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Faculty of Philosophy
General Linguistics

Syntax & Semantics WiSe 2022/2023

Lecture 4: Dependency Grammar I (DG)

08/11/2022, Christian Bentz

Overview

Section 1: Recap of Lecture 3

Definition

"The **head** of a constituent/phrase is the element which determines the *most important properties* of the constituent/phrase. At the same time, the head also determines the *composition of the phrase*. That is, the head requires certain other elements to be present in the phrase."

Müller (2019). Grammatical theory, p. 28.

Example:

Ayacucho Quechua (quy, Quechuan)

(1) wayna runa mikuy-ta yanu-n
young man.NOM.SG food-ACC cook-PRS.3SG
"The young man cooks the food."

Determining the Head

The head of a phrase is the element that provides the "grammatical scaffolding":

(2) _ _-ta **yanu-n**
_.NOM.SG _-ACC cook-PRS.3SG
"_ cooks _."

Imagine we only hear/read "... yanun", and the rest of the information of the sentence is lost. We can still determine from this partial information that there has to be a *cooker* and a *cooked*,[1] that the cooker has to be *third person singular*, and that the cooked has to be marked for *accusative case*. In a sense, from *yanun* we can predict the occurrence of *-ta*.

[1] I make the assumption here that *yanun* is not used with a single participant like in "he cooks" in English.

Definition

"The combination of a head with another constituent is called a **projection of the head**. A projection which contains all the necessary parts to create a well-formed phrase of that type is a **maximal projection**. A sentence is the maximal projection of a finite verb."

Müller (2019). Grammatical theory, p. 29.

Arguments

The head of a phrase requires certain other elements to be present in order to form a *maximal projection*. These *strictly required* elements are called **arguments** of the head (sometimes also called *dependents* of the head, though the term dependent normaly also includes adjuncts).

Müller (2019). Grammatical theory, p. 30-34.

(3) _ _-ta **yanu-n**
_.NOM.SG _-ACC cook-PRS.3SG
“_ cooks _.”

In our Ayacucho Quechua example from above, the finite verb is the head, and it requires *at least* two further elements in the empty slots of the grammatical “scaffolding” (represented by underscores) in order to become a maximal projection: e.g. *wayna runa* and *mikuy-ta*.

Adjuncts

Beyond the obligatory arguments, there are also *optional* elements that might be used to further modify the utterance. These are called **adjuncts**. Typical adjuncts are adjectives, adverbials and prepositional-phrases.[2]

Müller (2019). Grammatical theory, p. 30-34.

(4) (wasi-pi) _ _-ta **yanu-n**
house-LOC _.NOM.SG _-ACC cook-PRS.3SG
"_ cooks _ (in the house)."

For example, *wasi-pi* "in the house" can be added to the sentence to further specify where the cooking happens, but it is not required to form a maximal projection of the head-verb *yanu-n*.

[2] Müller 2019, p.34) points out how in some cases these are also obligatory, e.g. with the German reflexive verb *sich befinden* "to be located", which requires a prepositional phrase, e.g. *in der Stadt* "in town" to form a grammatical sentence.

Valence according to Tesnière

> *"Nous avons vu qu'il y avait de verbes sans actant, des verbes à un actant, des verbes à deux actants et des verbes à trois actants."*
>
> *Tesnière (1959). Éléments de syntaxe structurale, p. 238.*

Verb	V	V	V	V
Arguments	_	A	A A	A A A
Sentence type:	impersonal sentence	intransitive sentence	transitive sentence	ditransitive sentence
Valency:	avalent (0)	monovalent (1), one-place predicate	bivalent (2), two-place predicate	trivalent (3), three-place predicate

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Verb	pleut	dort	frappe	donne
Arguments	_ (il)	Alfred	Alfred Bernard	Alfred le livre Charles
Example:	*il pleut* "it rains"	*Alfred dort* "Alfred sleeps"	*Alfred frappe Bernard* "Alfred hits Bernard"	*Aflred donne le livre à Charles* "Alfred gives the book to Charles"

Passivization Test

Alfred hits Bernard $\rightarrow$ **passivization** $\rightarrow$ *Bernard was hit (by Alfred)*

Conclusion: *hit* requires two arguments, and is a genuinely *transitive* verb.

Alfred weighs seventy kilograms $\rightarrow$ **passivization** $\rightarrow$ **Seventy kilograms were weighed (by Alfred)*

Conclusion: *weigh* requires two arguments (*Alfred weighs), but is not a *transitive* verb according to the passivization test,
i.e. *two-place* predicate $\neq$ *transitive*.

Subject and Object

"In some theories, grammatical functions such as **subject** and **object** form part of the formal description of language (see Chapter 7 on Lexical Functional Grammar, for example). [...] it is by no means a trivial matter to arrive at a definition of the word subject which can be used cross-linguistically."

Müller (2019). Grammatical theory, p. 35.

Valence and Grammatical Functions

"If we can be clear about what we want to view as a subject, then the definition of *object* is no longer difficult: objects are all other arguments whose form is directly determined by a given head. [...] it is commonplace to talk of *direct objects* and *indirect objects*. The direct object gets its name from the fact that – unlike the indirect object – the referent of a direct object is directly affected by the action denoted by the verb."

Müller (2019), p. 38.

Verb	V	V	V	V
Arguments	_	A	A A	A A A
Gramm. Functions:	None or SUBJ	SUBJ	SUBJ, OBJ	SUBJ, DOBJ, IOBJ
Valency:	avalent (0)	monovalent (1)	bivalent (2)	trivalent (3)

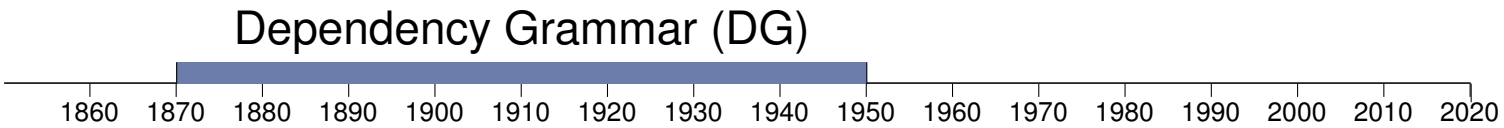
Notation: DOBJ (direct object), IOBJ (indirect object)

Section 2: Historical Notes

Historical Perspective

"Dependency Grammar (DG) is the oldest framework described in this book. According to Hudson (2019), the basic assumptions made today in Dependency Grammar were already present in the work of the Hungarian Sámuel Brassai in 1873 (see Imrényi 2013), the Russian Aleksej Dmitrievsky in 1877 and the German Franz Kern (1884). The most influential version of DG was developed by the French linguist Lucien Tesnière (1893–1954)."

Müller (2019). Grammatical theory, p. 365.



Note: The chronology bars indicate the rough time period where the first and foundational works relating to a framework were published. All of the theories discussed here still have repercussions also in current syntactic research.

Some Notes about Dependency Grammar

- It is more wide-spread in Central Europe and (particularly Germany) than in the English-speaking world. Maybe due to late translation of the work by Tesniére into English?
- It is often preferred over constiutent-based analyses by researchers working on languages with highly flexible word order (see next slide), since it deals with dependency relations rather than linearization of constituents.
- It is frequently also the first choice for computational analyses, since dependencies are relatively easy to handle, and many dependency annotated corpora exist (e.g. Universal Dependencies in currently more than 100 languages).[3]

[3] https://universaldependencies.org/

Constituency and Dependencies

"The syntactic structure here [example of Thalanyji case-tagging below] is most elegantly represented via a dependency formalism (supplemented with appropriate morphological features) rather than a constituency one."

Evans & Levinson (2009). The myth of language universals, p. 441.

(5) Kupuju-lu **kaparla-nha** yanga-lkin **wartirra-ku-nha**
child-ERG dog-ACC chase-PRES woman-DAT-ACC
"The child chases the woman's dog."

Analyzed Languages[4]

Danish, English, **Esperanto**, **Estonian**, Faroese, **Finnish**, French, German, Irish, **Japanese**, Latin, **Mandarin Chinese**, Norwegian, Old Icelandic, Portuguese, Russian, Spanish, **Swahili**

According to Müller (2019). Grammatical theory, p. 367.

Language Families[5]

Artificial, Atlantic-Congo (Bantu), Indo-European, Japonic, Sino-Tibetan, Uralic

[4] The non-Indo-European ones are marked in bold face. Note that these are the languages named by Müller. If we count the languages of the Universal Dependencies (UD) project as well, we have many more.

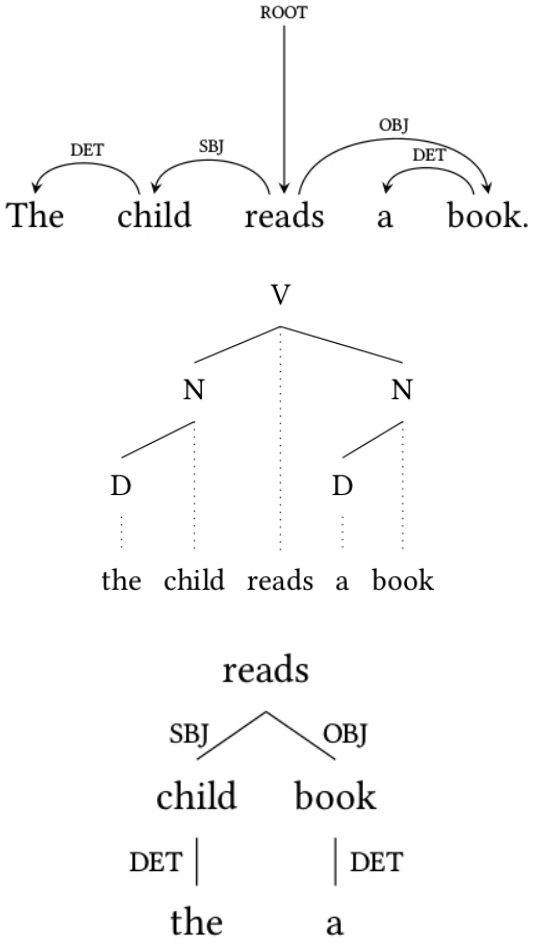
[5] According to Glottolog 4.0, https://glottolog.org/.

Section 3: Notational Conventions

The Representational Format

There are (at least) *three different ways* of illustrating a dependency grammar analysis of a given phrase/sentence (see Müller 2019, p. 268-269). We here generally follow the approach by Hudson (2007), namely, illustrating dependencies by curved arrows from the head to the dependent.

Note: There is an online tool at www.spacy.io that automatically generates lemmas, POS, etc. for sentences of a set of languages (English, German, French, etc.). This can also be used to generate dependency graphs.



Adopted from Müller (2019). Grammatical theory, p. 369.

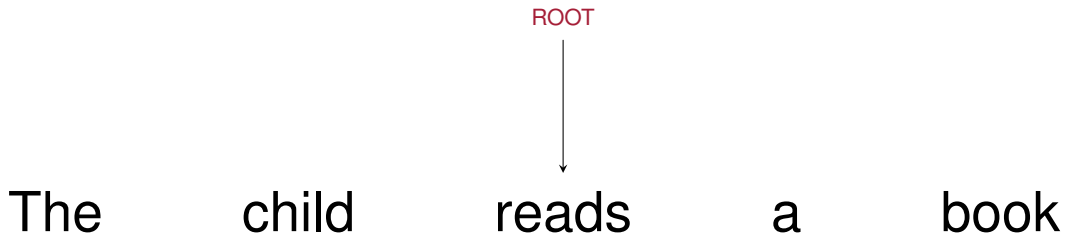
Dependency Relations

We here generally follow the dependency relations as worked out in Müller (2019). They are based on the distinction between heads and dependents as discussed in the lecture on basics. In some cases, however, the Universal Dependencies (UD) coding is used, for instance, if the respective construction is not discussed in Müller (2019).

Example	Head	Phrase Type
she **knows** the man	knows (V)	VP
he **is smart**	smart (A), is (V)	AP, VP
smart **woman**	woman (N)	NP
the **woman**	woman (N)	NP
the man's **cat**	cat (N)	NP
very **beautiful**	beautiful (A)	AP
very **quickly**	quickly (Adv)	AdvP
in the library	in (P)	PP

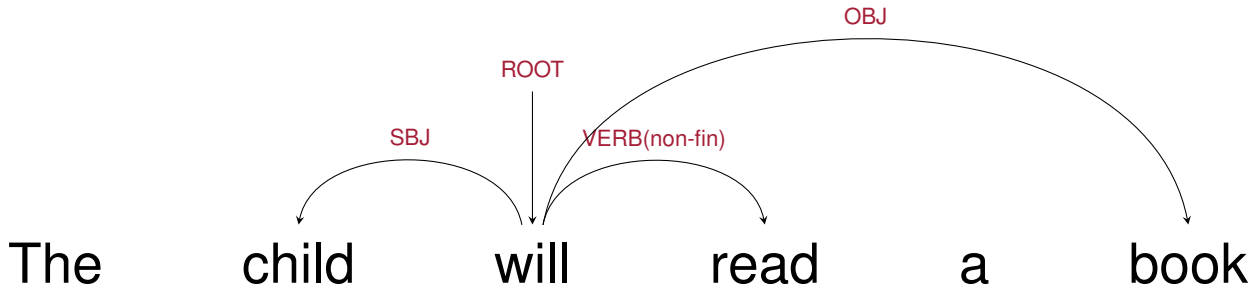
Notation: The Head/Root

The **root** of a sentence is the overall **head** of the maximal projection (i.e. a verb with all arguments filled). The root is indicated by a downwards arrow to the lexical item that represents it.



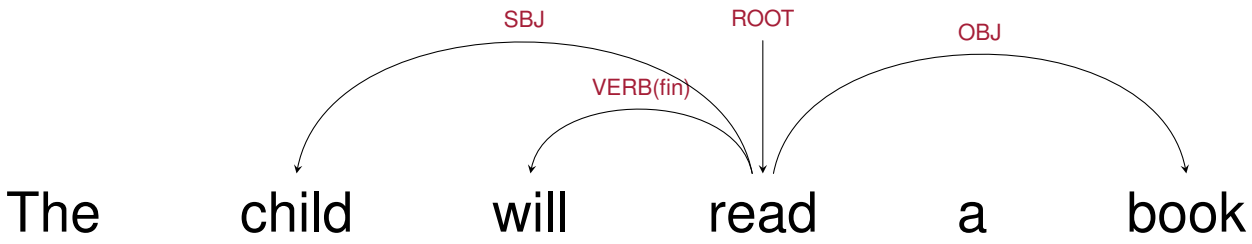
Notation: Auxiliary Verbs

When an **auxiliary verb** is used in a sentence, it is the finite verb (inflects for person and number). This is then considered the **root** of the sentence. The second verb form is then a non-finite verb (e.g. participle or infinitive), which depends on the auxiliary verb. Also, note that the arguments of the sentence (SBJ and OBJ) now depend on the auxiliary verb, rather than the non-finite verb. This is because agreement with the arguments concerns the inflected auxiliary rather than the non-finite verb form.



Possible Alternative

From a valency perspective it could be argued that the non-finite verb form determines the valency of the verb complex, rather than the auxiliary, but here morphosyntax is given precedence over valency. For a discussion see also Müller (2019), p. 594-595.[6]

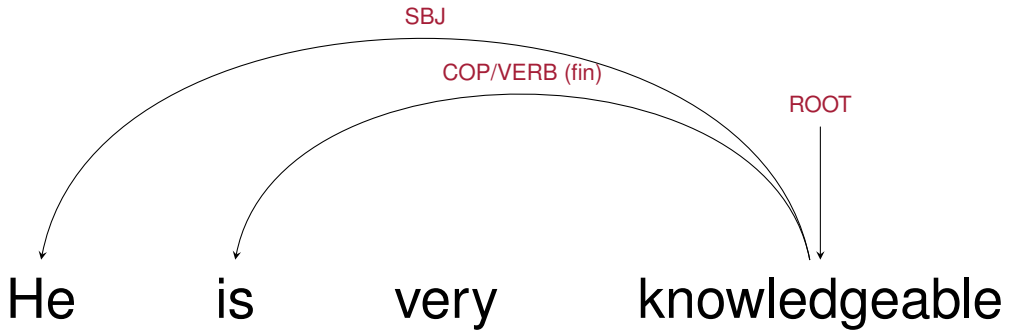


Note: In the course of the lecture, we follow the first analysis with the auxiliary verb as root.

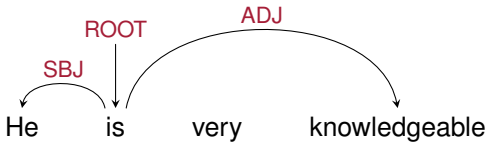
[6] In the Universal Dependencies Corpora of English, the auxiliary is considered to depend on the non-finite verb form.

Notation: Copular Clauses

For **copular clauses** we here follow the analysis which assumes that the contentful predicate is not the copula, but rather an adjective/noun.

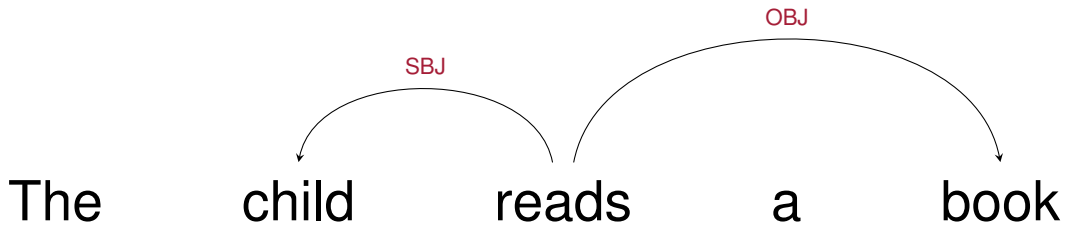


Note: Remember from the basics lecture that this is a potentially controversial analysis, but it follows the Universal Dependencies for English (en_ewt-ud-dev.conllu, UD version 2.6). The possible alternative would be:



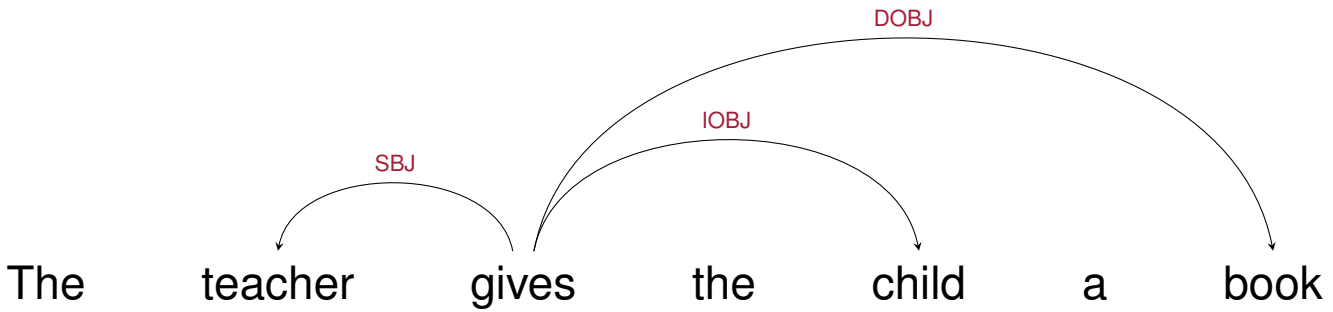
Notation: Subject and Object

Dependents are the arguments of the head that have to be filled, as well as further adjuncts. In the example below, these are the **subject** and **object** of the transitive clause. The arrow runs from the head to the respective dependent. The label on the arrow gives the type of argument that is filled by the dependent.



Notation: Direct and Indirect Object

In the case of trivalent verbs, we typically have a **direct object** and an **indirect object**. Prototypically the direct object is more directly affected by the action represented by the verb (Müller 2019, p. 38).

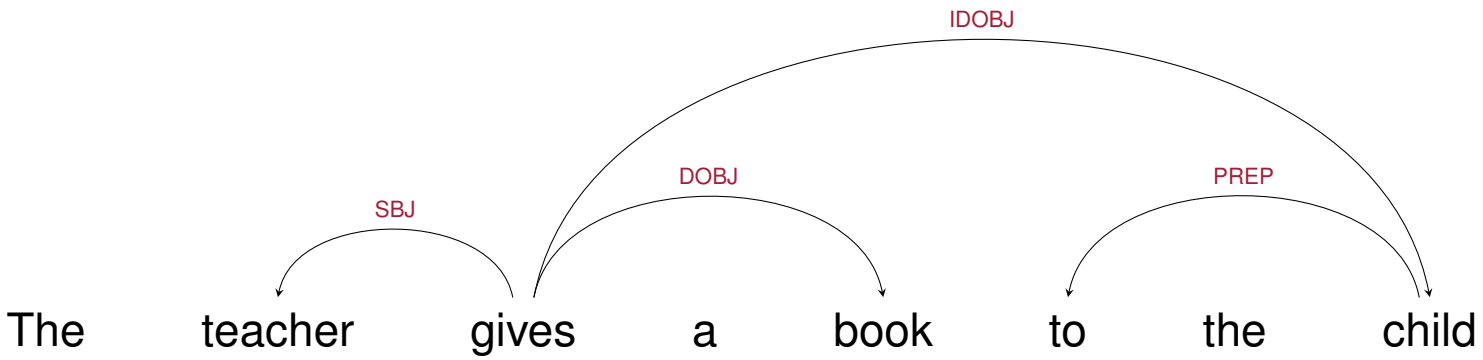


Note: In English, it is considered ungrammatical to put the direct object before the indirect object (Hudson, 2007, p. 134):

* The teacher gives a book the child.

Problem: Dative Alternation

In English, speakers can decide between using a construction with or without a preposition for ditransitive (trivalent) verbs. This is the so-called **dative alternation**. We have to decide whether we want to put a dependency between the verb and the preposition or between the verb and the indirect object.



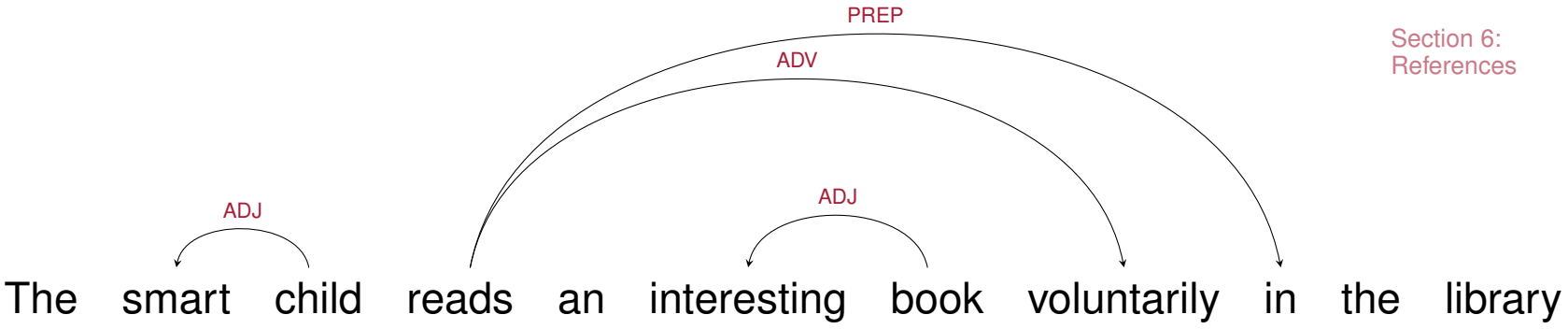
Note: In this lecture series, the analysis with **the indirect object depending on the verb** (and the preposition then depending on the indirect object) is preferred, though a reference for this analysis in the dependency grammar literature is missing. We here follow the English Corpora of Universal Dependencies.

Notation: Determiners

Determiners are here considered to *depend on the noun-(phrase)* they modify, rather than the other way around. That is, the dependency arrow runs from the noun(-phrase) to the determiner.

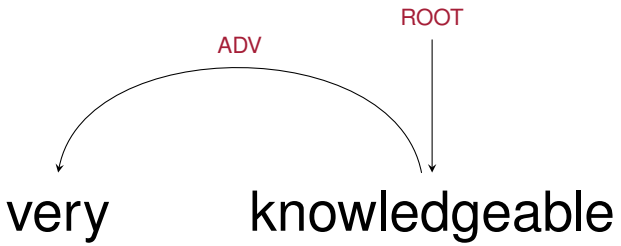
Notation: Adjuncts

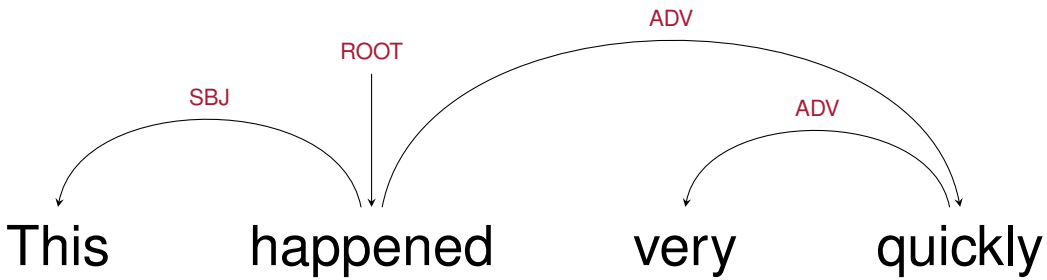
Remember from Lecture 3 that **adjuncts** are typically *adjectives* (ADJ), *adverbs* (ADV) or *prepositional phrases* (PREP). They depend on the respective head of the phrase. Below is a modified version of the example by Müller to illustrate this.



Notation: Adjuncts (Adverbs)

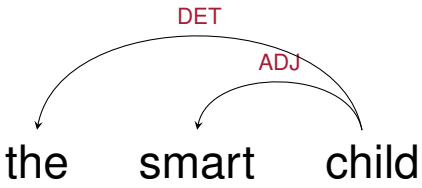
For adjuncts, i.e. **modifiers** of adjectives or verbs, the POS-tag ADV is used (this also follows UD). In theory, we could also distinguish between adverbial modifiers and adjectival modifiers.





Notation: Adjuncts (Adjectives)

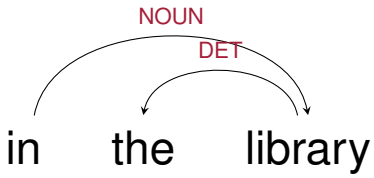
Adjectives depend on nouns or noun-phrases. If we deal with a noun-phrase that also contains a determiner, than both the determiner and the adjective depend on the noun (see example in Müller (2019), p. 396).[7]



[7] There are alternative analyses where the noun depends on the adjective, and the determiner on the noun. However, since we have defined before that adjectives depend on nouns, this option is ruled out here.

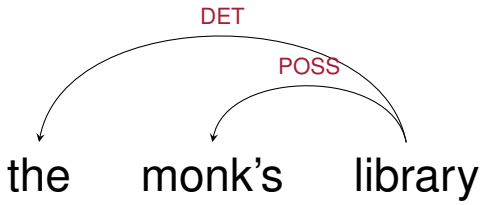
Notation: Adjuncts (Prepositional Phrases)

In a prepositional phrase, the noun depends on the preposition, and the other elements, e.g. adjectives and determiners, depend on the noun (see also example in Müller (2019), p. 397).



Notation: Adjuncts (Possessor Phrases)

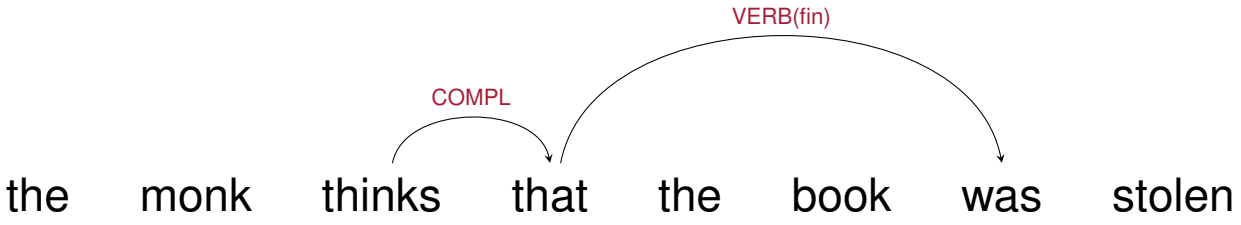
In **possessor phrases**, the possessee noun is the head of the phrase, and the possessor hence depends on it. We here mark this with an arrow labeled with POSS.



Note: For simplicity, we here assume that the genitive *'s* is an inflection rather than a possessive clitic.

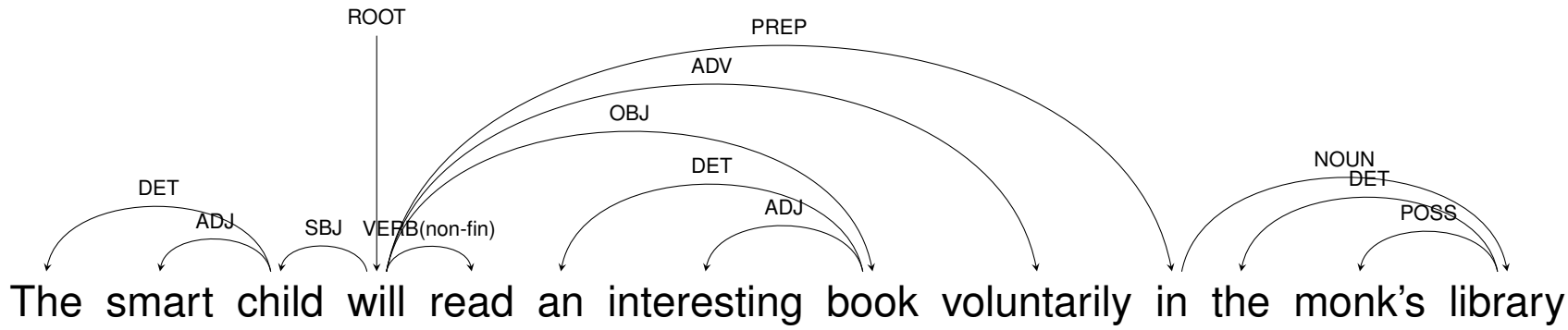
Notation: Complementizer Phrases

In **complementizer phrases**, the complementizer depends on the head-verb of the main clause, and is itself seen as the head of the subordinate clause (similar to a prepositional phrase).



Note: This is in line with the analysis of Müller (2019, p. 380) who gives the German sentence *Wen glaubst du, dass ich gesehen habe?* as an example. However, it contradicts the analysis in UD, where the complementizer rather depends on the verb of the subordinate clause (i.e. *stolen*).

Summary: The Full Example



Notation Glossary

ADJ: adjective
ADV: adverb
COMPL: complementizer (i.e. *that*)
COP: copular verb
DET: determiner[1]
DOBJ: direct object[2]
IOBJ: indirect object[2]
NOUN: noun[3]
OBJ: object
PART: particle
PREP: preposition
POSS: possessor noun
ROOT: head[4]
SBJ: subject
VERB(non-fin): non-finite (infinitive) verb[5]
VERB(fin): finite verb [6]

[1]Definite and indefinite.
[2]Applicable only in ditransitive sentences.
[3]For simplicity, we also include pronouns and proper names here.
[4]Head of the overall sentence.
[5]Applicable if there is another, finite verb form in the sentence, i.e. an auxiliary.
[6]Required in complementizer-constructions.

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Section 4: Syntactic Phenomena

A Note on "Word Order"

When researchers talk about **word order** (e.g. the order of Subject, Object, and Verb), it is important to remember that this could either refer to **particular sentences of a language** or to the respective **word order of the language as a whole** (however that is defined and assessed).

> *"Some languages can be assigned straightforwardly to one of the six types, because all orders other than one are either ungrammatical or used relatively infrequently and only in special pragmatic contexts. Such languages can be said to have **rigid order**. There are many other languages in which all six orders are grammatical. Such languages can be said to have **flexible order** [...] In some languages with flexible order, there is one order which is most common and which can be described as the **dominant order**."*

Dryer (2013) at https://wals.info/chapter/81.

Verb position

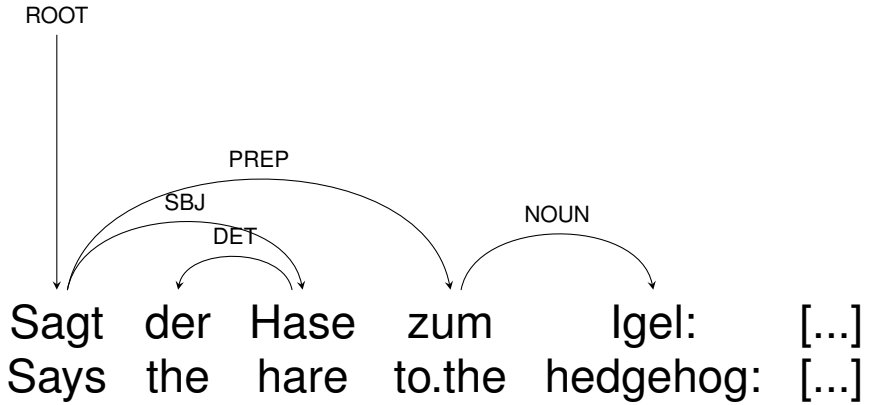
"In many Dependency Grammar publications on German, **linearization issues** are not dealt with and authors just focus on the dependency relations. The dependency relations between a verb and its arguments are basically the same in verb-initial and verb-final sentences [...] only the position of the verb is different, but the dependency relations are the same, as it should be."

Müller (2019). Grammatical theory, p. 375.

Verb position (Initial)

In **head-initial sentences**, the dependencies – at least of the arguments – project *forwards* (i.e. from left to right).

German (deu, Indo-European)

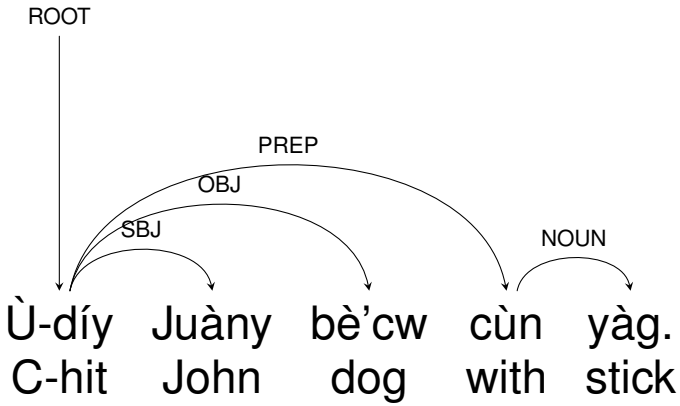


“The hare says to the hedgehog: [...]”

Verb position (Initial)

There are also **head-initial languages**, i.e. it is argued for these that transitive sentences generally start with a verb, and the dependencies project *forwards* (i.e. from left to right).

Zapotec (???, Otomanguean)[8]



"John hit the dog with the stick."

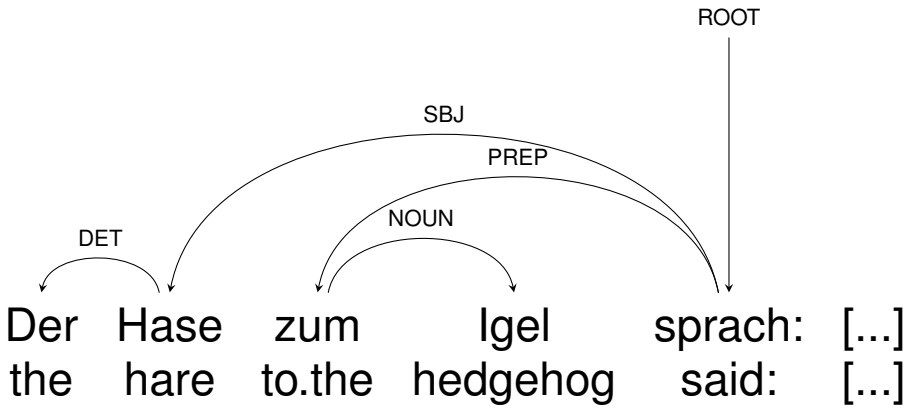
Adopted from Hudson (2007), p. 174.

[8]There are many different "Zapotec" languages, all with their own ISO codes. This is an example of where the language information is highly underspecified.

Verb position (Final)

In **head-final sentences**, the dependencies – at least of the arguments – project *backwards* (i.e. from right to left).

German (deu, Indo-European)

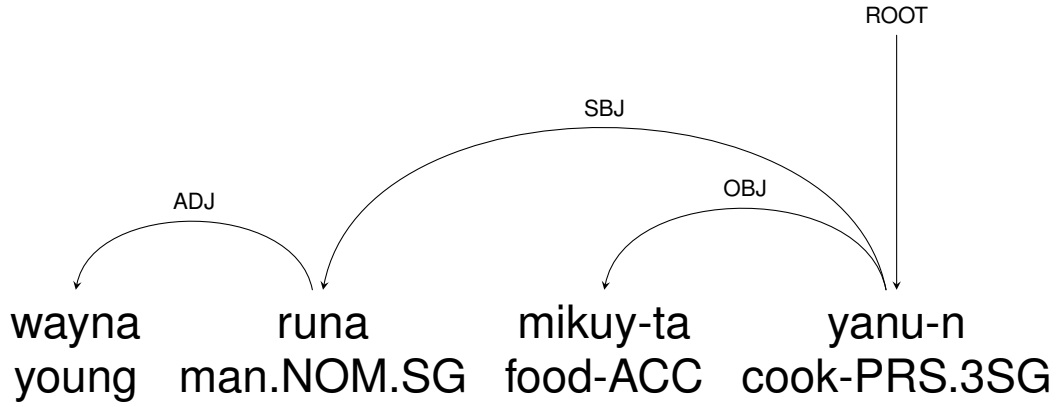


“The hare said to the hedgehog.”

Verb position (Final)

In **head-final languages**, the dependencies – at least of the arguments – are argued to generally project *backwards* (i.e. from right to left).

Ayacucho Quechua (quy, Quechuan)

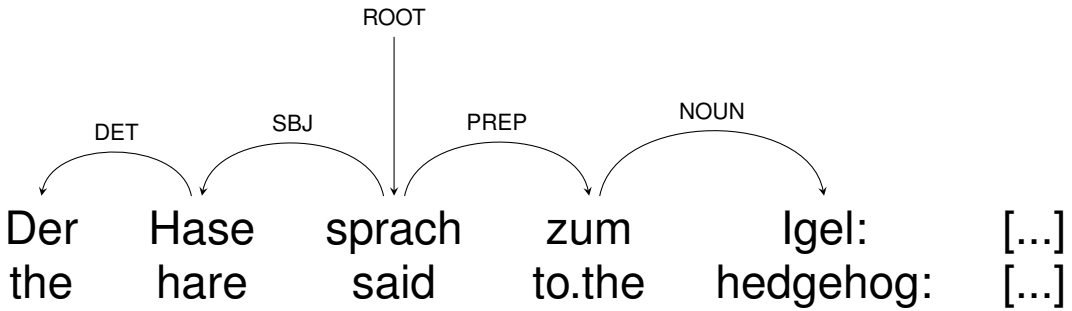


“The young man cooks the food.”

Verb position (Medial)

In **head-medial sentences**, the dependencies project *in both directions*.

German (deu, Indo-European)

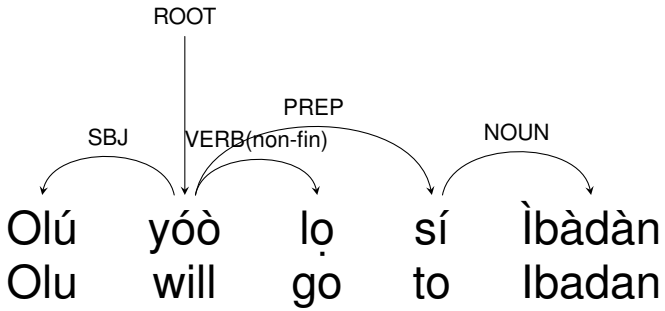


“The hare said to the hedgehog: [...]”

Verb position (Medial)

In **head-medial** languages, the dependencies – at least of the arguments – project *in both directions*.

Yoruba (yor, Atlantic-Congo)



“Olu will go to Ibadan.”

Adopted from Adesola (2006), p. 7.

Section 5: Outlook

Outlook: Dependency Grammar II

- Syntactic Phenomena Modelled in DG
  - Linearization
  - Coordination
  - The Passive
  - Crossing Dependencies
- Advantages and Disadvantages of the DG framework
- Recent Research
  - The Word Order Permuation Ring
  - Dependency-Length Minimization
  - Universal Dependencies

Section 6: References

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Thank You.

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