Multiword Expressions in Czech: Typology and Lexicon

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Outline of the talk

Two main parts:

- **typology** of multiword expressions in Czech (V. Petkevič)
- presentation of the **lexical database** (P. Vondřička)

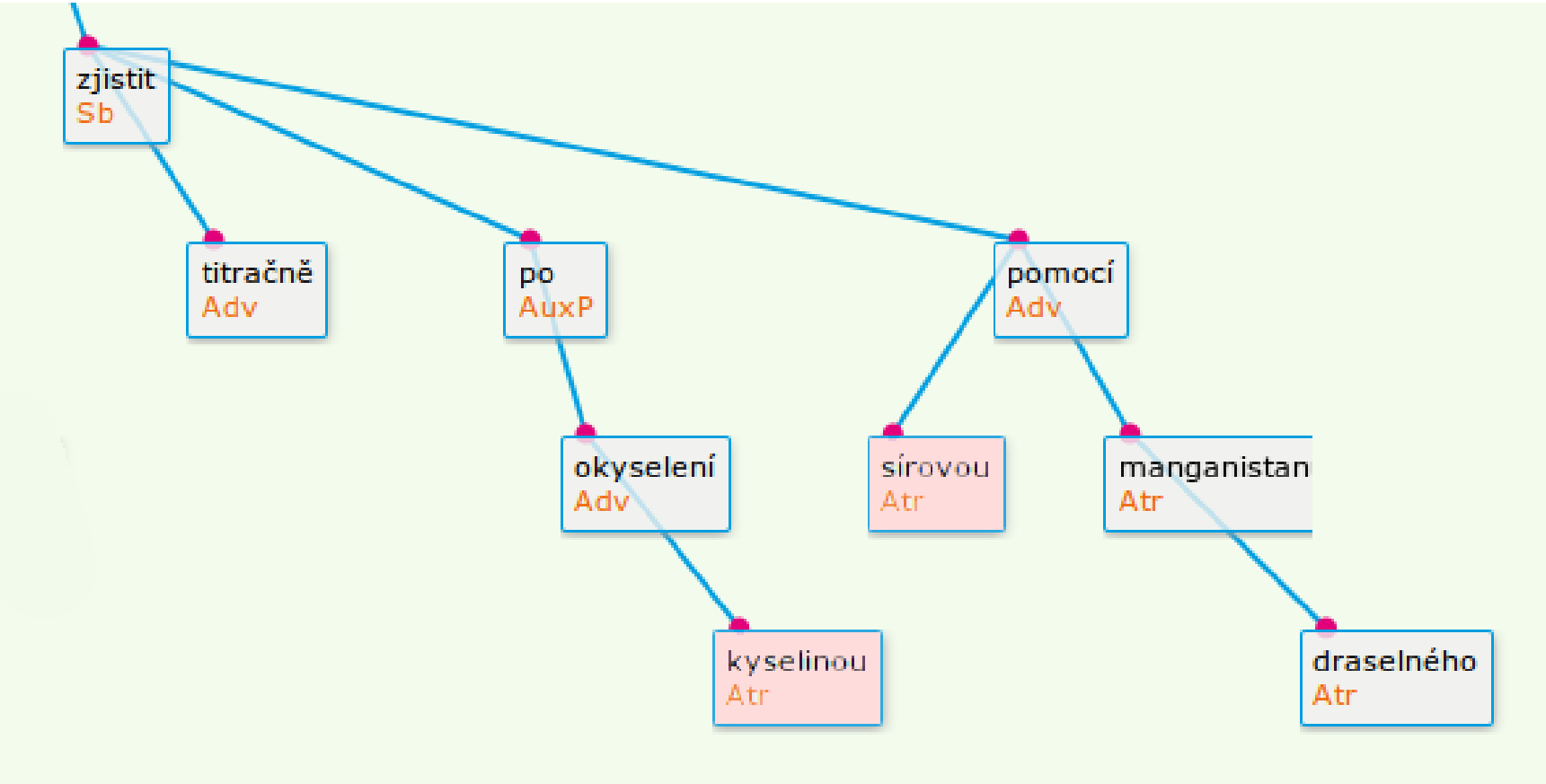
Need of a MWE lexicon for NLP tools (and their users)

MWEs play a significant role in any language, often standing in contrast to its standard grammatical properties

Objectives:

- Description, typology and classification of MWEs
- Improvement of POS tagging, parsing, word sense disambiguation, semantic tagging
- Identification and search of MWEs in their standard form, but also of their **fragments** and **variants** – morphological, syntactic and lexical

Parsing



Correct structure: [kyselinou $_{Attr}$[sírovou]]
'sulphuric acid'

MWE tagging in a corpus

Hits: **49,887,368** | i.p.m. ⓘ: **10,845.92** (related to the whole "syn_v5") | ARF ⓘ: **30,247,135.4** | Result is shuffled 1 / 3,325,825

Line selection: simple | Attributes:

Hospodářské noviny	(NYSE) se na této burze ve	skutečnosti/ve_skutečnosti	odehraje méně než 35 procent .</s><s>Rychlost obchodů
Deníky Bohemia	čtvereční .</s><s>V těchto dnech mají plné ruce	práce/mít_plné_ruce_práce	ženy ze střediska údržby veřejné zeleně Technických služeb
Deníky Bohemia	potenciál .</s><s>* Zlato zMS jste získal na	podzim/na_podzim	a letošní MČR je na programu už za
Blesk	neštěstí došlo kvůli trhlině v tepelném štítu levého	křídla/levé_křídlo	, do níž se dostal horký vzduch vznikající
Reflex	Brychtovou - ze skla sochy , jaké nemají	obdoby/nemít_obdoby	.</s><s>- Připadá mi , že jste své
ForMen	se pěstuje Arabica Bourbon a Tipica .</s><s>Prvně	jmenovaná/prvně_jmenovaný	se pyšní nasládlou chutí , Tipica má mírně
Právo	, v lékárnách nepochodí .</s><s>" Máme na	skladě/mít_na_skladě	deset balení .</s><s>Češi ale o ně zájem
24 hodin	, že na dávky v hmotné nouzi nemá	nárok/mít_nárok	člověk , který nepracuje , ani není v
Marketing & Media	ohřívat) , nebo mrazené zboží .</s><s>I	když/i_když	na takové případy jsme už vybavení a nezaskočí
Mladá fronta DNES	chceme ukazovat ty sporty , které nejsou k	vidění/být_k_vidění	jinde .</s><s>V budoucnu bychom se chtěli podobat
Deníky Bohemia	1:4 (0:3) Zásadě se v poslední	době/v_poslední_době	herně daří a svěřenci trenéra Libora Lubase to
Mladá fronta DNES	koloniálu nás znají , tam se cítím v	pohodě/v_pohodě	, nikdy mě tam nikdo z ničeho neobvinil
Mladá fronta DNES	předává v dobrém stavu .</s><s>Ani jedno dobré	slovo/dobré_slovo	ovšem nemá pro piráty silnic , kteří zásobují
Mladá fronta DNES	na nákupy za hranice , o tom vědí	své/vědět_o_tom_svoje	.</s><s>Ceny jsou v německých obchodech často srovnatelné
Deníky Bohemia	deníku</s><s>NOVOROČNÍ VÝŠLAP na Zelenou horu si nenechalo	ujít/nenechat_si_ujít	na osm stovek lidí .</s><s>Užili si výlet

1 / 3,325,825

Identification of fragments and variants

Base MWE:

vzít rozum do hrsti

'keep one's wits about one'

lit. 'take reason into the cupped hand'

Fragment:

rozum do hrsti

lit. 'reason into the cupped hand'

Variant:

Sebral jsem ještě rozum do hrsti a utekl.

'I still kept my wits about one.'

lit. 'I gathered still reason into the cupped hand and fled.'

MWE lexical database

The desired content of the lexical database:

- 7000 MWEs in Czech with
- a detailed description of every MWE based on
- MWE classification/typology
- Focus on variability

Sources:

- *Slovník české frazeologie a idiomatiky* (Dictionary of Czech collocations and idioms) by F. Čermák et al.
- *FRANTALEX* – a list of idioms and collocations
- *Czech National Corpus*
- *Vallex* – a valency dictionary of Czech

Classification/Typology of MWEs

- We adopt the 3D classification used in the PARSEME[1] project:
  - **syntactic structure**
  - **fixedness/flexibility**
  - **idiomaticity**
- **Style/register** typology
- **Usage/global type** typology

[1] see https://typo.uni-konstanz.de/parseme/; Baldwin, T., Kim, S.N.: Multiword expressions. 2010

Style/Register

Standard: *hořet zvědavostí*
'be consumed with curiosity'
lit. 'burn with curiosity'

Colloquial: *brát něco hákem*
'go at sth hammer and tongs'
lit. 'take sth with a hook'

Dialect: *bejt jako boží vědro*
'be totally drunk'
lit. 'be like a God's bucket'

Expressive: *dřina jako prase*
'hard work'
lit. 'toil like a pig'

Slang

Other

Usage/Global type

Proverb: *(mít) co na srdci, to na jazyku*
'wear one's heart on one's sleeve'
lit. '(have) what on heart, it on tongue'

Weather lore: *Únor bílý, pole sílí.*
'White February, fields are strengthened.'

Comparison/simile: *držet se koho jako klíště*
'cling to sth like a barnacle'

Citation: *Nevědomost hříchu nečiní.*
'Ignorance is bliss.'

Set phrase: *na tom nesejde*
'it makes no difference'; lit. 'on it doesn't descend'

Formula

Term

Syntactic type

Noun phrase: *žabí muž*
'frogman'

Adjectival phrase: *všeho schopný*
'capable of anything (bad)'

Verb phrase: *stát za starou belu*
'not worth a damn'

Verbonominal (light verb) constructions

Adverbial phrase

...

Syntactic structure and Valency

In the lexicon, every MWE is represented as

- **a dependency tree**
- **a phrase-structure tree**

Valency is included in syntactic trees, sometimes it is idiosyncratic:

dát na srozuměnou, že...
give on understanding that
'to make it clear that...'

Neither *dát* nor **srozuměná* has a *that*-clause in their valency.

Fixedness/flexibility

- Variants
- Fragments
- **Word order**
- **Internal modifiability**
- **Transformations**
- **Morphological restrictions**

Word order

Czech is a language with "free word order", but some structures/words have a fixed word order:

- inside NPs and PPs the word order is fixed, e.g.
  - Preposition precedes a Noun
  - Adjective precedes a Noun
- clitics are placed on the 2nd position

Only deviations from the standard word order are marked in lexical entries:

Constituents cannot be shifted:

nedá se svítit

'nothing can be done'; lit. 'it's impossible to (make) light'

Noun precedes adjective:

skokan zelený

'edible frog'; lit. 'jumper green'

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Internal modifiability

By default, content words may be modified:

uhodily [*třeskuté*] *mrazy*

'[bitter] frosts struck'

We mark only exceptions:

běžet jako o ***závod***

'go like the wind'

lit. 'run like for a race'

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Transformations

- passivization / active form impossible

  MWE cannot be passivized:

  jak si přejete

  'as you wish'

  MWE cannot have the active form:

  budiž ti přáno

  'enjoy it!'; lit. 'let be you.DAT wished'
- (impossible) nominalization (of verbal MWEs)
- (impossible) adjectivization

Morphological restrictions

Restriction in number, mood, case, non-standard form...:

Number:

Kostky jsou vrženy.PL
'The die is cast.'

Mood:

stůj.IMP *co stůj*.IMP
'at all costs'; lit. 'cost.IMP what.ACC cost.IMP'

Case

Non-standard form

...

Types of idiomaticity

Lexical: some lexical items occur in MWEs only

mírnyx týrnyx

'for no reason'; from German 'mir nichts dir nichts'

Morphological: some morphological forms occur in MWEs only

chca nechca instead of *chtě nechtě*

'nolens volens'

Syntactic: MWE breaks some syntactic rule

ber kde ber

'take wherever you can'; lit. take.IMP where take.IMP

Semantic: non-compositional meaning of MWE

zamilovaný až po uši

'head over heels in love'; lit. 'in love up to ears'

Type of idiomaticity II

Pragmatic: MWE is used in specific situations

Smím prosit?

'May I have this dance?'; lit. 'May I ask?'

Statistical: "selection restriction", terms, compound prepositions...

silný čaj

'strong tea'

kyselina sírová

'sulphuric acid'

Conclusion

- A complex typology of Czech MWEs was presented with PARSEME typology being enhanced primarily with:
  - global/usage type
  - style/variety
  - syntactic trees including valency
  - fragments/variants and core
  - morphological idiomaticity
- A MWE lexical database was designed

Future plans:

- Enlarging the database
- Refining the typology (if needed)
- Database integration with parsing

Initial requirements for the lexical database

- main challenge: variability
- MWE – a sequence of tokens/types; different levels of specificity:
  - particular lexeme; one or more possible morph. forms
  - choice of lexemes
  - any word in particular form (valency?)
  - a phrase of some type (obligatory or typical valency)
- features – both for the MWE and its components:
  - *morphological idiomaticity* is a feature of a component
  - *syntactic type* is a feature of the whole MWE
  - *style* may depend on a particular component or be the feature of the MWE (e.g. "mít něco na háku")
- purpose: both **lexicographical** (human users) and **technical** (machine parsing)

Structure of a lexical database entry

- **slots** – the individual components of the MWE (syntagmatic dimensions)
- **fillers** – possible types, which may appear as variants of a component (paradigmatic dimension)
- **features** – custom **name=value** pairs assignable both to the MWE entry, or to a particular slot or a filler

- a MWE entry is a sequence of slots
- a slot is an enumeration of possible fillers:
  - **fixed** – the component may only be realized by one of the listed types
  - **open** – the component may be any lexeme (in a particular form)
  - **semi-open** – the component is usually realized by one of the listed lexemes, but other synonyms or semantically related expressions may sometimes appear

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Representation of different component types

- single token: slots with one or more possible fillers; a filler defines particular type by means of positional attributes (lemma, tag); tag as prefix, regular expressions used to match acceptable forms, e.g.
  - fixed case, singular or plural: `lemma="ryba", tag="NNF[SP]1"`
  - any verbal form: `lemma="stát", tag="V"`
  - any common adjective: `tag="AA"`

  => fillers represent exact types to be matched by the parser
- phrases (valency): open slots without fillers, features define type and morphological restrictions on the contents

  => slots may also represent more abstract units for lexicographical description (human users) or advanced parsing

Variable components (slots with several fillers)

drát/vtírat se na mysl
(lit. force/intrude into (one's) mind)
Various verbs: drát se, vtírat se

Advanced description: tree structures

- variable components consisting of several tokens
- dependency relations
- constituency structure

Solution:

- dependency: relations between slots (features)
- constituents: "non-terminal" slots; fillers may refer to a sequence of other slots

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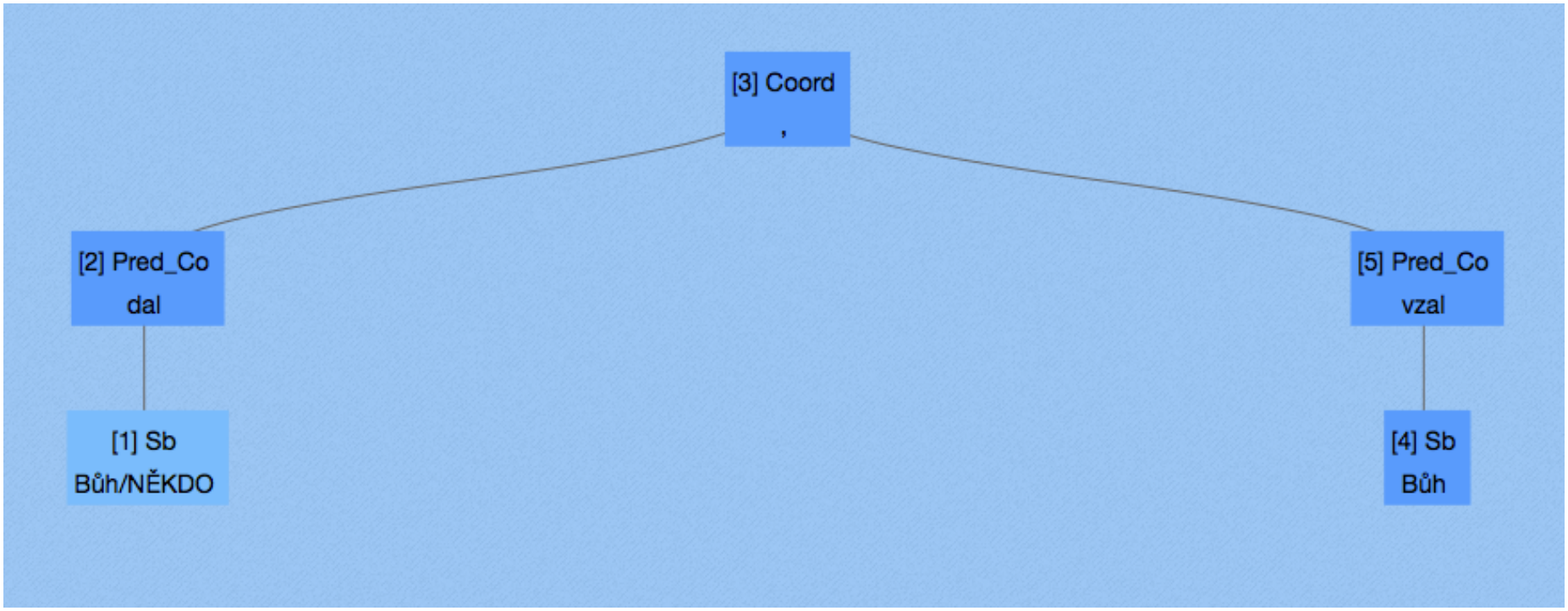
Dependency structure

Bůh dal, Bůh vzal
(lit. God gave, God took)



Constituency structure

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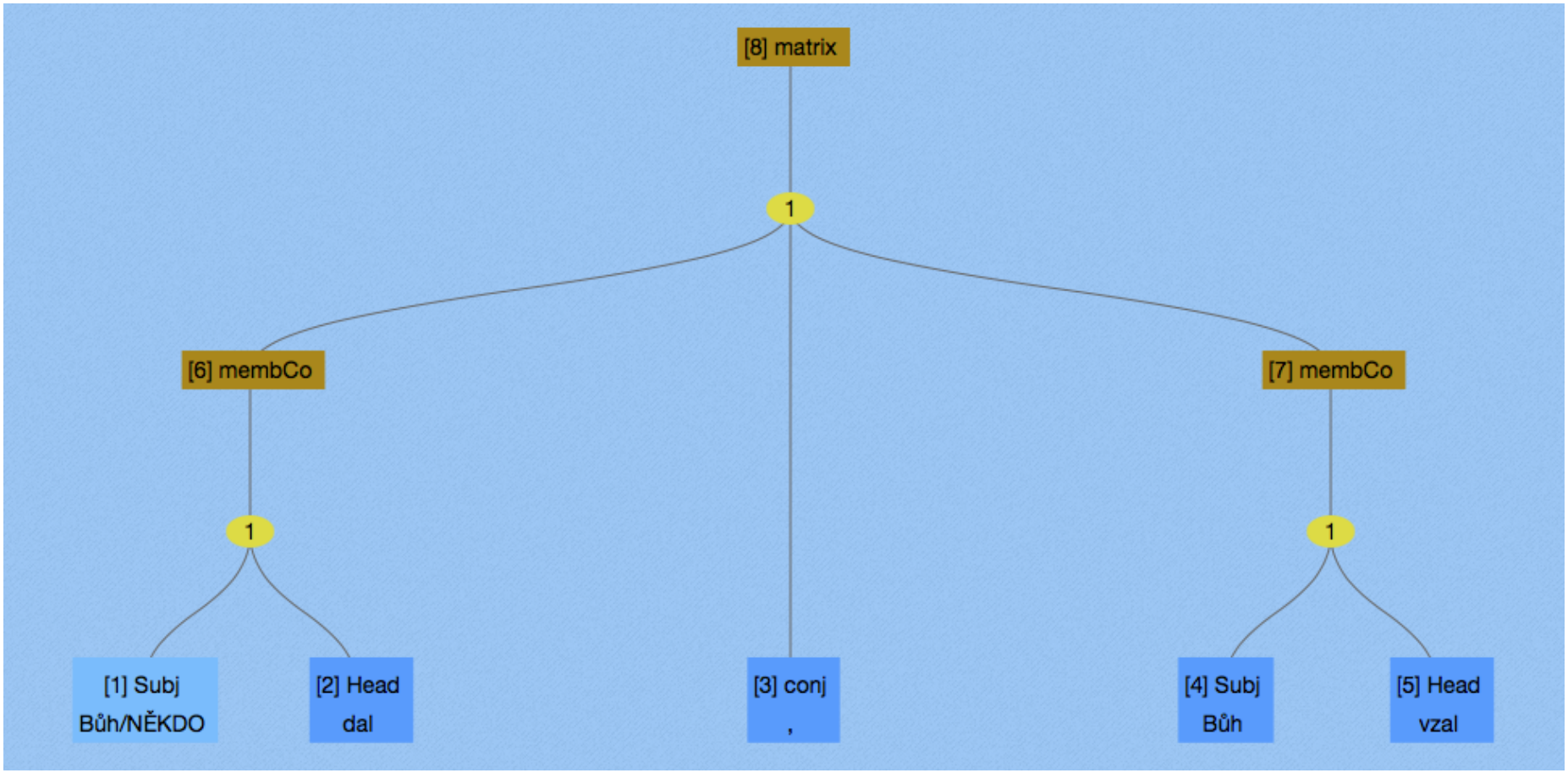
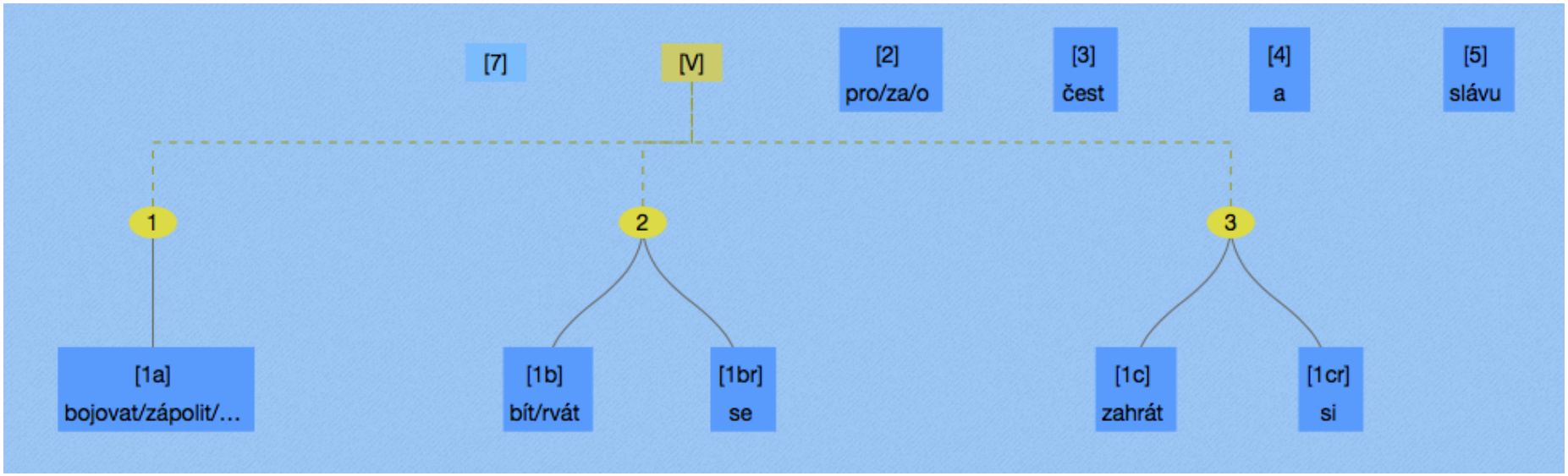


Constituency structure – additional “non-terminal” slots

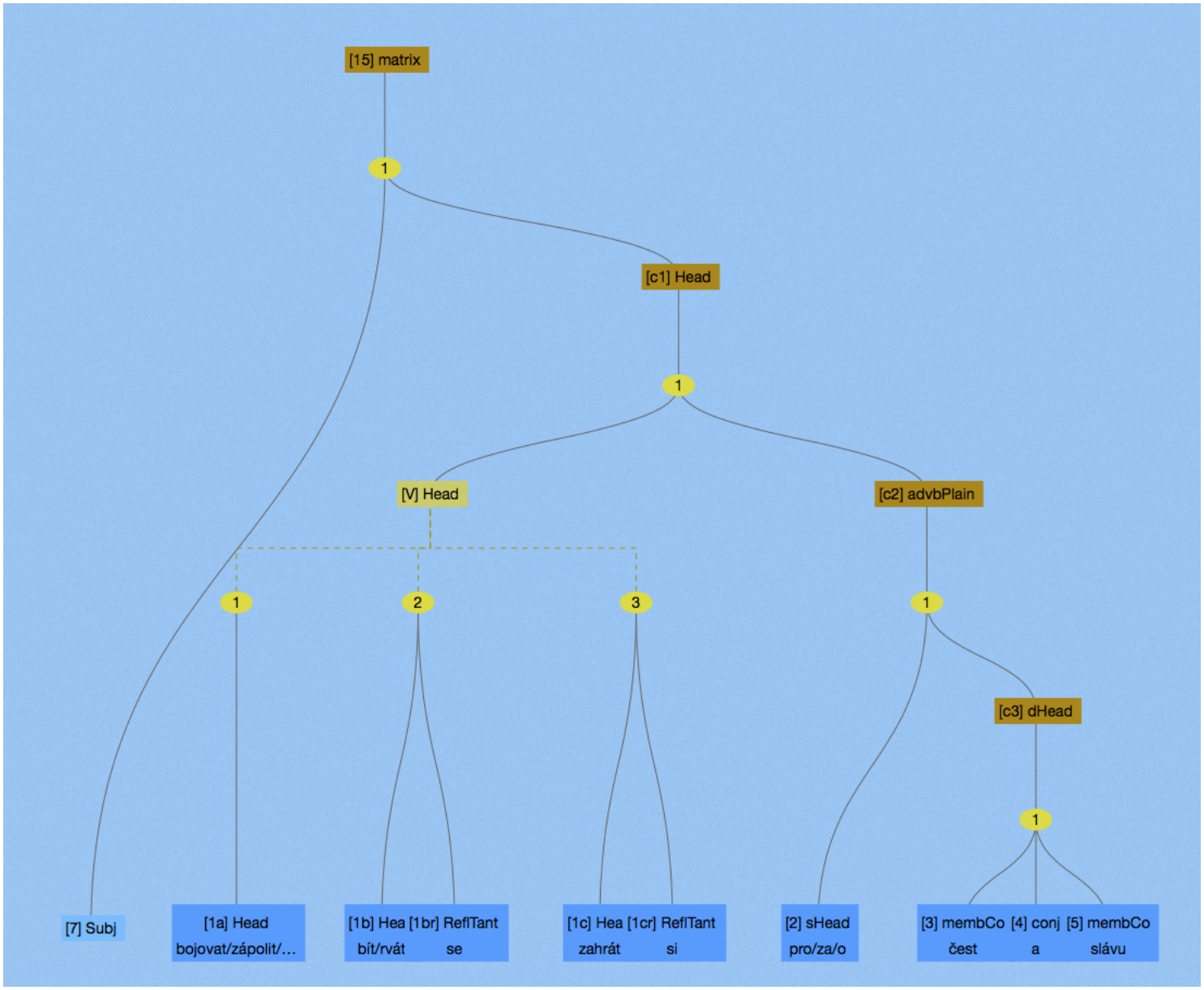
Multi-token variants

bojovat pro/za/o čest a slávu
(lit. fight for honor and glory)
Various verbs: bojovat, zápolit; bít se, rvát se; zahrát si

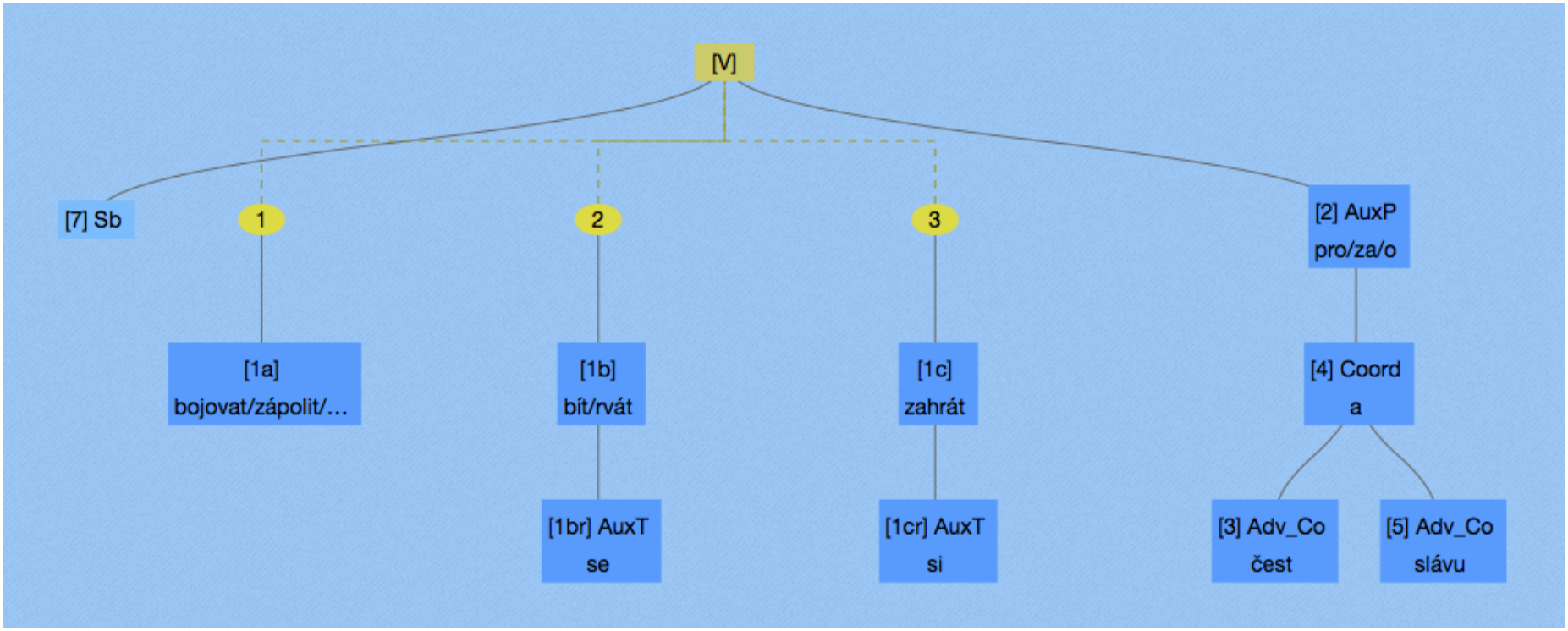


. . . additional “non-terminal” slot grouping the variants

...variability within the constituent structure

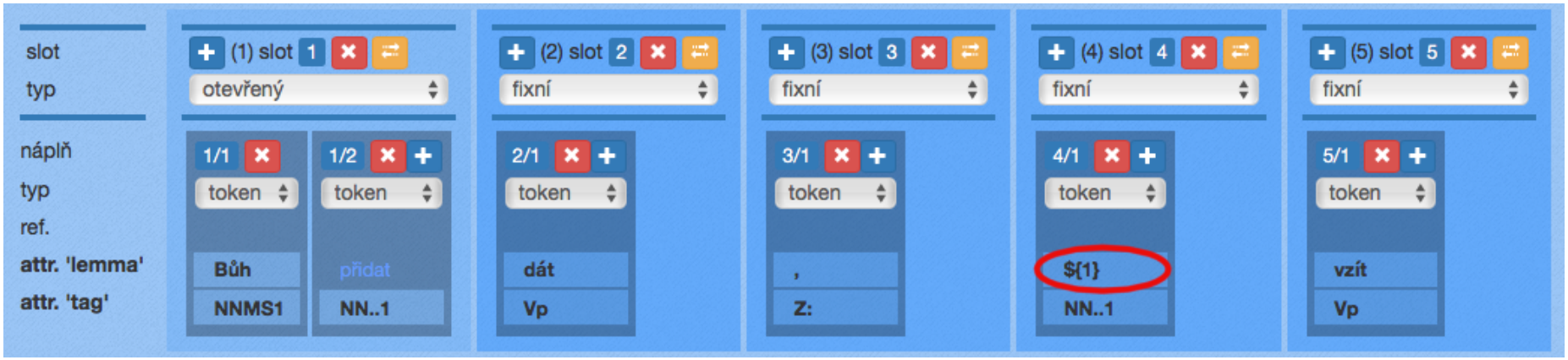


. . . variability within the dependency structure?



Challenges: repeating the same (variable) lemma

Bůh/X dal, Bůh/X vzal
(lit. God/X gave, God/X took)



The value of the lemma attribute of the filler in the 4th slot is a reference to the lemma used in the 1st slot.

Challenges: dependencies among "optional" components

Two optional components, but at least one must be present:

	mít	NĚCO	pro	SVOU	vlastní	potřebu	
	mít	NĚCO	pro	SVOU		potřebu	
	mít	NĚCO	pro		vlastní	potřebu	
*	mít	NĚCO	pro			potřebu	
(lit.	to have	ST.	for	ONE'S	own	need/use	)

Exclusive syntactic alternations:

	naložit	NĚKOMU	NĚCO	na		bedra	
	naložit		NĚCO	na	NĚČÍ	bedra	
*	naložit	NĚKOMU	NĚCO	na	NĚČÍ	bedra	
*	naložit		NĚCO	na		bedra	
(lit.	to load	SO.	ST.	on		loins/shoulders	
or	to load		ST.	on	SO.'S	loins/shoulders	)

Technical implementation

Implemented on a prototype of a more generic experimental database of annotation units.

- Elasticsearch used as backend (Java; Lucene based search engine)
- generic abstraction/model with a REST API (Python)
- highly configurable web interface (Angular, bootstrap, d3.js)