

Uniformity versus Diversity: Dependency Grammar for All



FACULTY
OF MATHEMATICS
AND PHYSICS
Charles University



Daniel Zeman

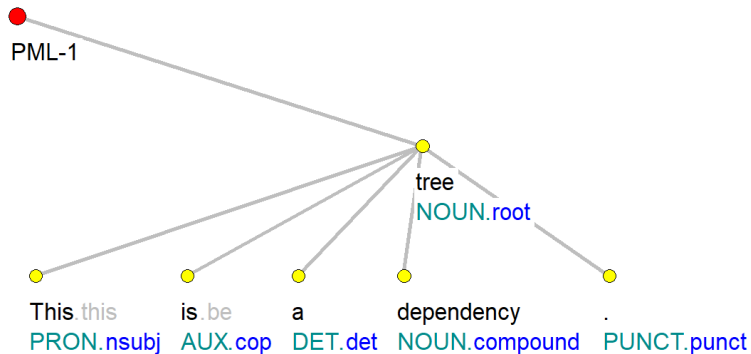
zeman@ufal.mff.cuni.cz

<http://universaldependencies.org/>

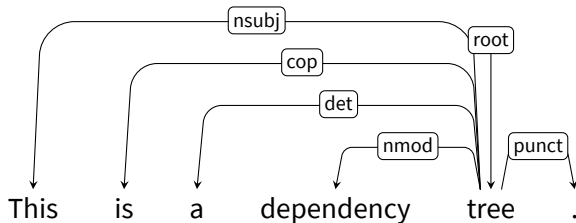
Universal Dependencies



Syntactic Trees



Syntactic Trees



Users (Simplified)



LT engineers

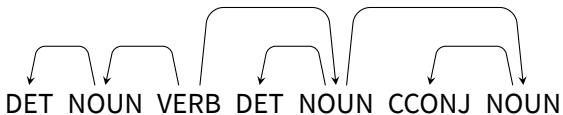
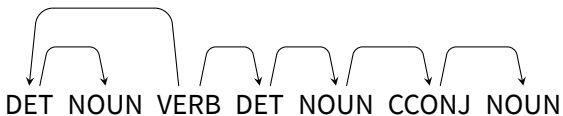
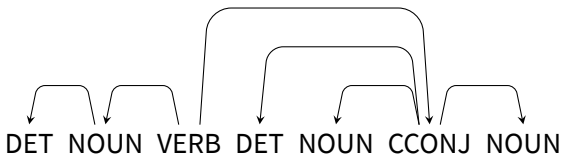
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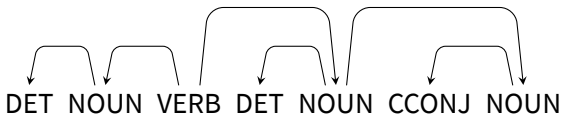
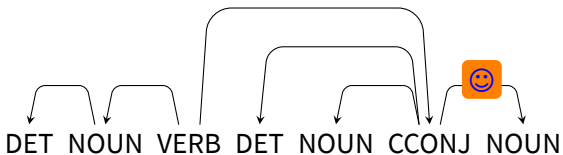


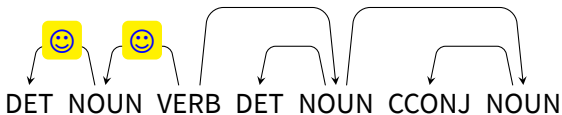
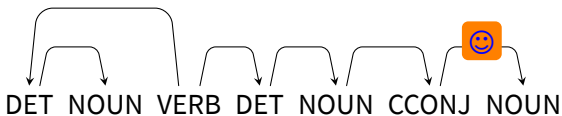
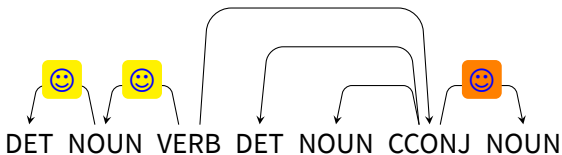
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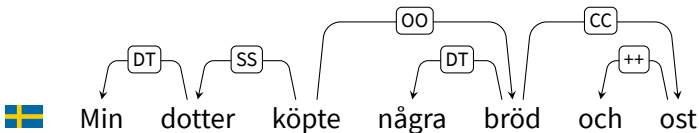
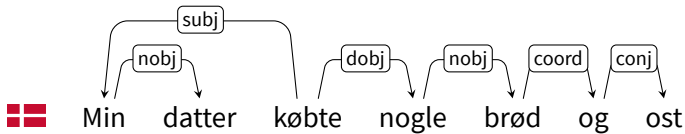
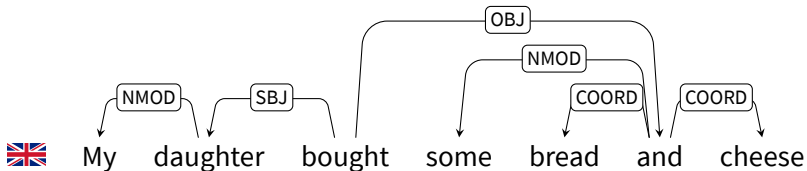
& linguists











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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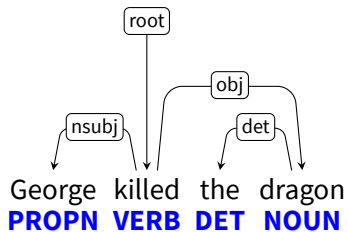
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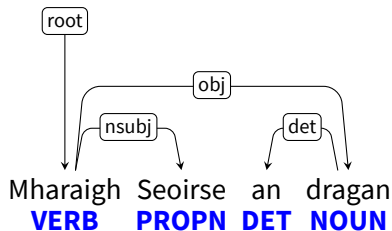
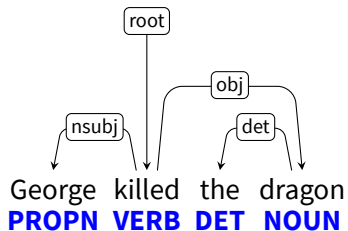
A Big Family: 69 Languages and Growing

- 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:  Estonian,  Finnish,  Hungarian,  Komi,  Sami
- Turkic:  Kazakh,  Turkish,  Uyghur
- Dravidian:  Tamil, Telugu
- Afro-Asiatic:  Arabic,  Coptic,  Hebrew
- Sino-Tibetan:  Cantonese,  Chinese
- Austro-Asiatic:  Vietnamese; Tai-Kadai:  Thai
- Austronesian:  Indonesian,  Tagalog
- Other:  Buryat,  Japanese,  Korean,  Basque,  Sw. Sign,  Naija,  Warlpiri

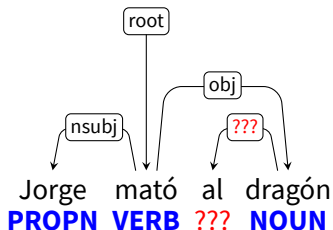
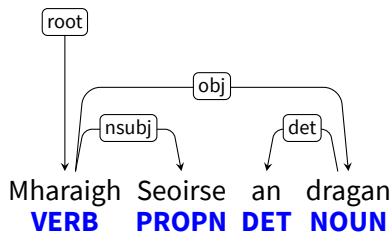
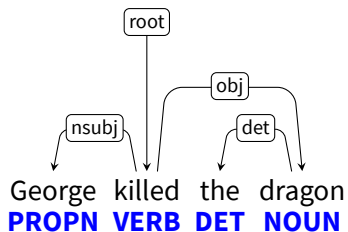
Same Thing Same Way



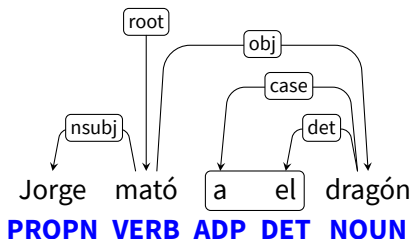
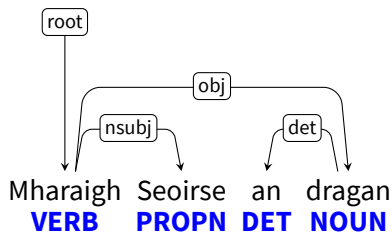
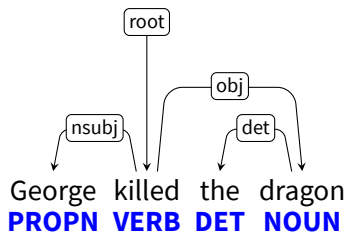
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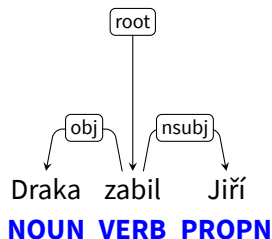
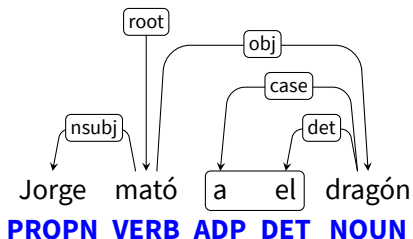
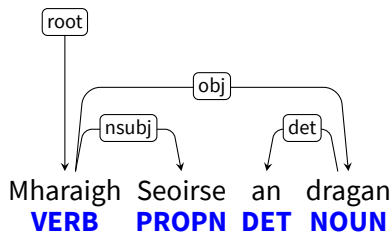
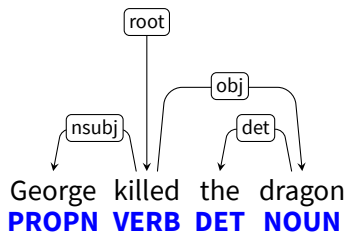
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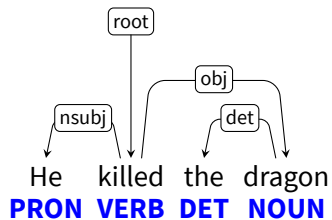
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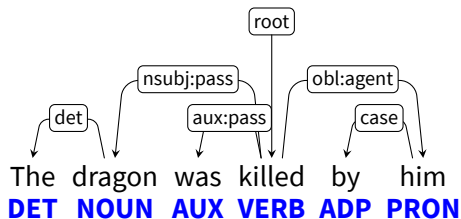
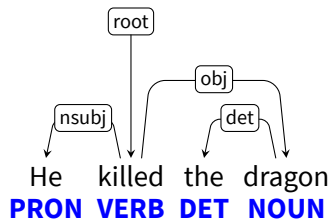
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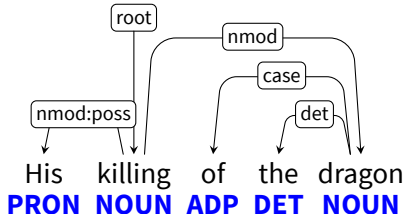
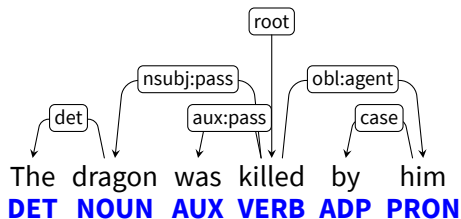
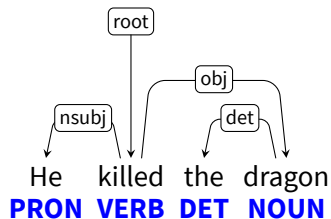
Same Meaning \neq Same Construction!



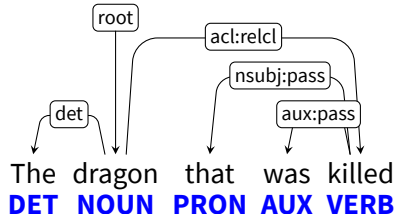
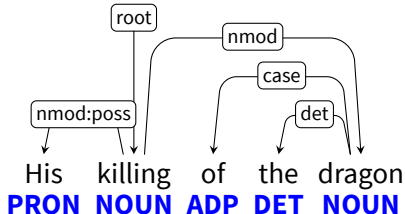
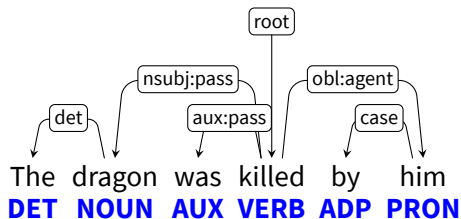
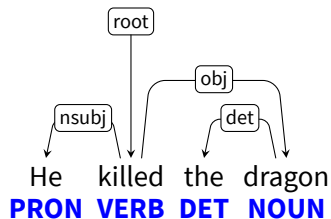
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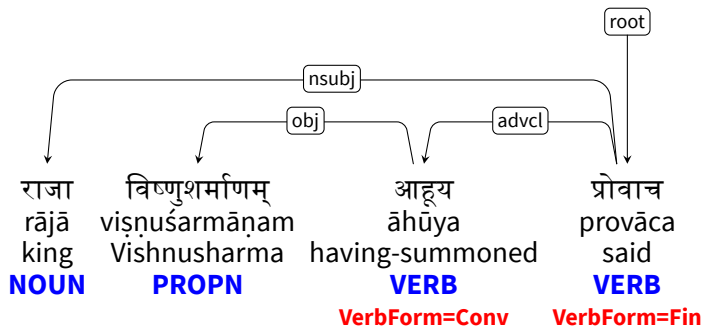
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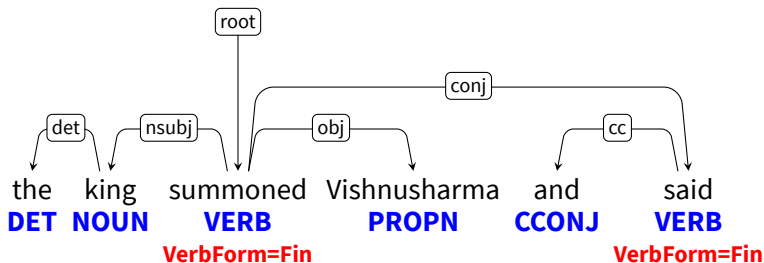
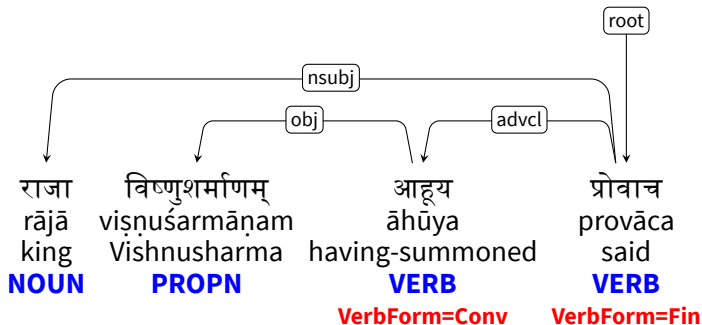
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Language-specific Preferences



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A Tour through UD

Morphology

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

Morphology

Některé	dívky	si	nicméně	pochvalovaly	zmrzlinu	.
<i>Some</i>	<i>girls</i>		<i>nevertheless</i>	<i>praised</i>	<i>ice-cream</i>	.
některý	dívka	se	nicméně	pochvalovat	zmrzlina	.

- Lemma representing the semantic content of the word

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

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některý	dívka	se	nicméně	pochvalovat	zmrzlina	.
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

ADJ

ADV

INTJ

NOUN

PROPN

VERB

Closed

ADP

AUX

CCONJ

DET

NUM

PART

PRON

SCONJ

Other

PUNCT

SYM

X

- 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

PronType

NumType

Poss

Reflect

Foreign

Abbr

Inflectional (Nominal)

Gender

Animacy

Number

Case

Definite

Degree

Inflectional (Verbal)

VerbForm

Mood

Tense

Aspect

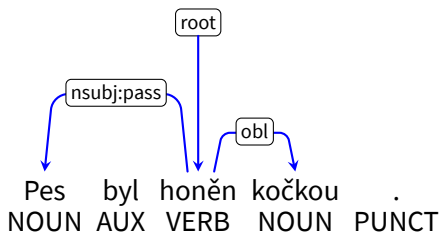
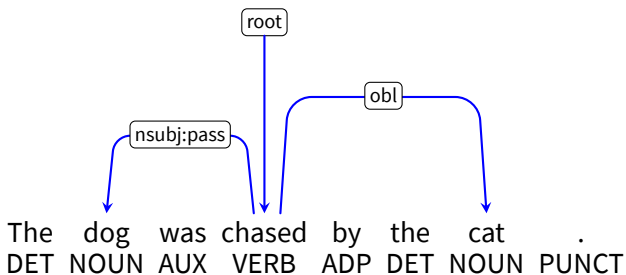
Voice

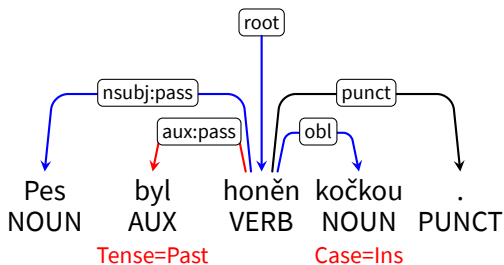
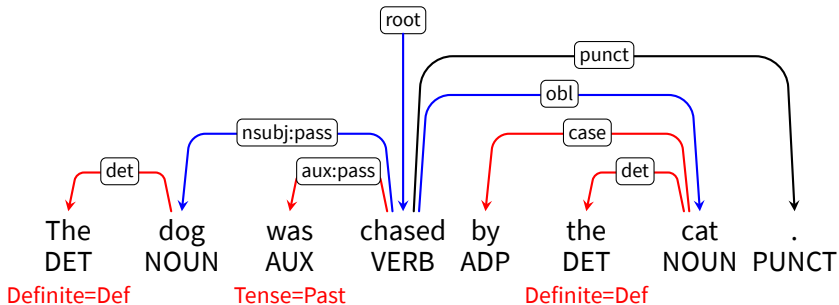
Evident

Person

Polite

Polarity





Dependents of Clauses (Verbal or Not)

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

Dependents of Verbs, Adjectives and Adverbs

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

Dependents of Nominals

Nominal	Clausal	Modifier	Function
nmod appos	acl	amod nummod	det case

Language-Specific Relation Subtypes

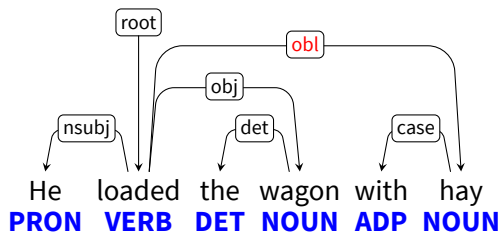
- Language-specific relations are **subtypes** of universal relations added to capture important phenomena
- Subtyping permits us to “back off” to universal relations

Language-Specific Relation Subtypes

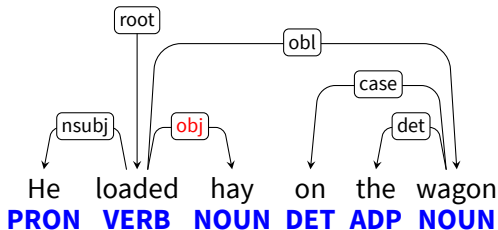
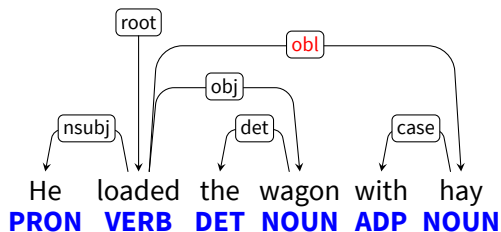
Relation	Explanation
acl:relcl	Relative clause
compound:prt	Verb particle (dress up)
nmod:poss	Possessive nominal (Mary 's book)
obl:agent	Agent in passive (saved by the bell)
cc:preconj	Preconjunction (both ... and)
det:predet	Predeterminer (all those ...)

Core vs. Oblique Dependents

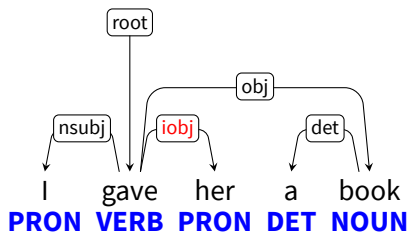
Information Packaging



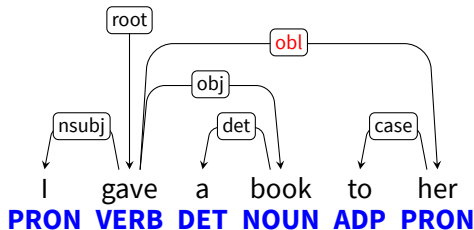
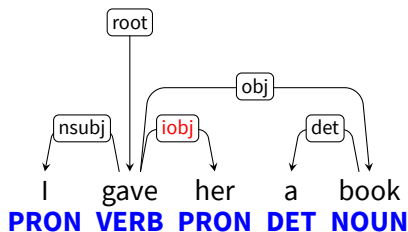
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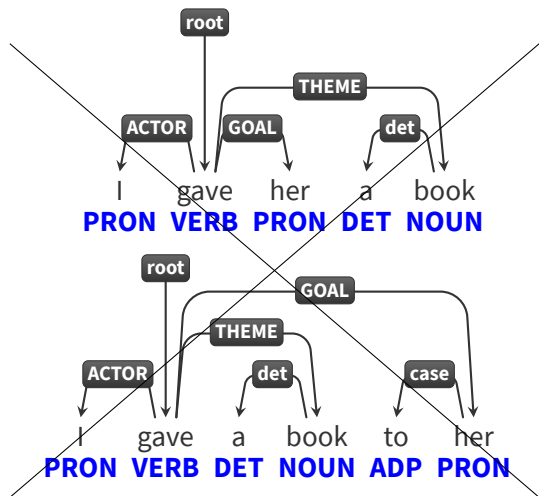
Information Packaging



Information Packaging



UD is NOT about Semantic Roles!



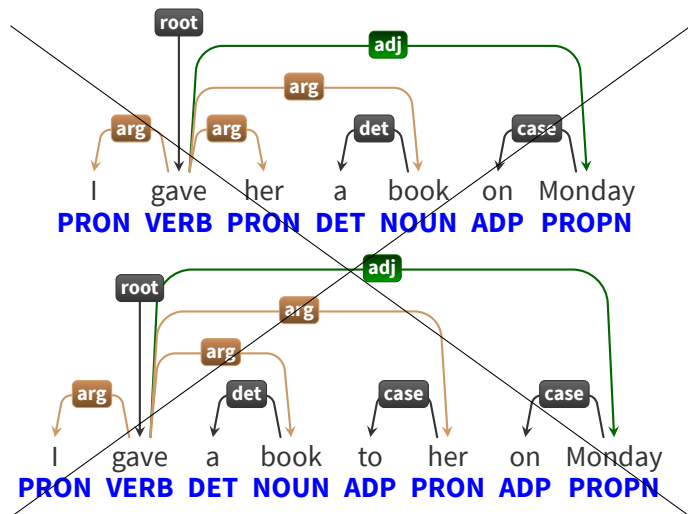
Manning's Law – What If We Do Semantic Roles?

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UD Avoids Argument-Adjunct Distinction!



So What Is Core and Why?

- English (simplified):
 - ▶ Bare noun phrase \Rightarrow core argument (`nsubj`, `obj`, `iobj`)
 - ▶ Prepositional phrase \Rightarrow oblique argument or adjunct (`obl`)

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 - ▶ Prepositional phrase \Rightarrow oblique argument or adjunct (`obl`)
- Other languages: not necessarily! (Spanish, Japanese)
- Clash with traditional terminology
 - ▶ Grammars of German, Czech etc. define **prepositional objects**
 - ▶ But these are not necessarily core...

Language-specific Coding Strategy

- Idea:
 - ▶ **Oblique** arguments are marked **similarly to adjuncts** (prepositions, certain morphological cases...)
 - ▶ Core arguments are marked differently
 - ★ ⇒ easy for annotators and non-linguists!

- Why are core arguments special?
 - ▶ They tend to be **targeted by grammatical rules**
 - ★ Passivization
 - ★ Control verbs
 - ★ Reflexives
 - ★ ...

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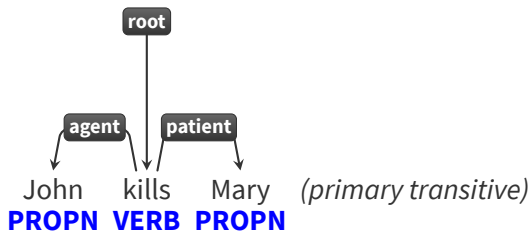
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 - ▶ Note the way they are coded
 - ▶ Note other grammatical rules that target them
 - ▶ Generalize to other predicates with same coding and rules

Language-specific Coding Strategy

- Core vs. oblique is not defined in traditional grammar
- How shall we define it?
- Andrews, 2007 (In Shopen: Language Typology)
 - ▶ Identify **primary transitive predicates**
 - ★ We need semantic roles for this! (One-time only.)
 - ▶ Actor/agent = function **A**
 - ▶ Undergoer/patient = function **P**
 - ▶ Note the way they are coded
 - ▶ Note other grammatical rules that target them
 - ▶ Generalize to other predicates with same coding and rules
- ▶ Then define:
 - ★ function A \Rightarrow **nsubj**
 - ★ function P \Rightarrow **obj**

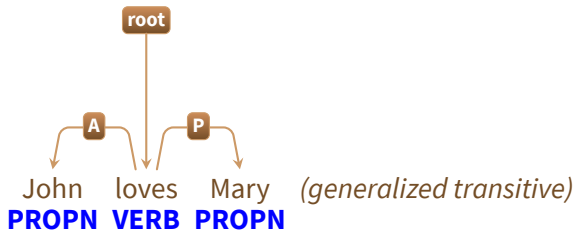
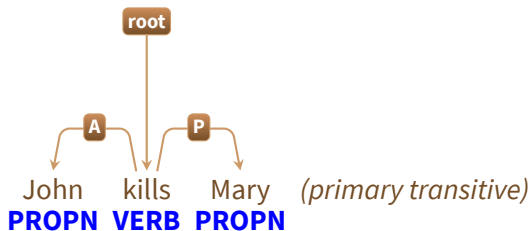


Transitive Predicates in English



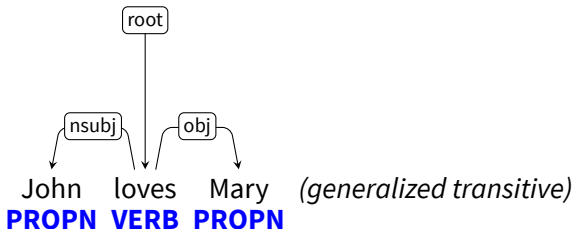
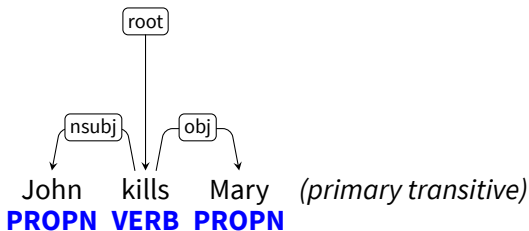


Transitive Predicates in English



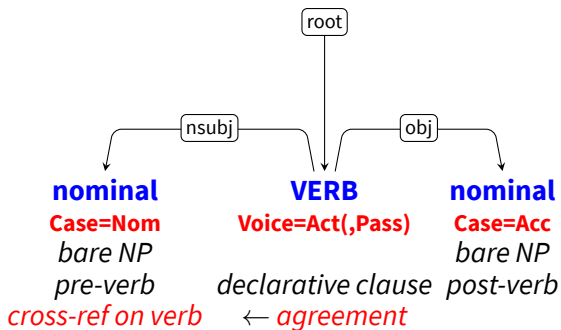


Transitive Predicates in English

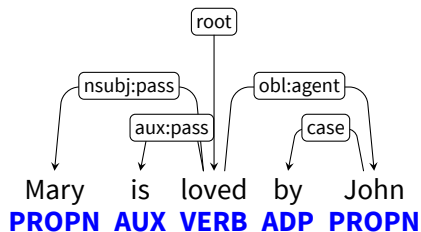
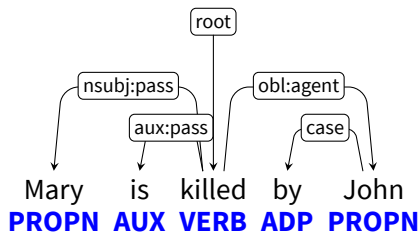




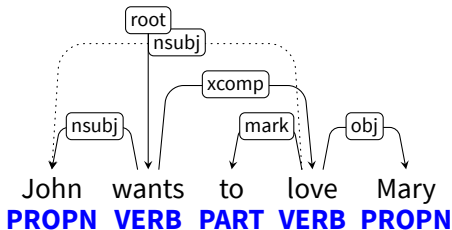
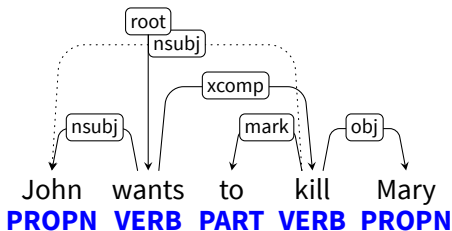
Transitive Predicates in English



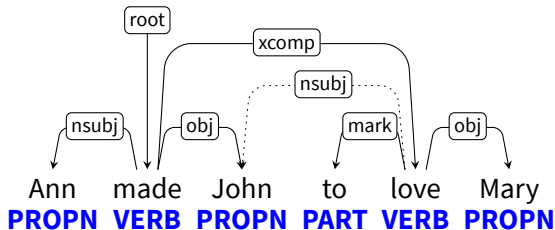
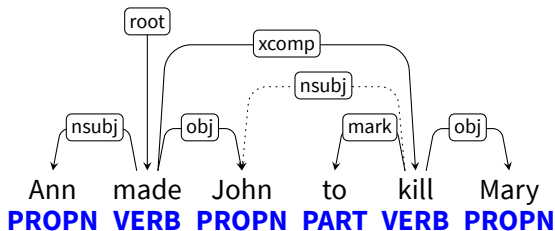
Passivization in English



Subject Control in English

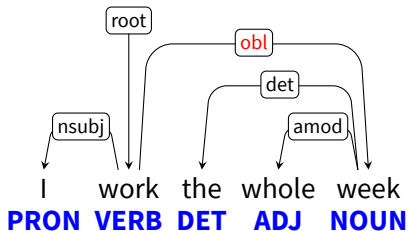


Object Control in English



Some Problems

- Some temporal adjuncts are bare noun phrases
 - ▶ *I work the whole week.*
 - ▶ *I work every Friday.*



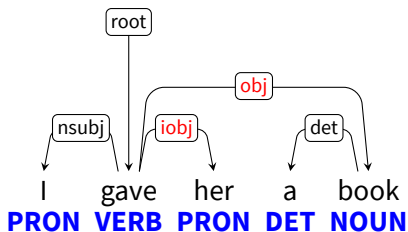
- It cannot passivize (not a strict diagnostic in English)
- Word order is less restricted (will not help in other languages)

Intransitive Predicates

- Just one core argument
 - ▶ We already “know” how to find out if there are two
- \Rightarrow function **S**
 - ▶ Regardless of semantic role:
 - ★ *John runs.*
 - ★ *John sleeps.*
 - ★ *John falls.*
- Then define:
 - ▶ function **S** \Rightarrow **nsubj**

Ditransitive Predicates

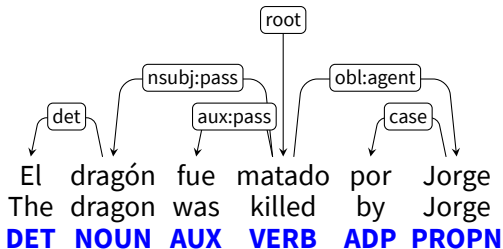
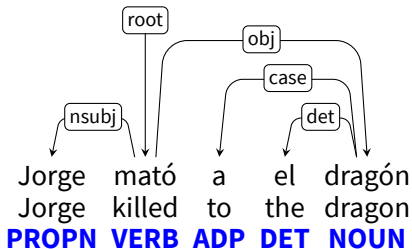
- Three core arguments
- Is one of them “least core”? ⇒ **iobj**



- Passivization:
 - ▶ *She* was given a book by me.
 - ▶ *?A book* was given her by me.

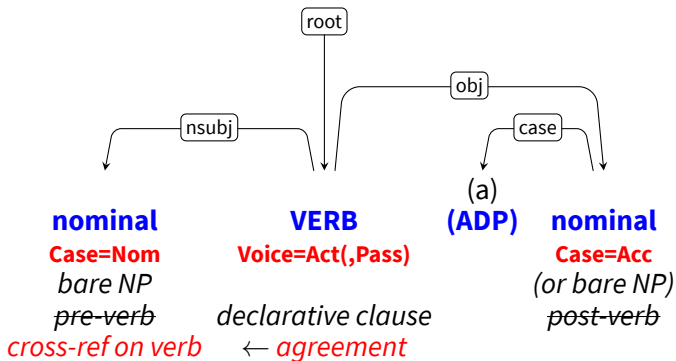


Spanish



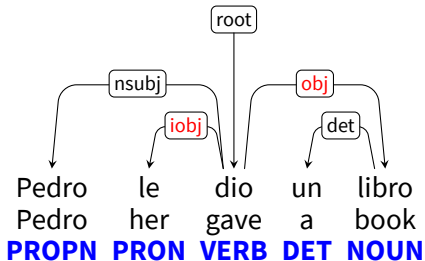
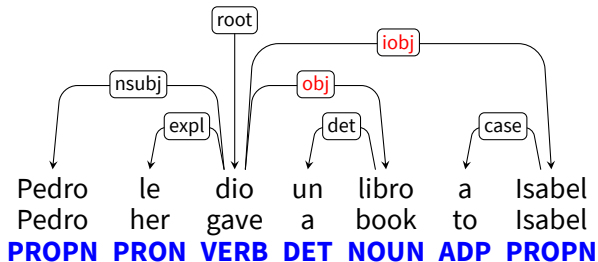


Spanish Transitive Clauses



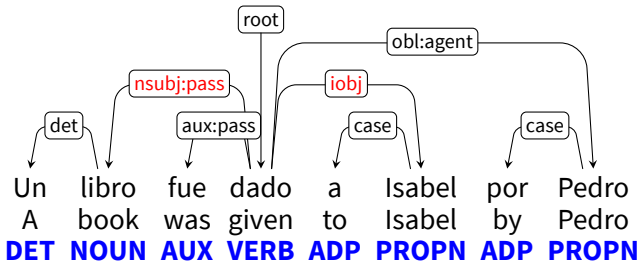
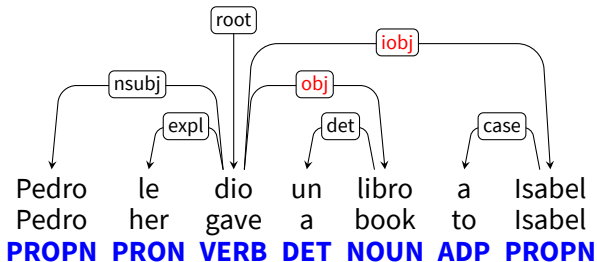


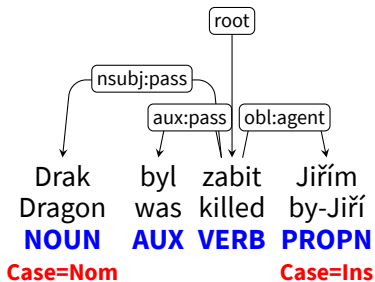
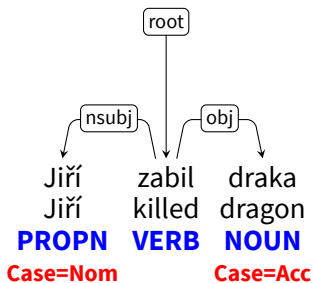
Spanish Ditransitive Clauses





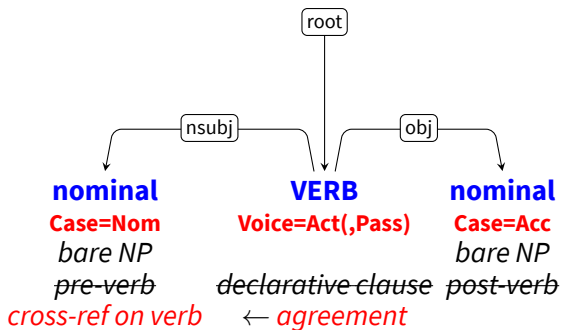
Spanish Ditransitive Clauses





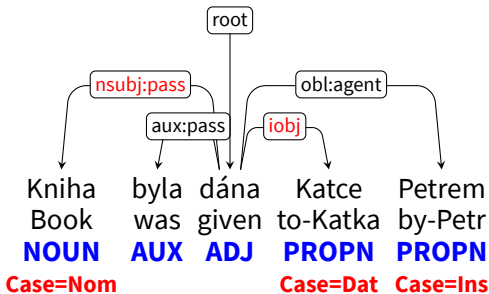
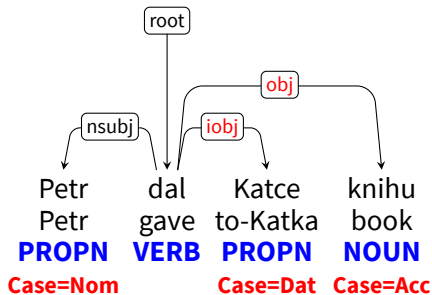


Czech Transitive Clauses



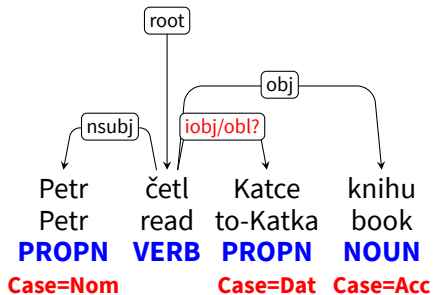


Czech Ditransitive Clauses



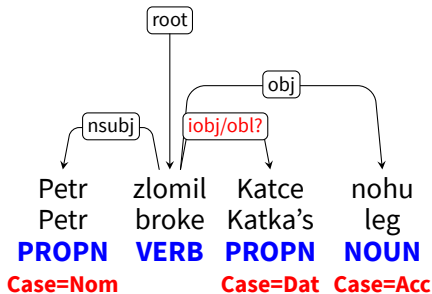
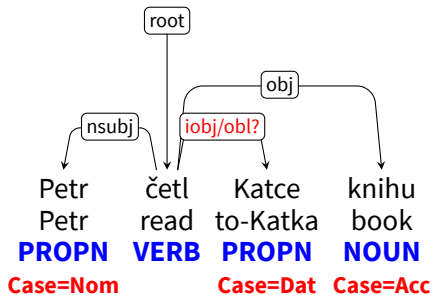


Dative: Recipient vs. Beneficiary



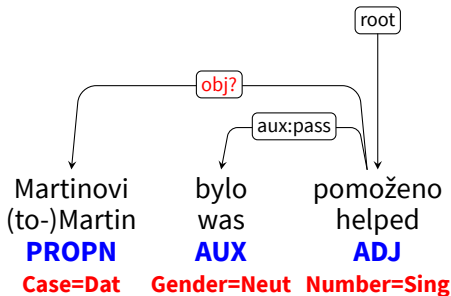
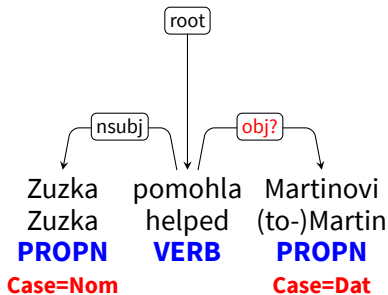


Dative: Recipient vs. Beneficiary



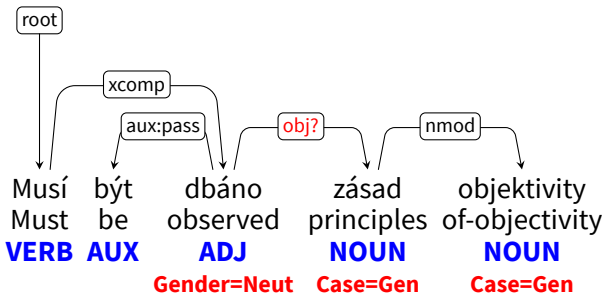
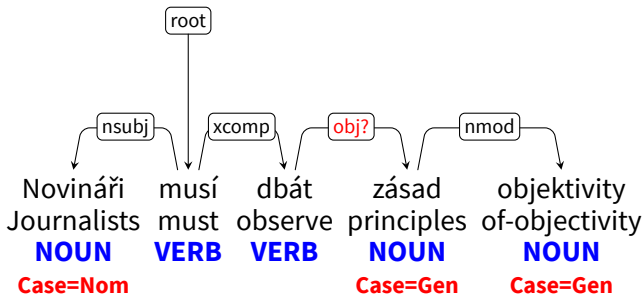


Monotransitive with Dative?



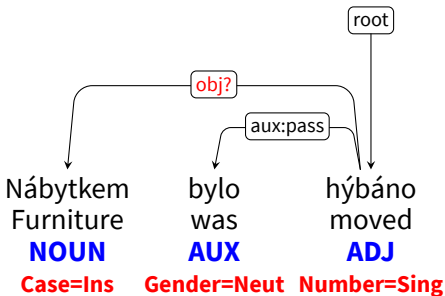
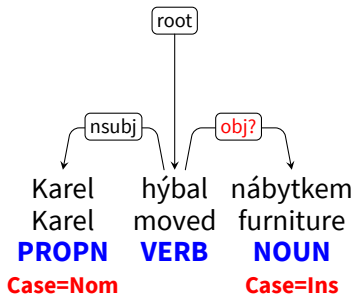


Monotransitive with Genitive?



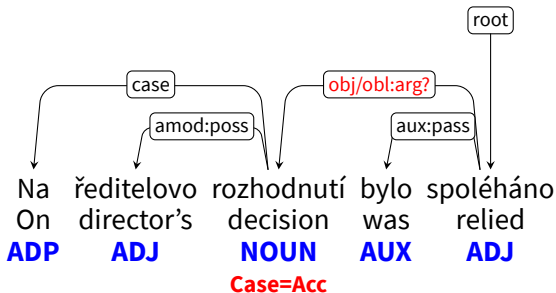
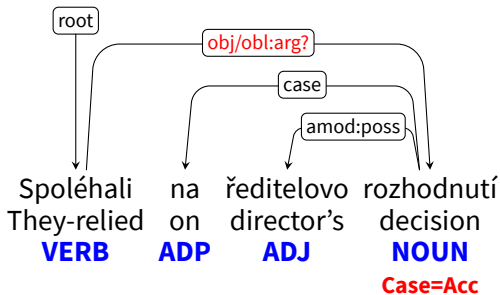


Monotransitive with Instrumental?





Monotransitive with Preposition?



Tentative Summary

- There is a core-oblique scale:
- **Nom** > **Acc** > **Gen,Dat** > **Ins** > **preposition**
- Where is the borderline?



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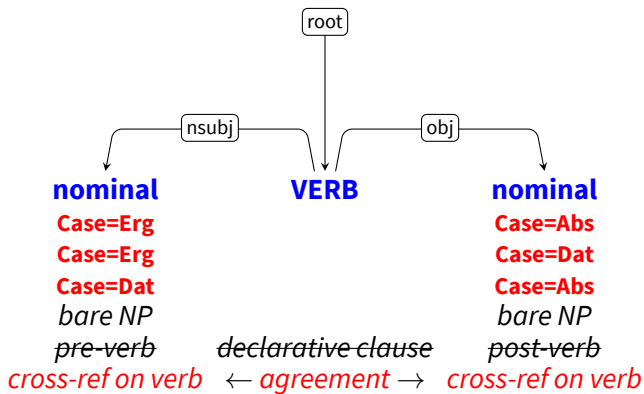


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- But perhaps we should go even further?
 - ▶ **Nom, Acc** > **Gen, Dat, Ins, ADP + adjuncts**

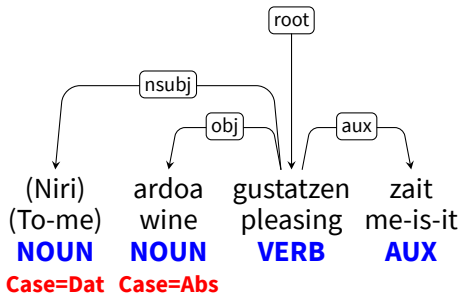
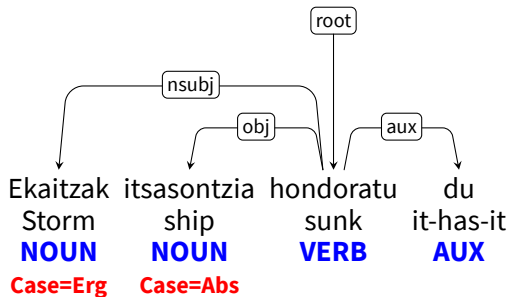


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- But perhaps we should go even further?
 - ▶ **Nom, Acc** > **Gen, Dat, Ins, ADP + adjuncts**
 - ▶ ⇒ No ditransitives in Czech!

Basque Transitive Clauses

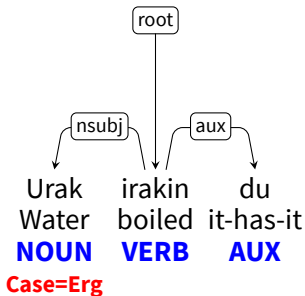
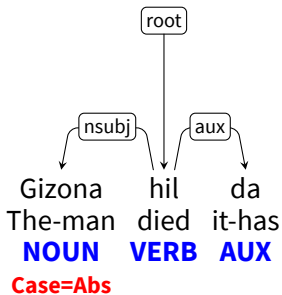


Basque Transitive Clauses



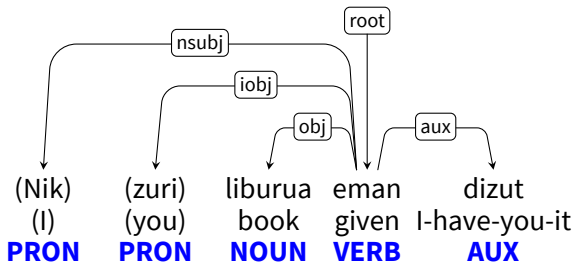


Basque Intransitive Clauses

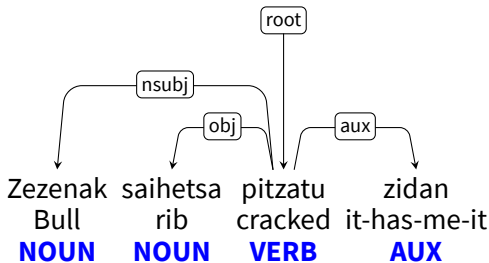




Basque Ditransitive Clauses



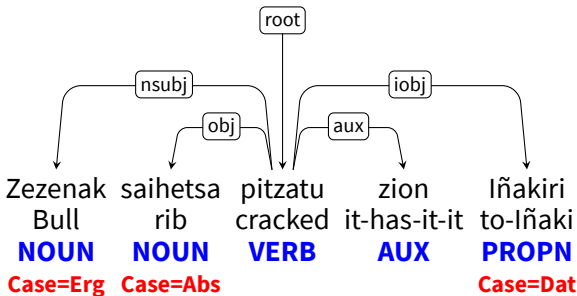
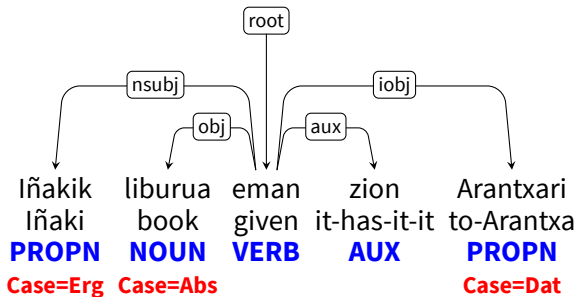
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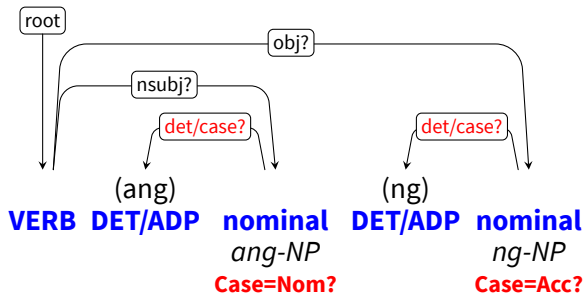
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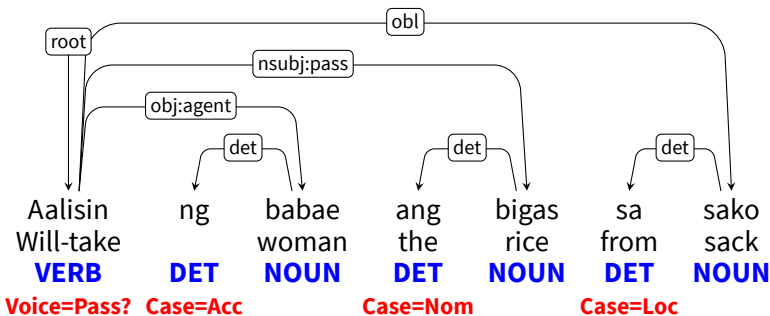
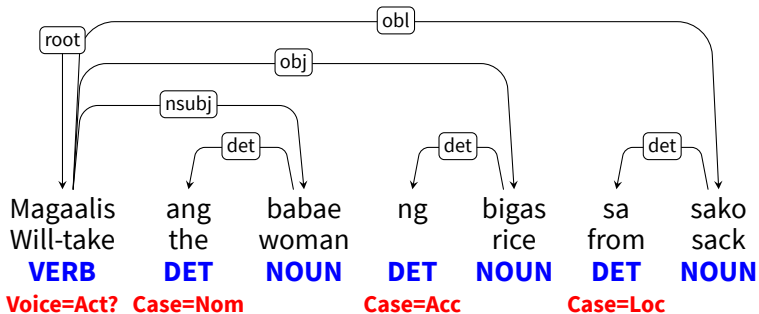


Basque Ditransitive Clauses

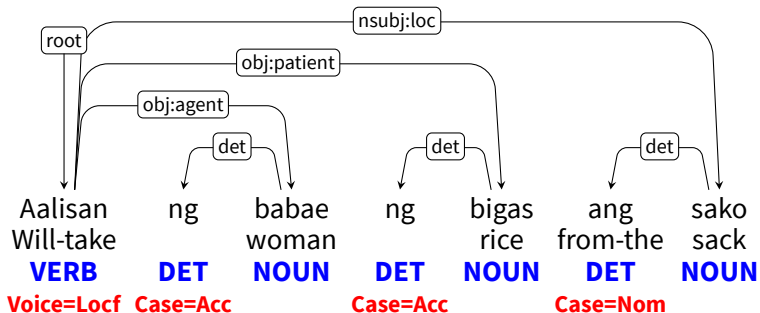


Tagalog Transitive Clauses

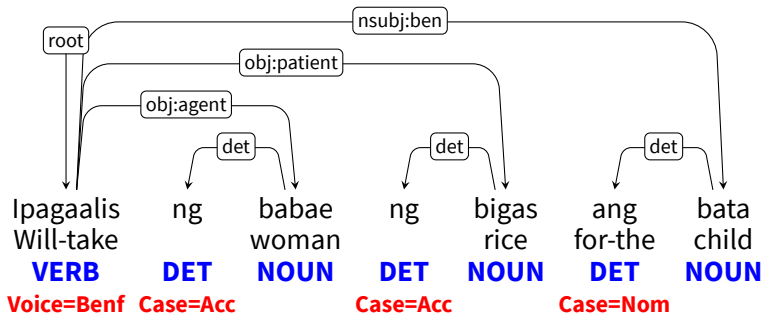




Tagalog Locative Voice \Rightarrow Ditransitive!

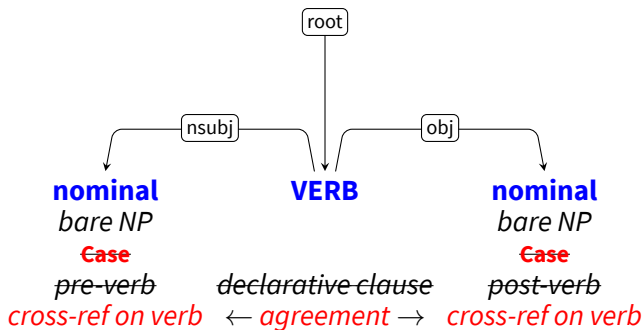


Tagalog Benefactive Voice \Rightarrow Ditransitive!



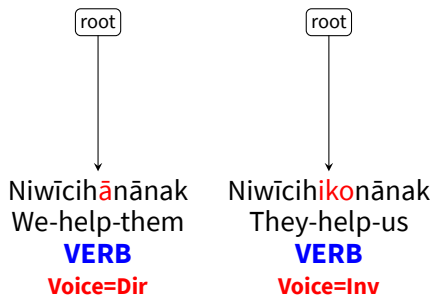


Plains Cree Transitive Clauses





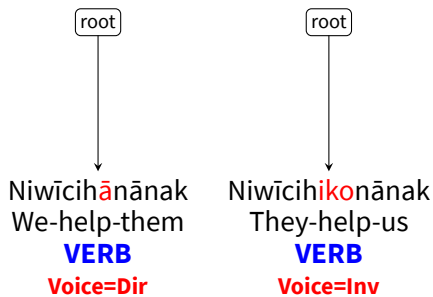
Direct-Inverse Voice in Plains Cree



Animacy hierarchy: 1st person > 3rd person



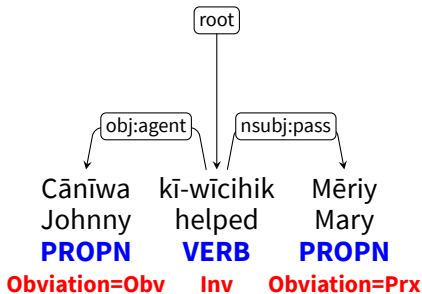
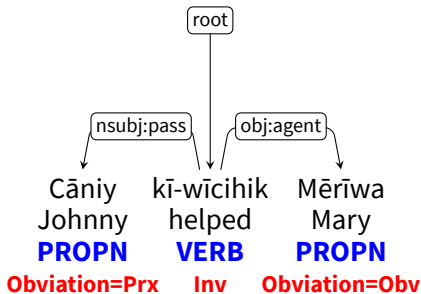
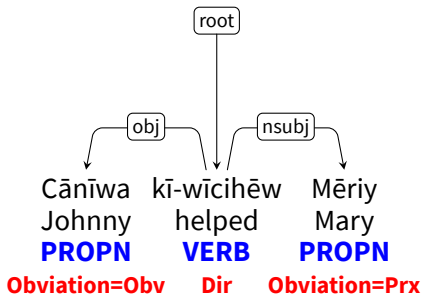
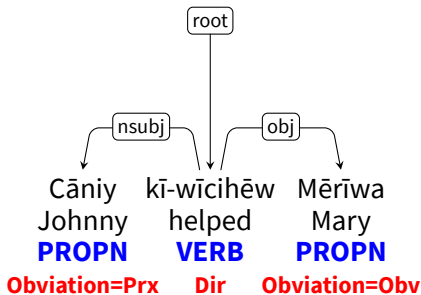
Direct-Inverse Voice in Plains Cree



Animacy hierarchy: 1st person > 3rd person
Should we set **nsubj** > **obj**?

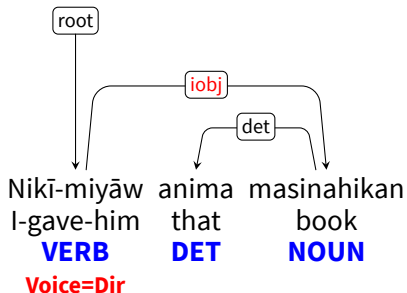


Direct-Inverse Voice in Plains Cree





Plains Cree Ditransitive Clauses



The **theme** (not the recipient) is indirect object because it is not cross-referenced on the verb (it is **inanimate**, while the verb references an animate object).

Wrapping Up



Wrapping Up

- UD has had a great start

Wrapping Up

- UD has had a great start
- It is a compromise

Wrapping Up

- UD has had a great start
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- It's being built “bottom-up” –
 - ▶ Every new language brings new issues to be solved...

Wrapping Up

- UD has had a great start
- It is a compromise
- It's being built “bottom-up” –
 - ▶ Every new language brings new issues to be solved...
- Get involved. It's fun!

Thank You, Community!

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Thank You! Questions?

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(<http://universaldependencies.org/>)
- PML-TQ
(<http://lindat.mff.cuni.cz/services/pmltq/>)
- Turku dep search / SETS
(http://bionlp-www.utu.fi/dep_search/)
- UDPipe parsing demo
(<http://lindat.mff.cuni.cz/services/udpipe/>)