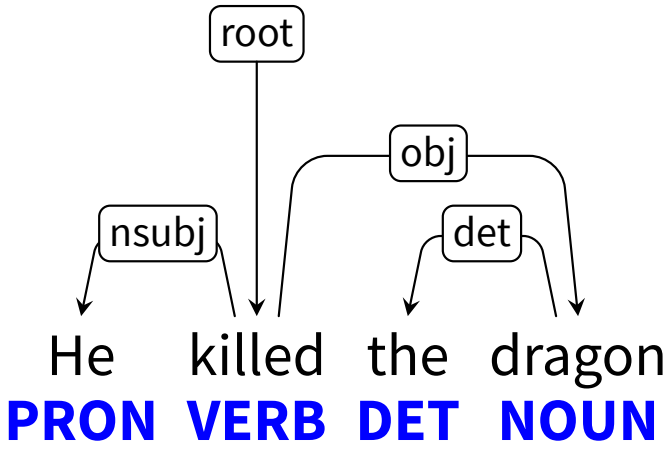

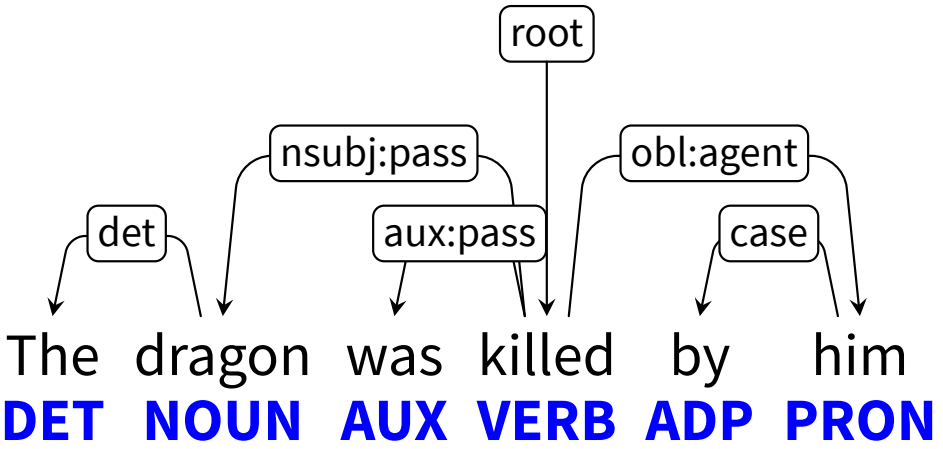

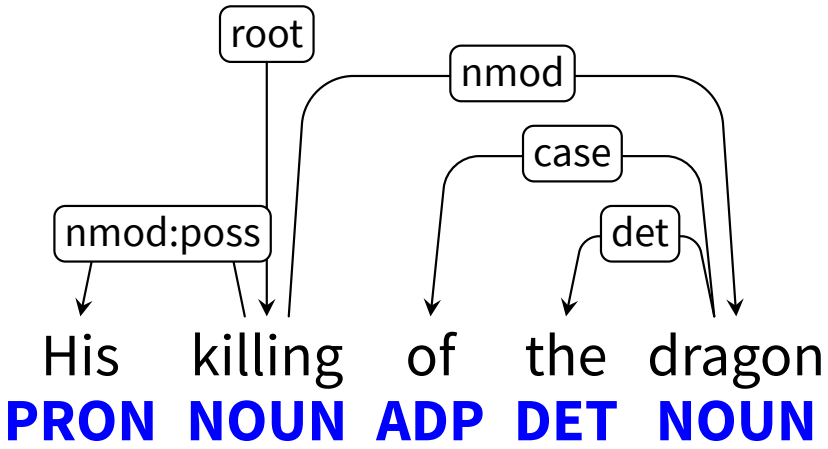

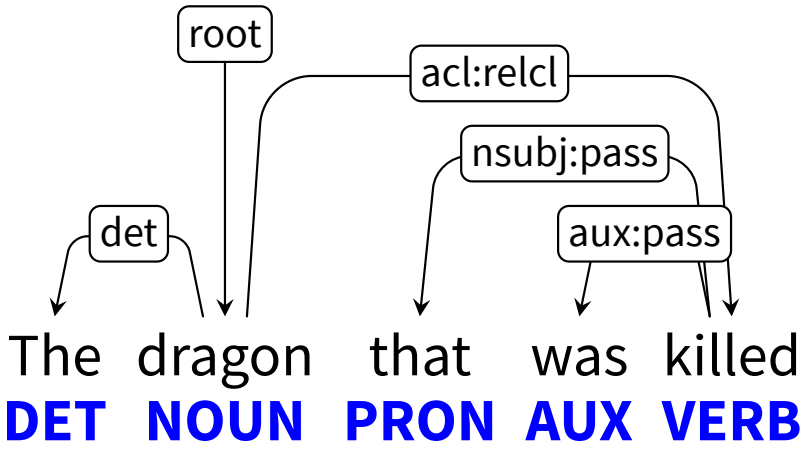

A Tour through UD

Word Segmentation

- Must be reproducible on new data
- Surface tokens vs. syntactic words
- Chinese, Vietnamese etc.: no clues, non-trivial algorithm
- Arabic, Tamil etc.: part of morphological analysis
- Spanish, German etc.: rather limited cases of contractions
- Others: only punctuation (low-level tokenization)

Word Segmentation

Vámonos	al	mar	.
VERB+PRON	ADP+DET	NOUN	PUNCT

Vamos	nos	a	el	mar	.
VERB	PRON	ADP	DET	NOUN	PUNCT

Word Segmentation

- Fusions
  - al = a + el
  - naň = na + něj
- Clitics
  - vámonos = vamos + nos
  - izmenjat'sja = izmenjat' + sja
  - potrafilibyśmy = potrafili + by + jesteśmy

Word Segmentation

Cośmy	jeszcze	zaniedbali	?
PRON+AUX	PART	VERB	PUNCT

Co	(jeste)śmy	jeszcze	zaniedbali	?
PRON	AUX	PART	VERB	PUNCT

Morphology

Některé	dívky	si	nicméně	pochvalovaly	zmrzlinu	.
Some	*girls*		*nevertheless*	*praised*	*ice-cream*	*.*

Morphology

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- Lemma representing the semantic content of the word

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DET	NOUN	PRON	CCONJ	VERB	NOUN	PUNCT

- Lemma representing the semantic content of the word
- Part-of-speech tag representing the abstract lexical category associated with the word

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Some	*girls*		*nevertheless*	*praised*	*ice-cream*	*.*
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DET	NOUN	PRON	CCONJ	VERB	NOUN	PUNCT
PronType=Ind Gender=Fem Number=Plur Case=Nom	Gender=Fem Number=Plur Case=Nom	PronType=Prs Reflex=Yes Case=Dat		VerbForm=Part Tense=Past Voice=Act Aspect=Imp Gender=Fem Number=Plur	Gender=Fem Number=Sing Case=Acc	

- Lemma representing the semantic content of the word
- Part-of-speech tag representing the abstract lexical category associated with the word
- Features representing lexical and grammatical properties associated with the lemma or the particular word form

Part-of-Speech Tags

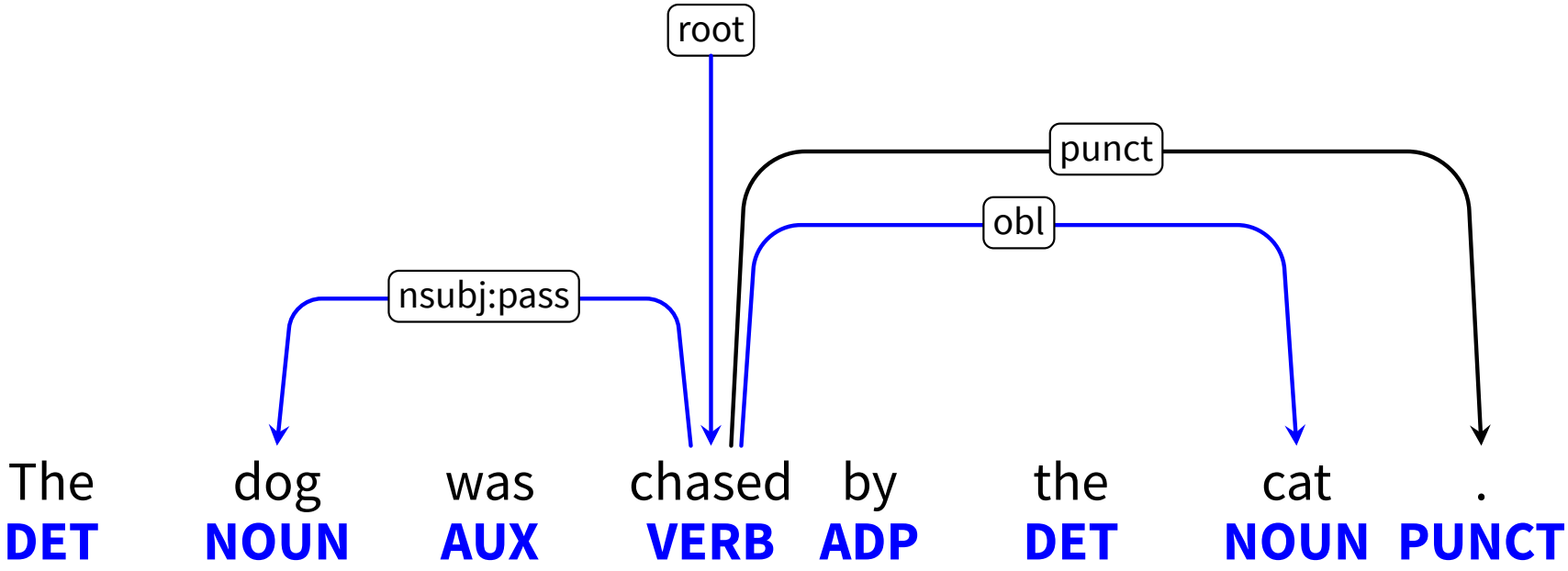
Open	Closed	Other
ADJ	ADP	PUNCT
ADV	AUX	SYM
INTJ	CCONJ	X
NOUN	DET	
PROPN	NUM	
VERB	PART	
	PRON	
	SCONJ	

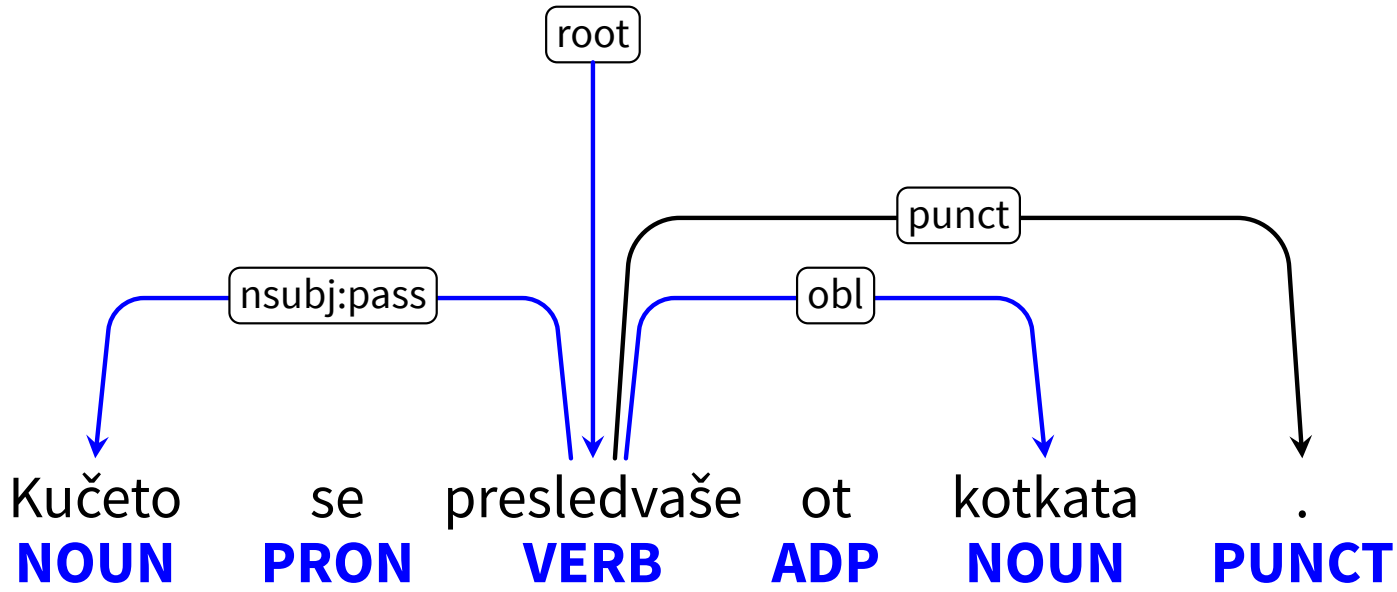
- Taxonomy of 17 universal part-of-speech tags, based on the Google Universal Tagset (Petrov et al., 2012)
- All languages use the same inventory, but not all tags have to be used by all languages

Features

Lexical	**Nominal**	**Pronominal**	**Verbal**
PronType	Gender	Person	VerbForm
NumType	Animacy	Clusivity	Mood
Poss	NounClass	Polite	Tense
Reflex	Number		Aspect
Foreign	Case		Voice
Abbr	Definite		Evident
	Degree		Polarity

- Standardized inventory of 23 morphological features, based on Interset (Zeman, 2008)
- Languages select relevant features and can add language-specific features or values with documentation


root
punct
obl
nsubj:pass
The dog was chased by the cat .
DET NOUN AUX VERB ADP DET NOUN PUNCT


root
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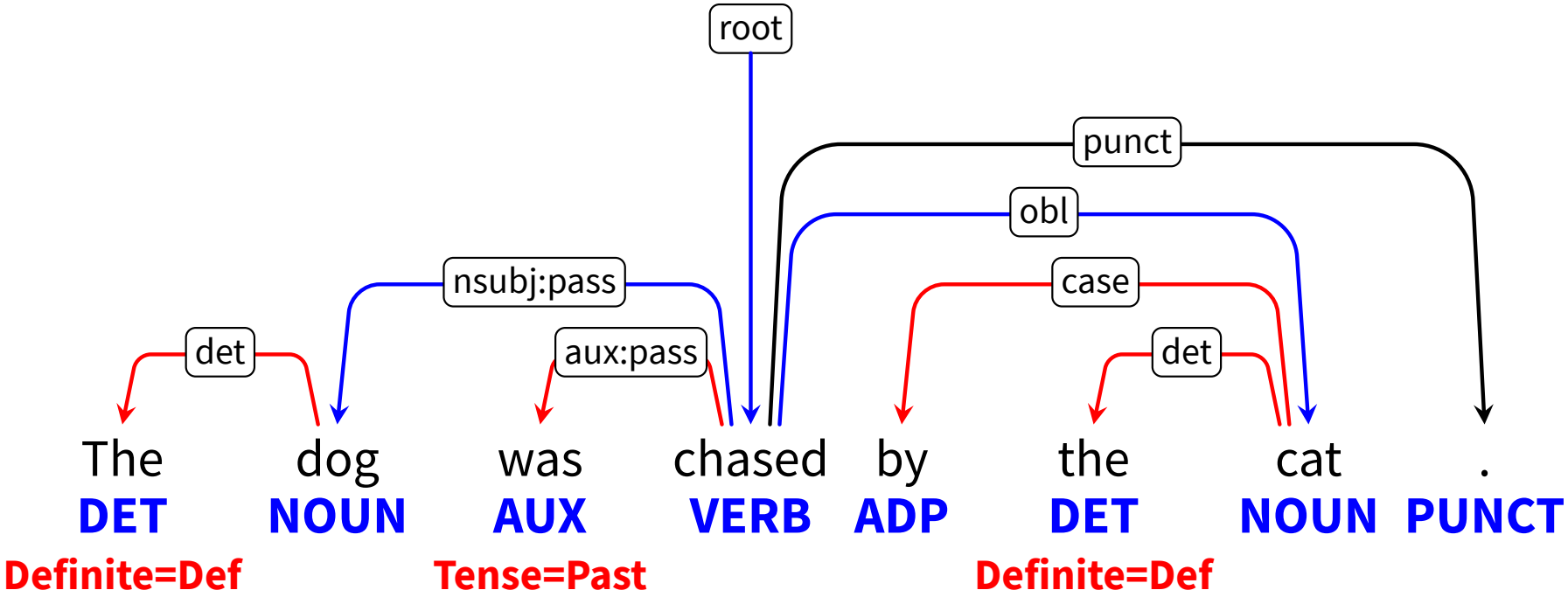
nsubj:pass
Kučeto se presledvaše ot kotkata .
NOUN PRON VERB ADP NOUN PUNCT


root
punct
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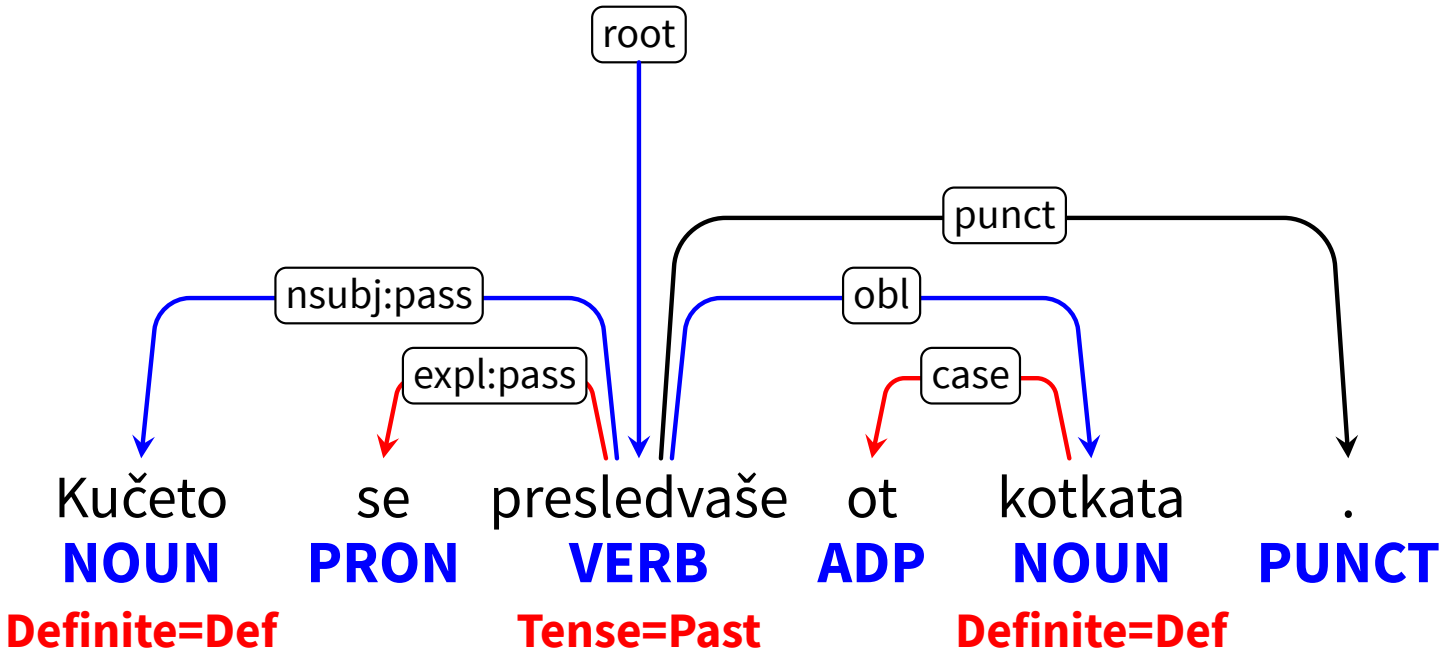
nsubj:pass
case
det
aux:pass
det
The dog was chased by the cat .
DET NOUN AUX VERB ADP DET NOUN PUNCT
Definite=Def
Tense=Past
Definite=Def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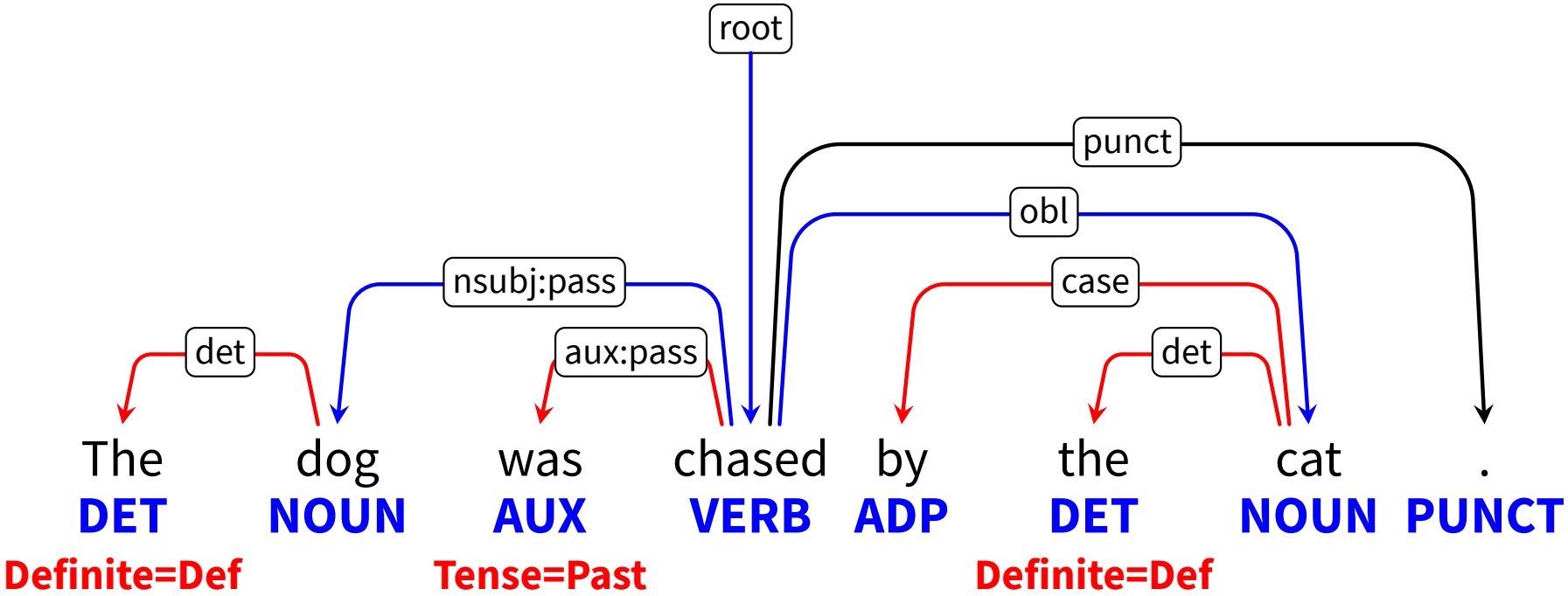
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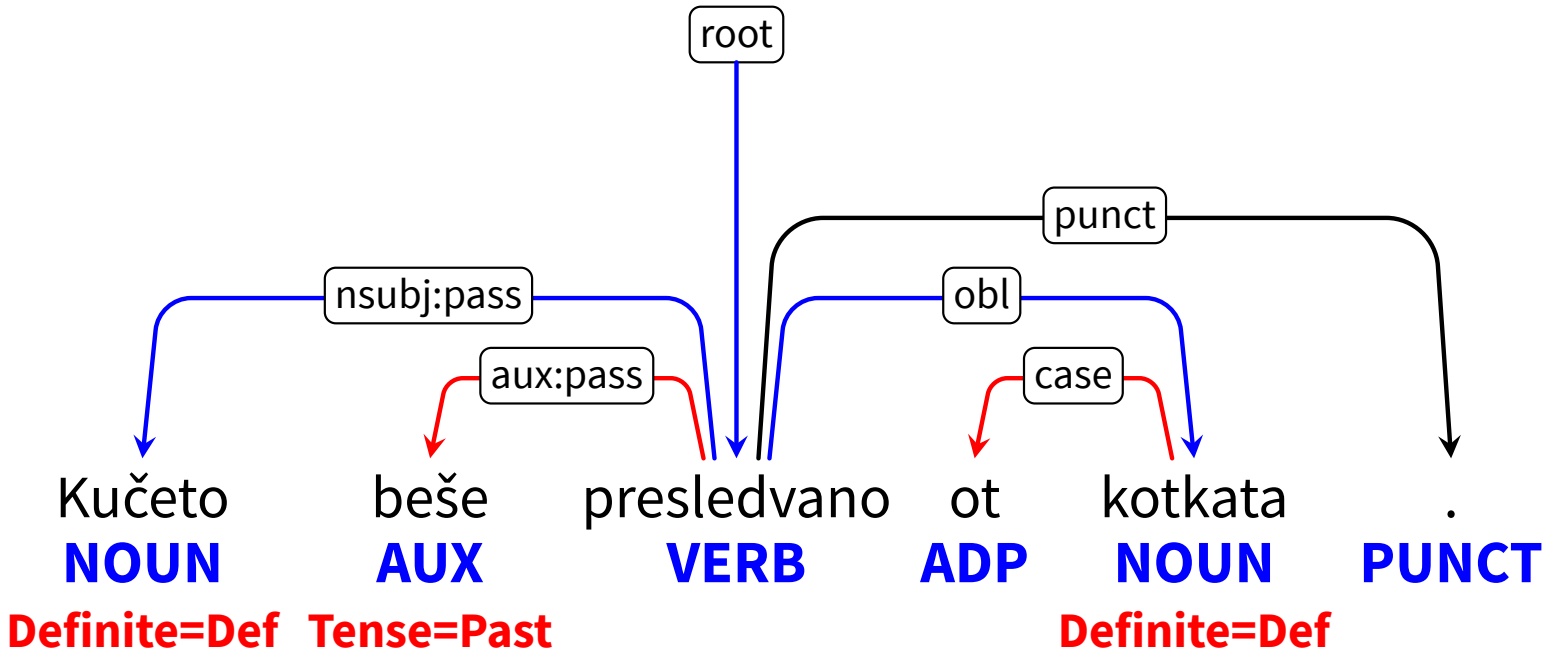
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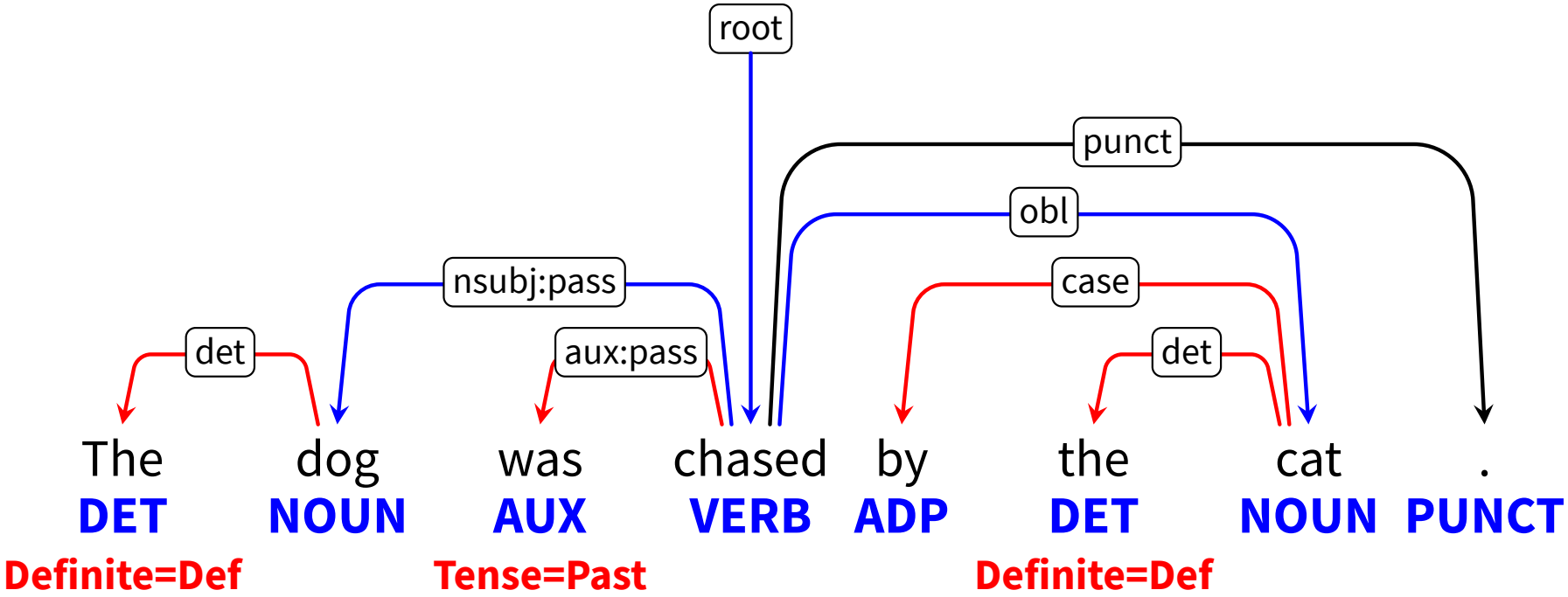
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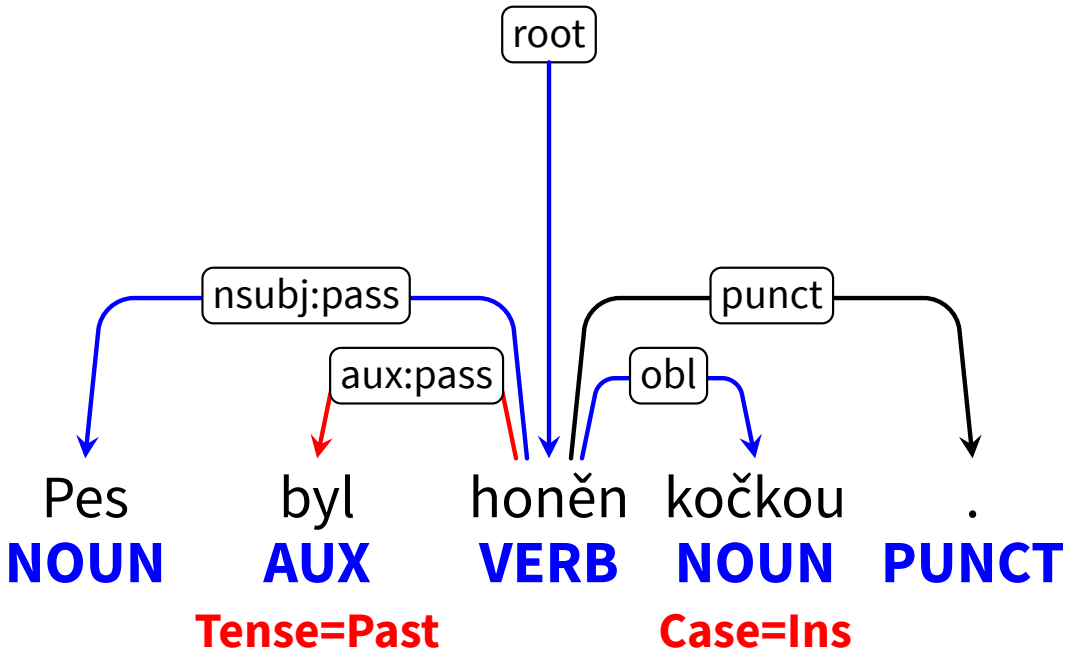

root
nsubj:pass
punct
aux:pass
obl
Pes byl honěn kočkou .
NOUN AUX VERB NOUN PUNCT
Tense=Past
Case=Ins

Dependents of Clauses (Verbal or Not)

	Nominal	Clausal	Modifier	Function
Core	**nsubj**	csubj		
Non-Core	**obl**	advcl	advmod	aux
	vocative		discourse	cop
	dislocated			mark
	expl			

Dependents of Verbs, Adjectives and Adverbs

	Nominal	Clausal	Modifier
Core	**obj**	ccomp	
	iobj	xcomp	
Non-Core	**obl**	advcl	advmod
	expl		

Dependents of Nominals

Nominal	Clausal	Modifier	Function
nmod	acl	amod	det
appos		nummod	case

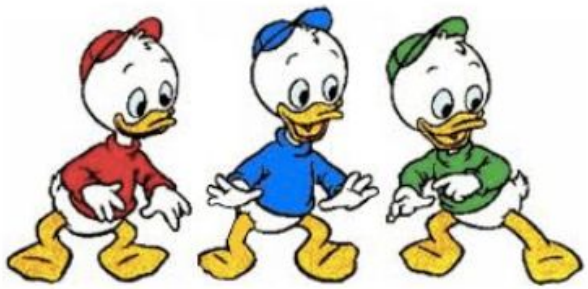
Language-Specific Relation Subtypes

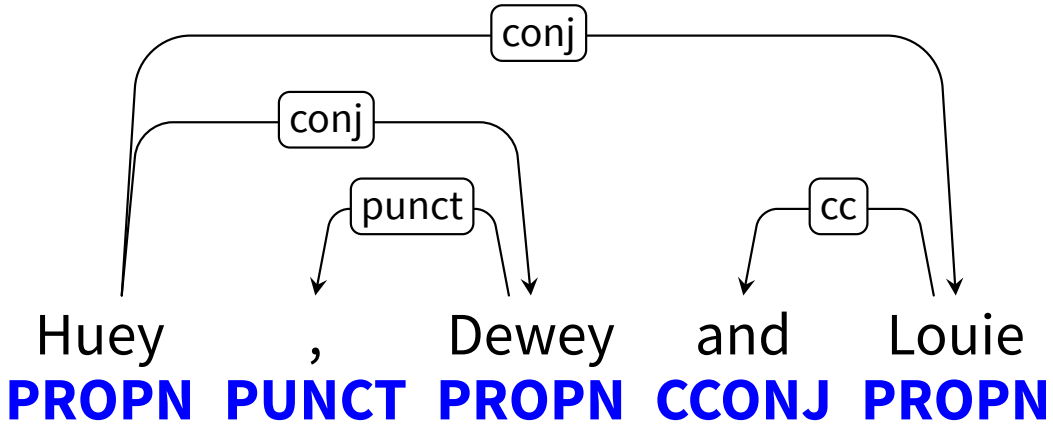
- Language-specific relations are subtypes of universal relations added to capture important phenomena
- Subtyping permits us to “back off” to universal relations

Language-Specific Relation Subtypes

Relation	**Explanation**
acl:relcl	Relative clause
compound:prt	Verb particle (dress up)
nmod:poss	Possessive nominal (Mary ’s book)
obl:agent	Agent in passive (saved by the bell)
cc:preconj	Preconjunction (both … and)
det:predet	Predeterminer (all those …)

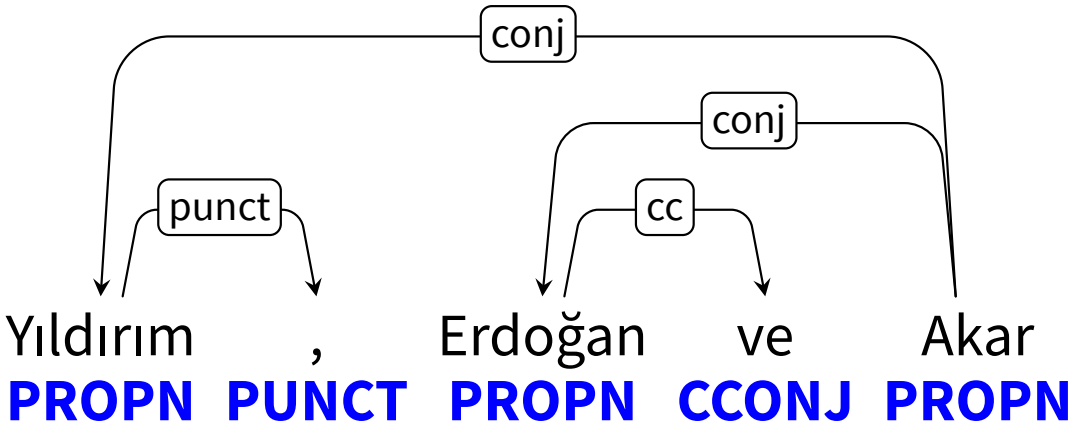
Coordination





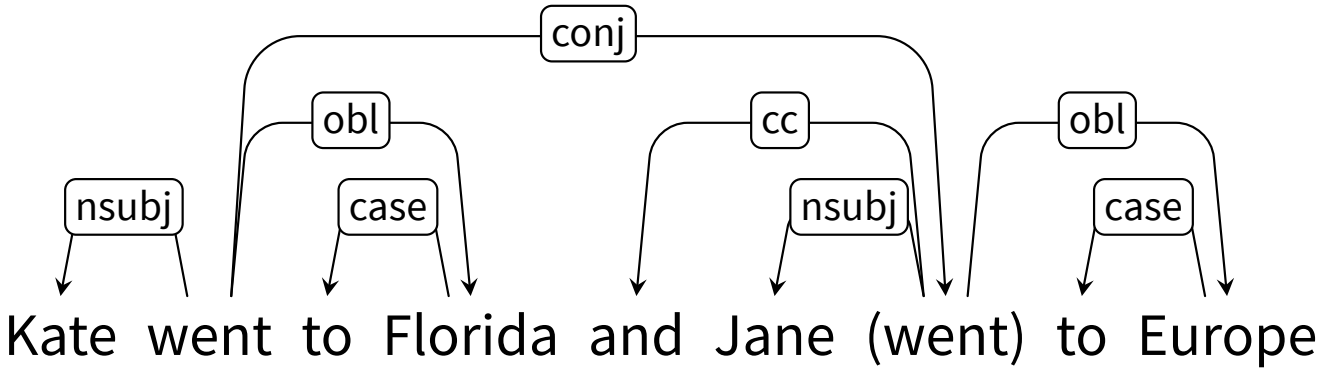
- Coordinate structures are headed by the first conjunct
  - Subsequent conjuncts depend on it via the conj relation
  - Conjunctions depend on the next conjunct via the cc relation
  - Punctuation marks depend on the next conjunct via the punct relation

But Some Languages Might Prefer the Opposite



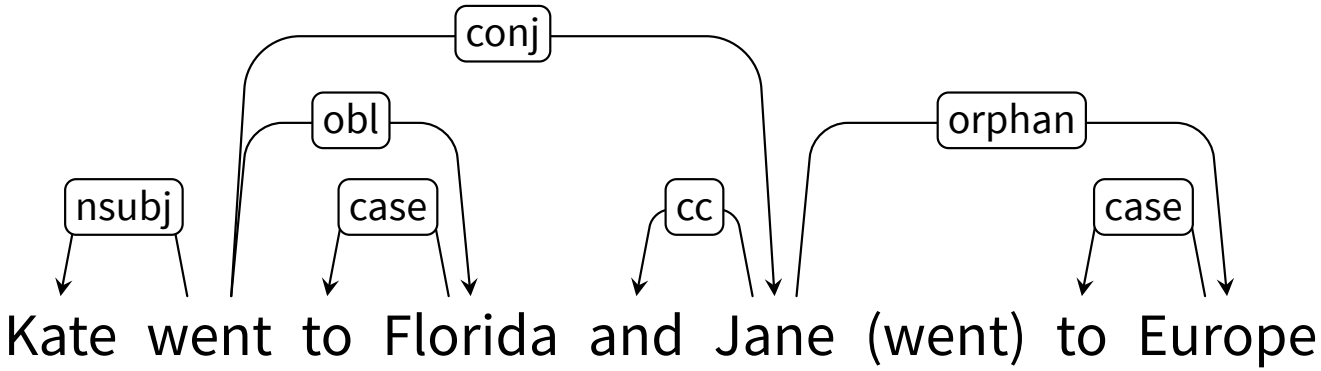
- Coordinate structures would be headed by the last conjunct
  - Preceding conjuncts would depend on it via the conj relation
  - Conjunctions would depend on the preceding conjunct
  - Punctuation marks would depend on the preceding conjunct

Deleted Predicates in Coordination

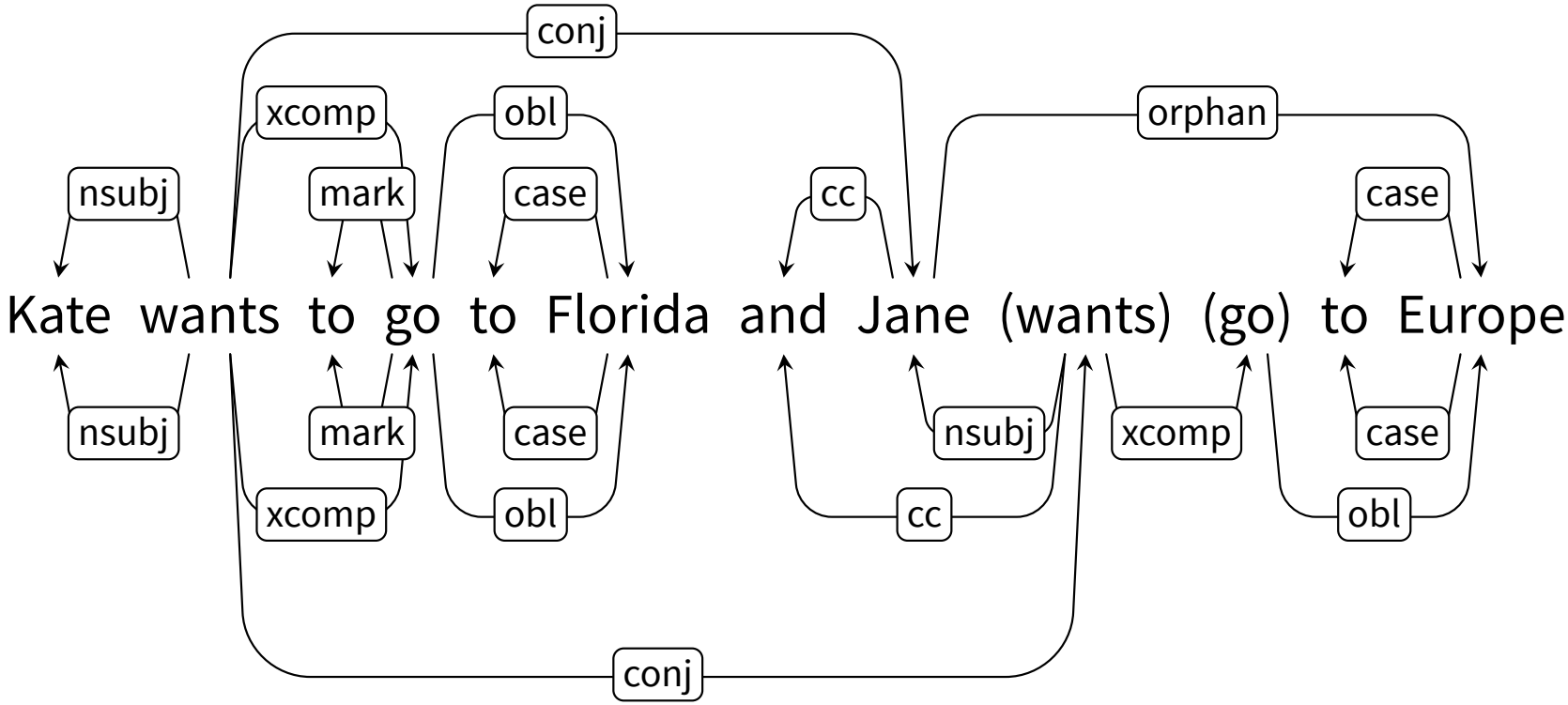


- Some treebanks would use an empty node to represent the second *went*.
- UD enhanced representation now allows empty nodes!
- But the basic representation sticks with the overt words.

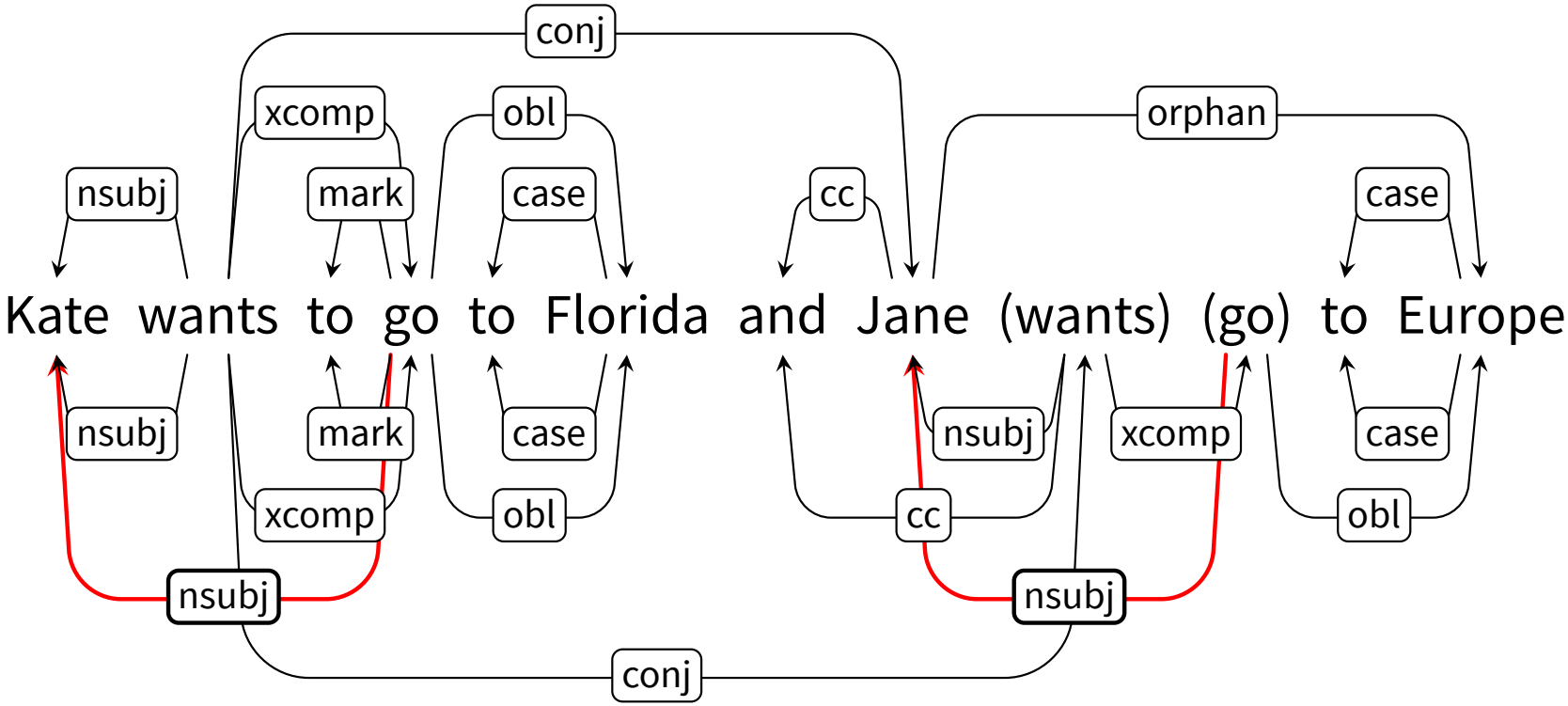
Ellipsis in Basic UD



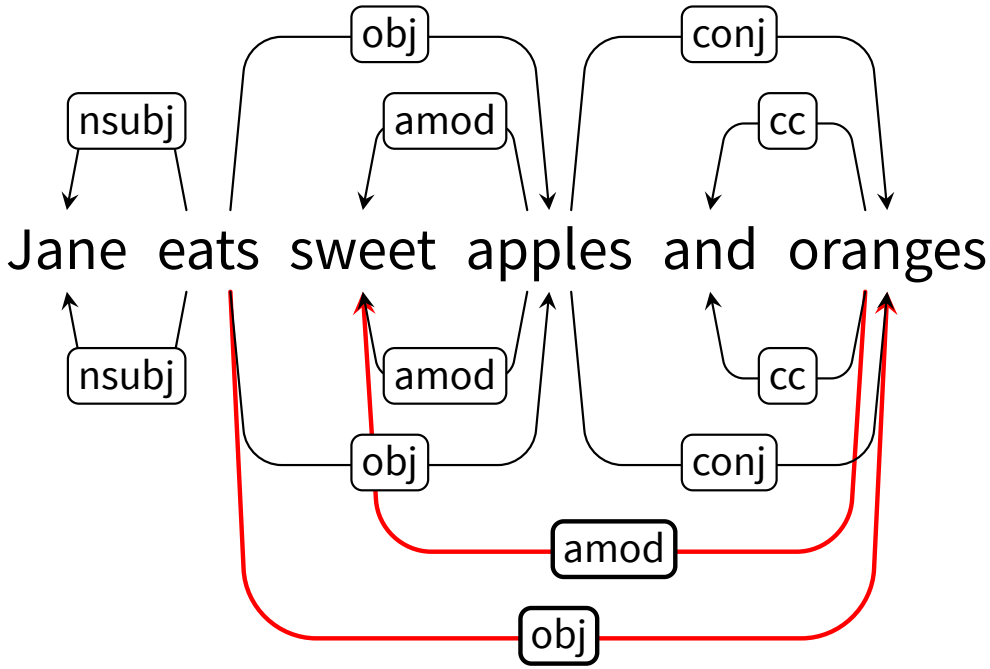
Enhanced Dependencies: Gapping



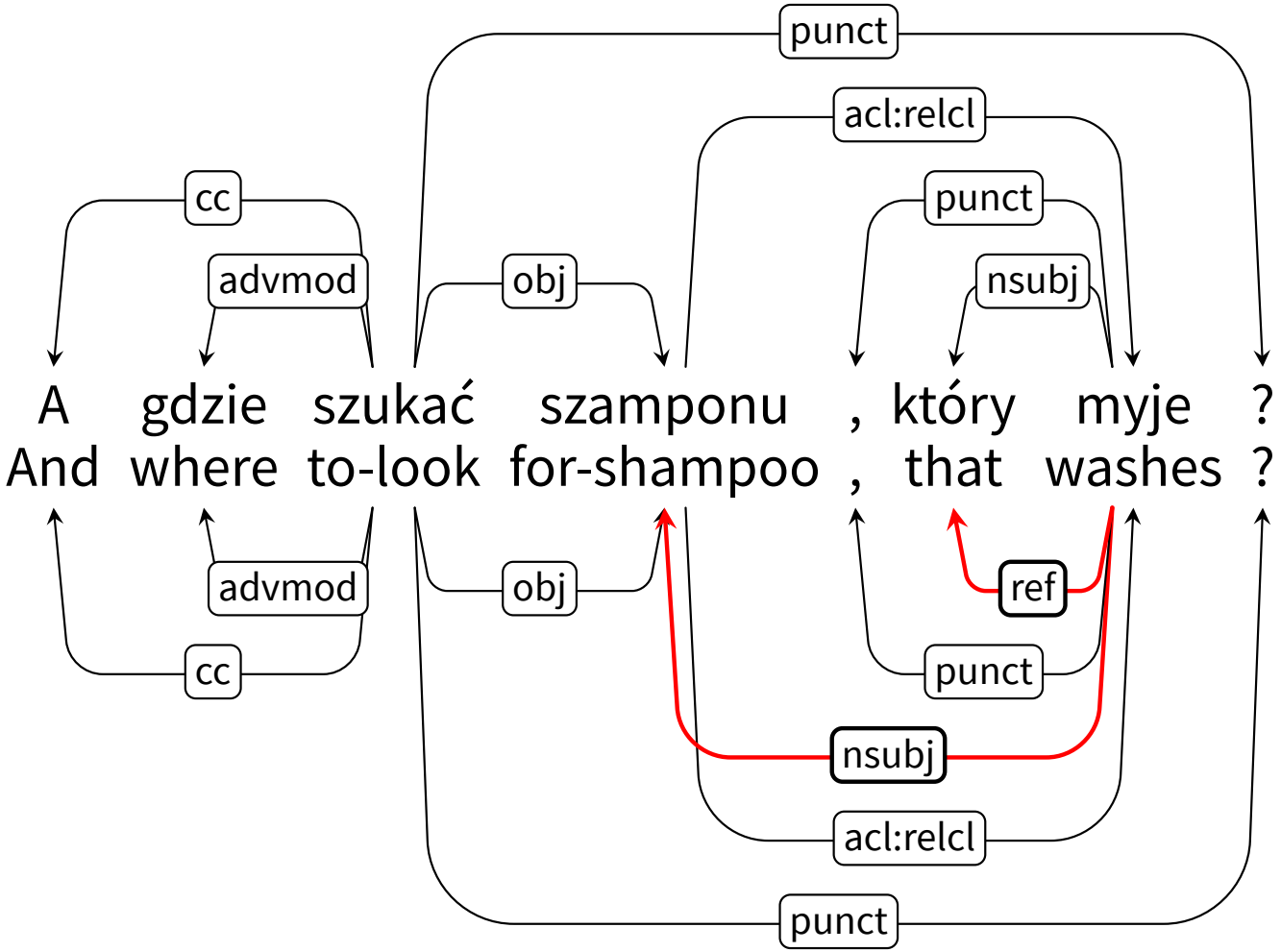
Enhanced Dependencies: Gapping and Control



Enhanced Dependencies: Coordination



Enhanced Dependencies: Relative Clauses

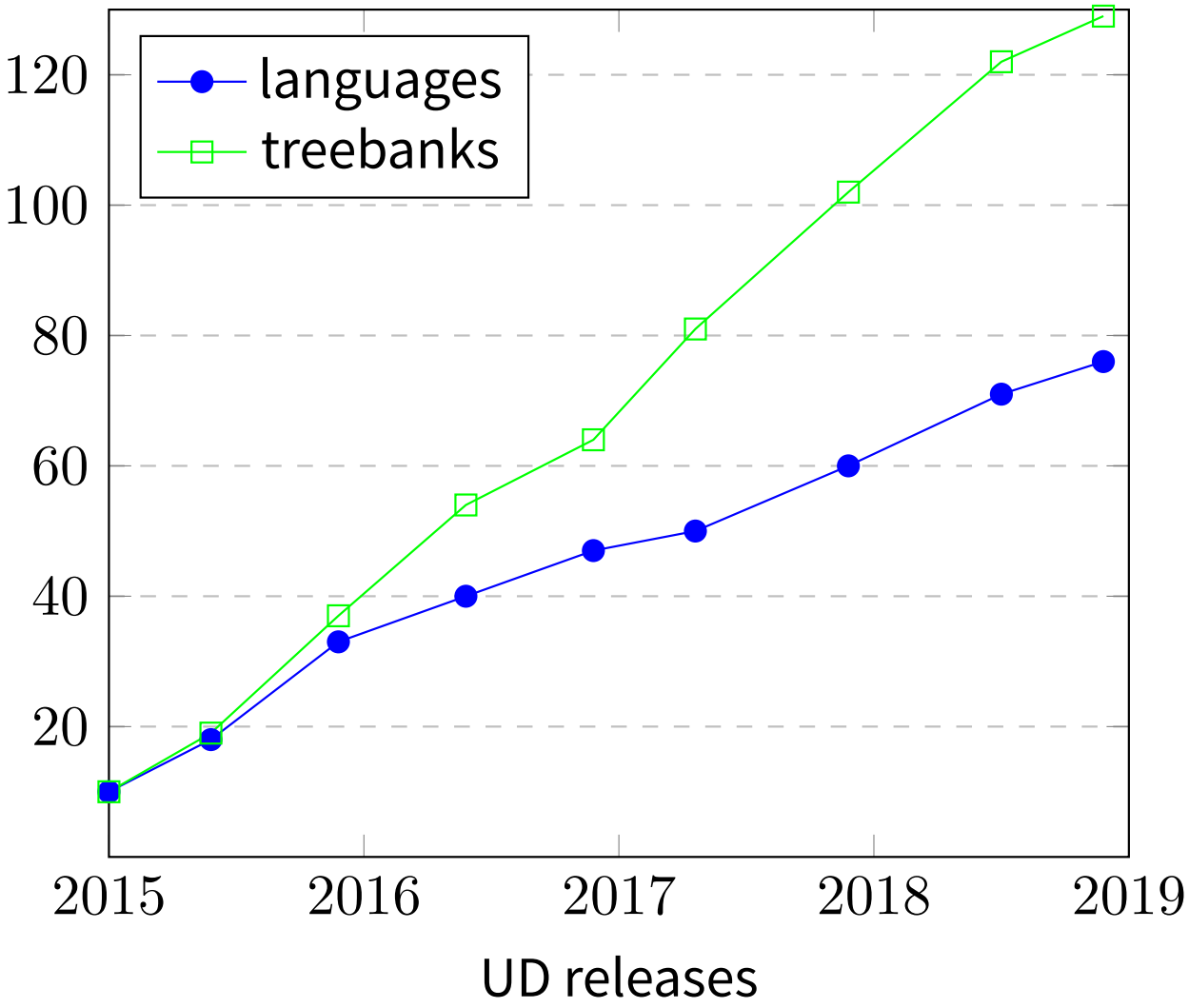


Where Are We Now?

Where Are We Now?

- Four and half years
- 9 treebank releases (every 6 months)
- 129 treebanks
- 75 languages (over 50% world's population)
- Over 18M tokens; treebanks range from <1K to 1.5M
- Over 280 contributors
  - language group consistency SIGs
- Two UD workshops
- Two CoNLL Shared Tasks in parsing UD

Growing Number of Languages



A Big Family: 75 Languages and Growing

- I.-E.: Armenian, Ancient Greek, Greek, Breton, Irish
  - Germanic: Afrikaans, Danish, Dutch, English, Faroese, German, Gothic, Norwegian, Swedish
  - Romance: Catalan, French, Galician, Italian, Latin, Old French, Portuguese, Romanian, Spanish
  - Balto-Slavic: Belarusian, Bulgarian, Croatian, Czech, Church Slavonic, Polish, Russian, Serbian, Slovak, Slovenian, Ukrainian, Sorbian, Latvian, Lithuanian
  - Indo-Ir.: Kurmanji, Persian, Hindi, Marathi, Sanskrit, Urdu
- Uralic: Erzya, Estonian, Finnish, Hungarian, Komi, Sami; Dravidian: Tamil, Telugu
- Turkic: Kazakh, Turkish, Uyghur
- Afro-Asiatic: Akkadian, Amharic, Arabic, Coptic, Hebrew, Maltese
- Sino-Tibetan: Cantonese, Chinese; Aus.-As.: Vietnamese
- Tai-Kadai: Thai; Austronesian: Indonesian, Tagalog
- Other: Buryat, Japanese, Korean, Basque, Sw. Sign, Naija, Bambara, Yoruba, Warlpiri

Existing Slavic Treebanks

Language	Code	Treebanks
Belarusian	[be]	HSE 8K
Bulgarian	[bg]	BTB 156K
Church Slavonic	[cu]	PROIEL 57K
Croatian	[hr]	SET 197K
Czech	[cs]	PDT 1506K, CAC 494K, CLTT 35K, PUD 18K, FicTree 167K
Polish	[pl]	SZ 83K, LFG 130K
Russian	[ru]	SynTagRus 1107K, GSD 99K, PUD 19K, Taiga 20K
Serbian	[sr]	SET 86K
Slovak	[sk]	SNK 106K
Slovenian	[sl]	SSJ 140K, SST 29K
Ukrainian	[uk]	IU 116K
Upper Sorbian	[hsb]	UFAL 11K

Pronouns and Determiners

- English + Romance languages: DET = article or pronominal adjective
  this, which, every

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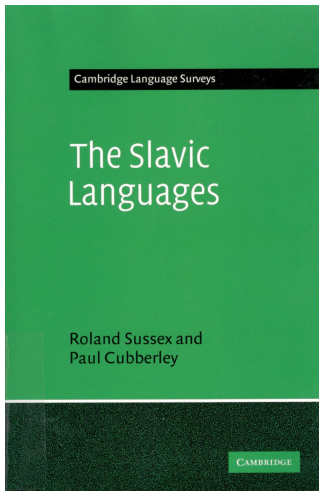

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  this, which, every
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- Some authors do recognize determiners in Slavic!
- UD v1: functional borderline (but ellipsis?)
  - *This*.DET *car is expensive.*
  - *This*.PRON *is expensive.*
- Less strict in UD v2.

Verb Forms

- Conflicting terminologies in traditional grammars

- Participle … verb or adjective?
- Converb / transgressive / gerund … verb or adverb?
- Verbal noun / gerund … verb or noun?

- Tags and features apply to individual words!

Conflicting Terminology & Language Change

- Past tense in modern East Slavic: -l / -la / -lo / -li, “finite” (no auxiliary).
- Past tense / active (“l”-)participle in West Slavic: auxiliary in 1st and 2nd persons. Also used in conditional mood.
- L-participle in Slovenian: auxiliary in all persons. Used for past, future and conditional.
- L-participle in old Slavic: perfect (resultative) aspect, and conditional.

она	пришла	к	нему
ona	prišla	k	nemu
she	came	to	him
PRON	**VERB**	**ADP**	**PRON**
	VerbForm=Fin Tense=Past		

я	хотел	бы	поблагодарить
ja	hotel	by	poblagodarit’
I	like	would	to-thank
PRON	**VERB**	**AUX**	**VERB**
	VerbForm=Fin Tense=Past		**VerbForm=Inf**

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přišel	jsi	nás	zabít
came	you-have	us	to-kill
VERB	**AUX**	**PRON**	**VERB**
VerbForm=Part Tense=Past	**VerbForm=Fin Tense=Pres**		**VerbForm=Inf**

přišel	nás	zabít
he-came	us	to-kill
VERB	**PRON**	**VERB**
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přišel	by	nás	zabít
came	he-would	us	to-kill
VERB	**AUX**	**PRON**	**VERB**
VerbForm=Part Tense=Past	**VerbForm=Fin Mood=Cnd**		**VerbForm=Inf**

přišel	nás	zabít
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VERB	**PRON**	**VERB**
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daleč	boste	přišli
far	you-will	come
ADV	**AUX**	**VERB**
	VerbForm=Fin Tense=Fut	VerbForm=Part

prišel	je	do	ugotovitve
come	he-has	to	conclusion
VERB	**AUX**	**ADP**	**NOUN**
VerbForm=Part	VerbForm=Fin Tense=Pres		

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пришелъ	есн	погоубитъ	насъ	да	не	бн	отъшелъ	отъ	нихъ
prišelъ	jesi	pogubitъ	nasъ	da	ne	bi	otъšelъ	otъ	nichъ
come	you-have	to-kill	us	that	not	would	leave	from	them
VERB	**AUX**	**VERB**	**PRON**	**SCONJ**	**PART**	**AUX**	**VERB**	**ADP**	**PRON**
VerbForm=Part Aspect=Res	**VerbForm=Fin Tense=Pres**	**VerbForm=Inf**				**Fin Cnd**	**VerbForm=Part Aspect=Res**		

Core Arguments

- Easier cross-linguistically than argument-adjunct?

- Subject of intransitive verb
- Agent of transitive verb
- Patient (direct object) of transitive verb

Core vs. Oblique Dependents

- **Core arguments:** what exactly is it?
  - Subject
  - Object
  - (Indirect object)
- English:
  - *He gave John the book.* (iobj)
  - *He gave the book to John.* (obl)
- Spanish:
  - *Dio el libro a John.* (iobj?)
- Slavic languages and German:
  - Only bare accusative deserves to be obj?
  - All other “objects” should be oblique arguments?

Reflexive Pronouns

- Direct or indirect object (obj, iobj):
  Řízl se do prstu / Řízl ho do prstu.
  - Including reciprocal usage:
    Políbili se. / They kissed each other.

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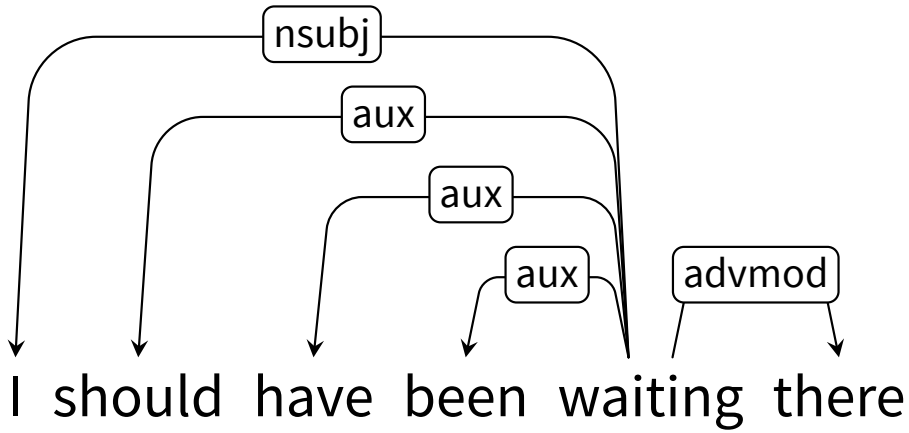
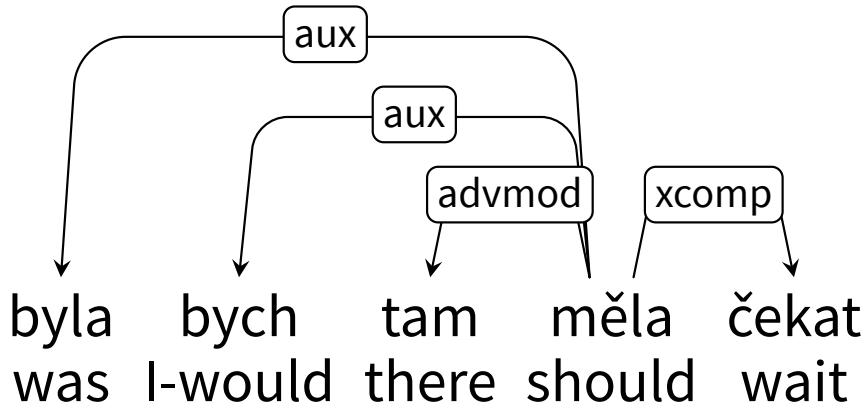
  - `expl:pass` (previously `auxpass:reflex`)
- Impersonal construction (~ passive?):
  Zde se mluví německy. / German is spoken here.
  - `expl:impers`

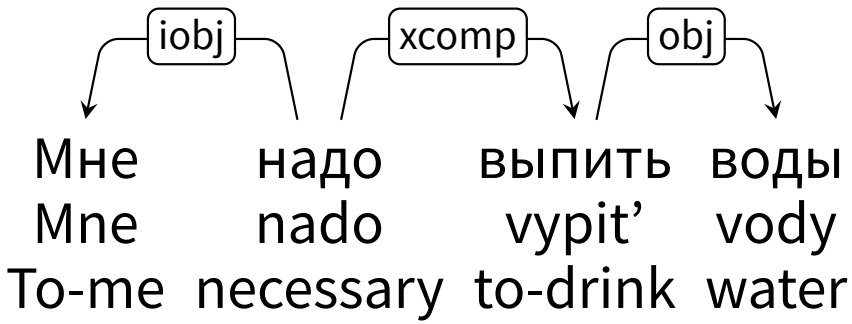
Modal Auxiliary in English



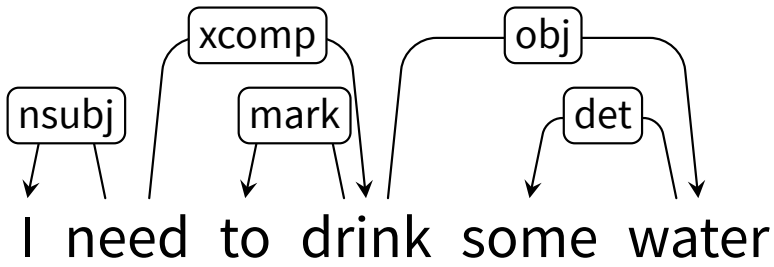
Modal Verb in Czech



Modal Predicative in Russian

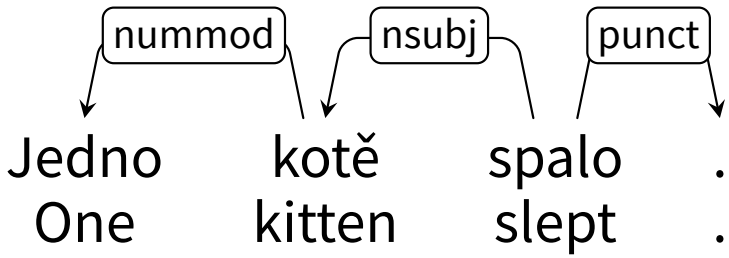


Modal / Control Verb in English



Still Have Time?

Quantified Noun Phrase



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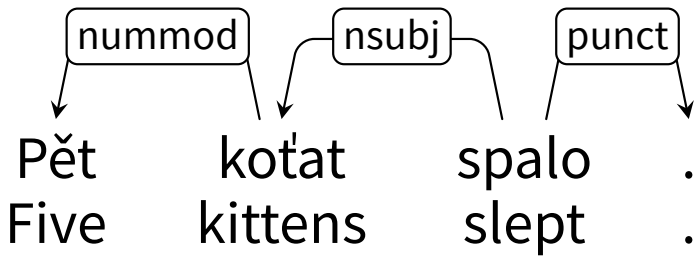

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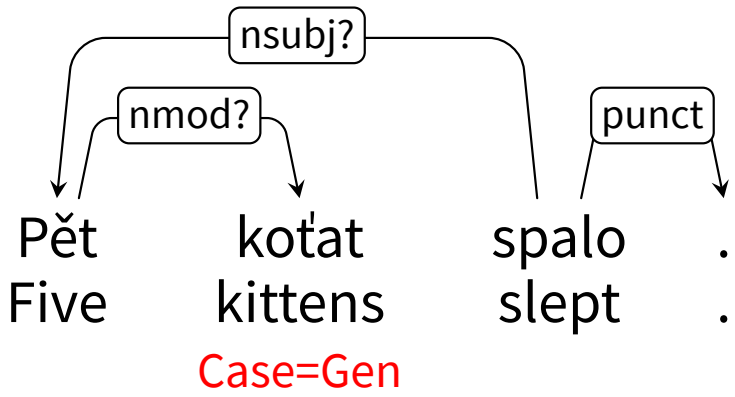

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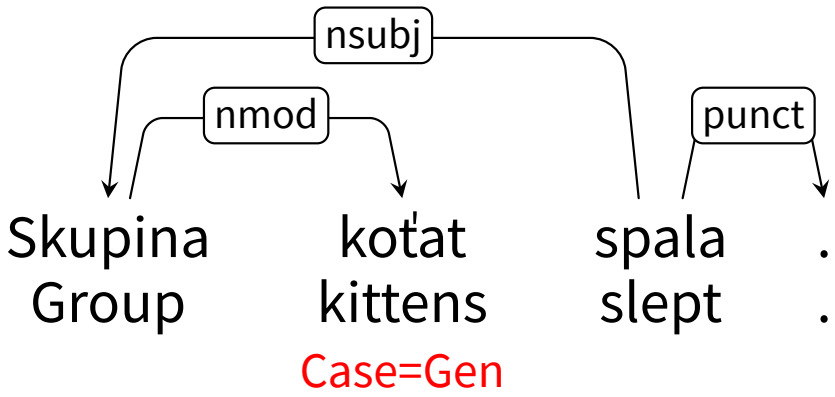

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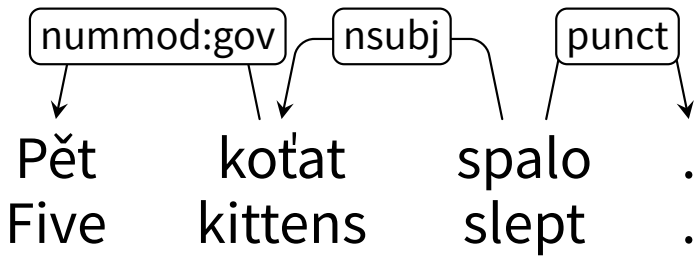

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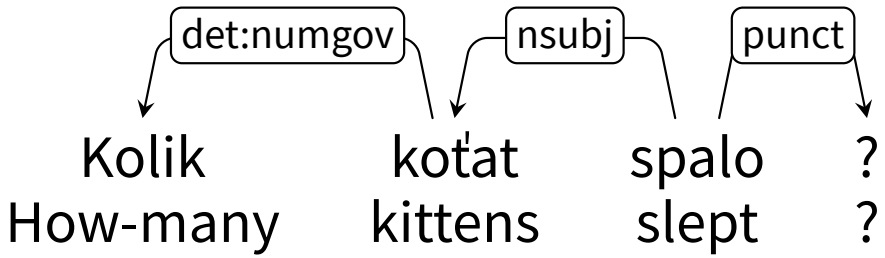
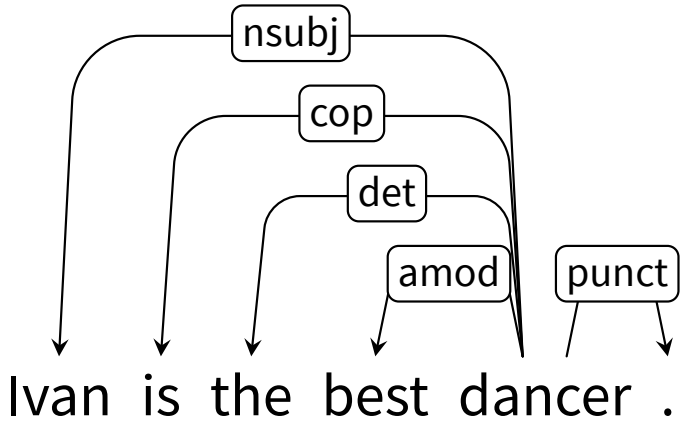


Language-Specific Labels

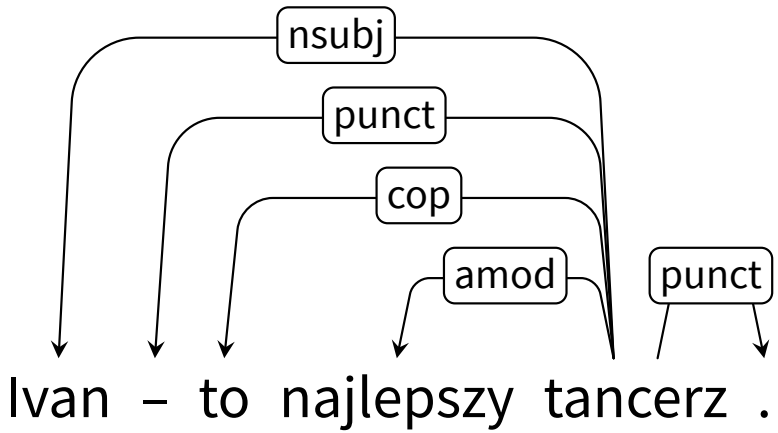
	Numeric	**Pronominal**
Noun governs	nummod	det:nummod
Numeral governs	nummod:gov	det:numgov

Nonverbal Predicate and Copula

- Some languages use a copula verb:



- Some languages use a copula pronoun:



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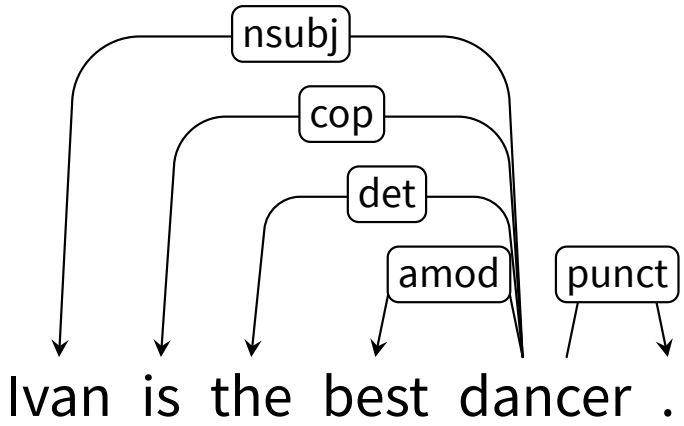
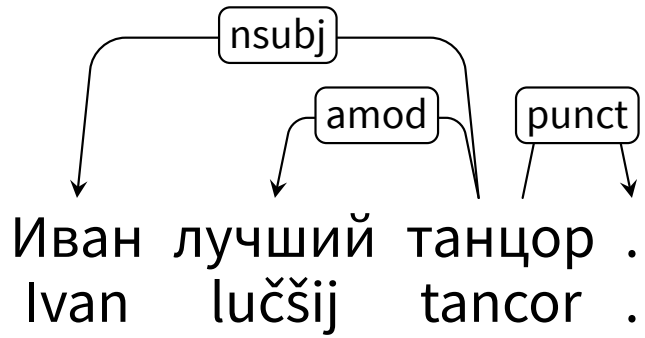


- Some languages omit the copula:



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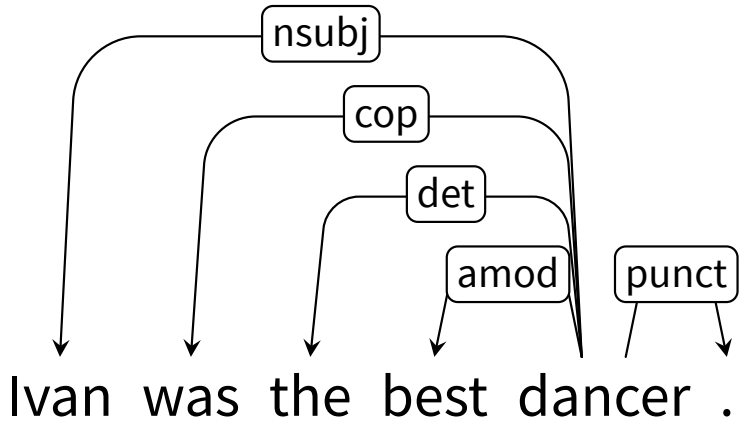
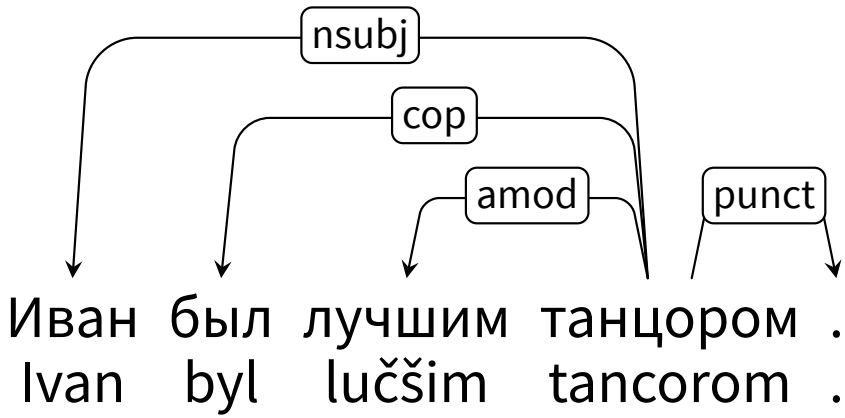
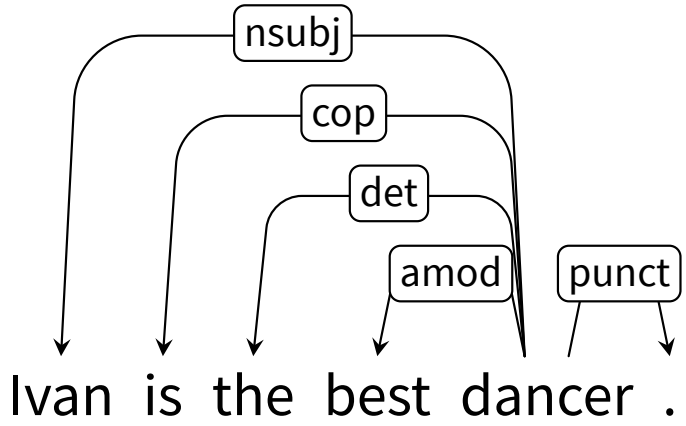


- Some languages use it only in some tenses:

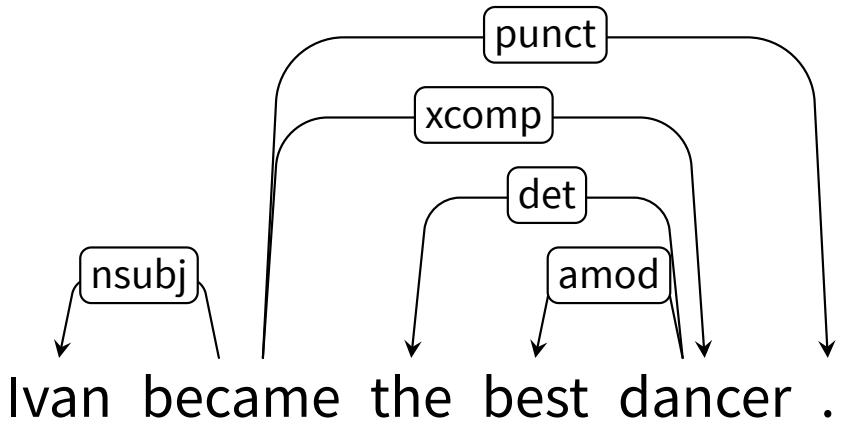


Copula Verbs: We Are Restrictive!

- *To be* is copula:

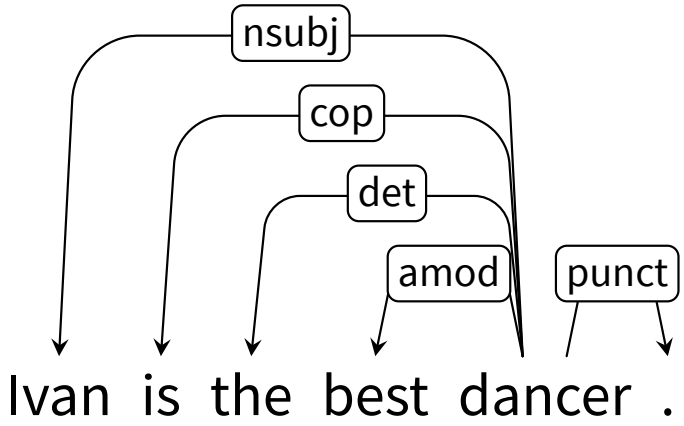


- *To become* is not copula:

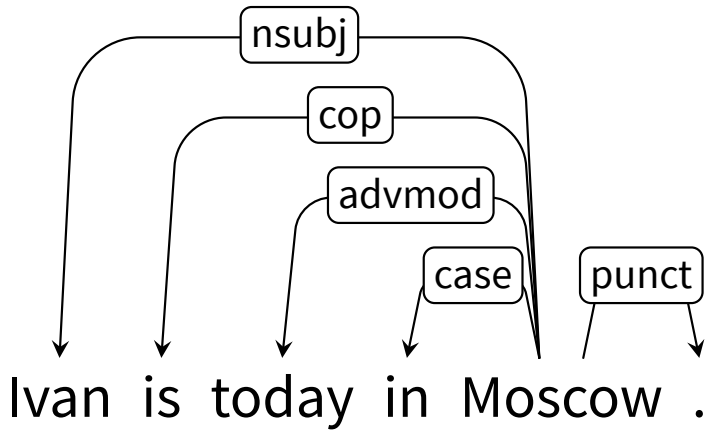


Once Copula, Always Copula!

- This is parallel with Russian:

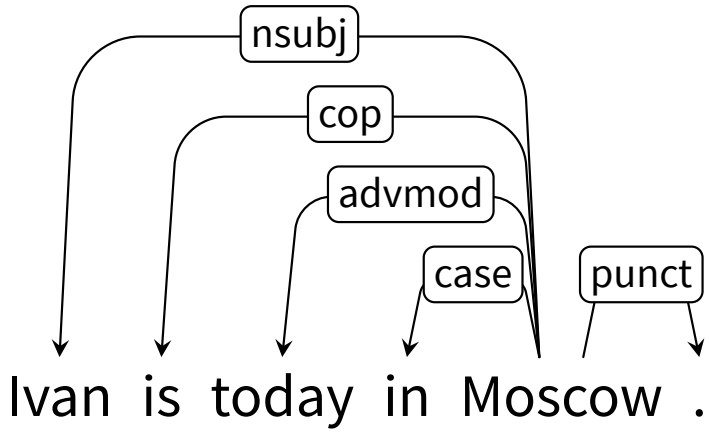


- This is also parallel with Russian:

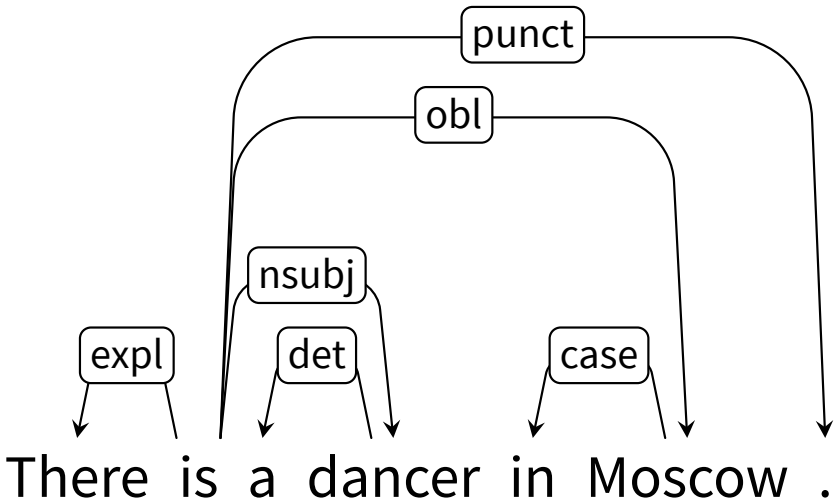


Well, Almost…

- This is parallel with Russian:

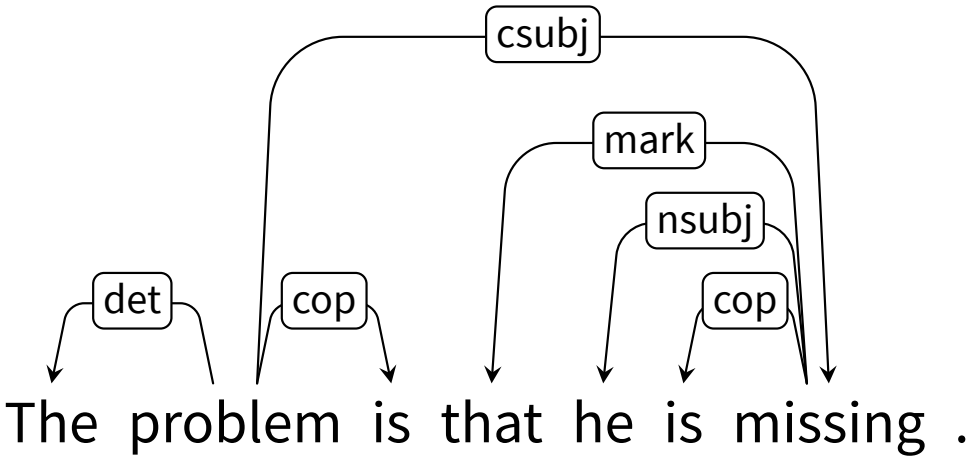


- But not with this in English:

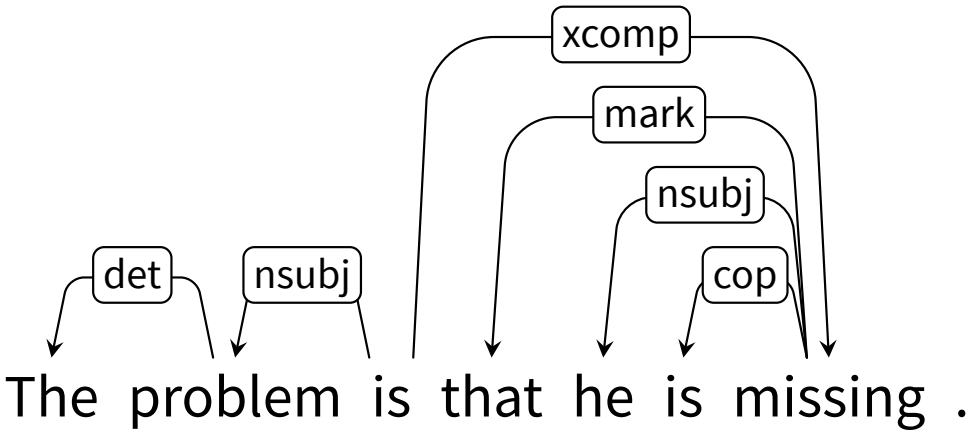


Clauses and Copula

- A clause can be the subject:



- But it cannot be annotated as the nonverbal predicate:



Wrapping Up

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- Slavic languages very well represented
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- UD is now the de-facto standard
- Slavic languages very well represented
- Consistency matters!
- Get involved. It's fun!

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Dźakuju so!
Prašenja?

Dziękuję!
Pytania?

Дякую!
Питання?

Děkuji!
Otázky?

Thank You!
Questions?

Ďakujem!
Otázky?

Hvala!
Vprašanja?

Hvala!
Pitanja?

Благодаря!
Въпроси?