

Possible but not probable: A quantitative analysis of valency behaviour of Czech nouns in the Prague Dependency Treebank

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Outline

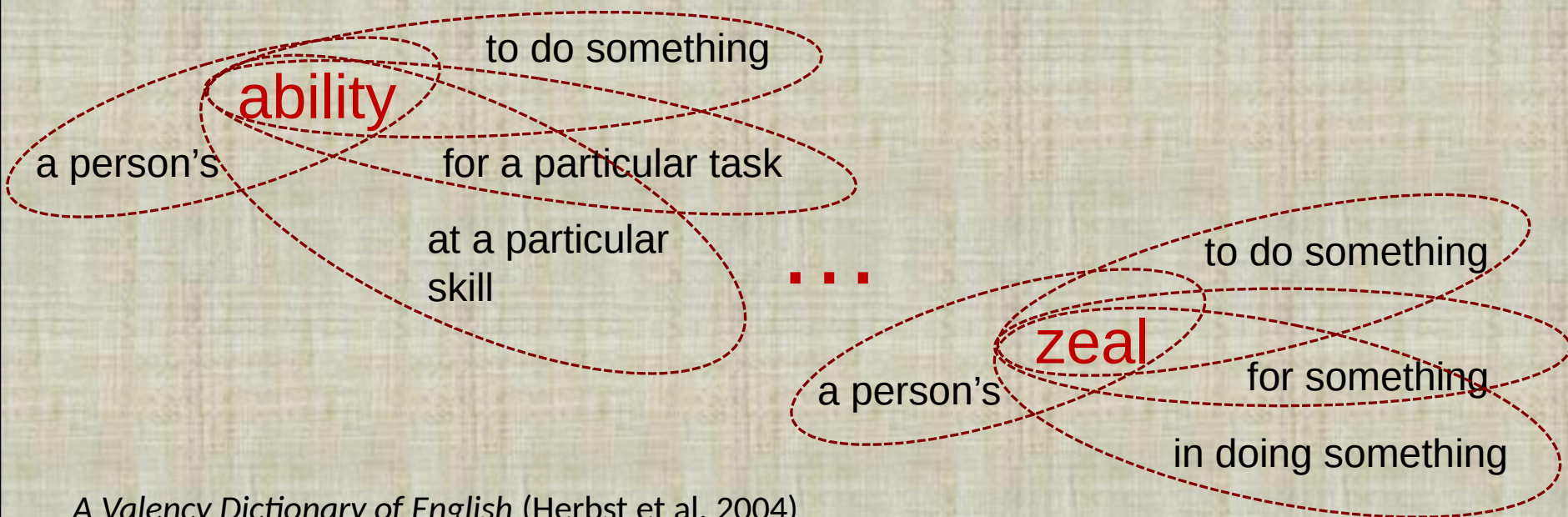
- Valency of Czech nouns
- **NomVallex**: a member of a family of Prague valency lexicons
- Lexicographic representation of valency patterns of nouns in NomVallex
- A quantitative analysis of data from the Prague Dependency Treebank
- Utility of WordSketches

Valency of nouns

- Valency: the range of syntactic elements either required or specifically permitted by a verb or other lexical unit

Concise Oxford Dictionary of Linguistics

- Valency lexicons (a ... z)



A Valency Dictionary of English (Herbst et al. 2004)

— complementation patterns of English verbs, nouns and adjectives

Corpus-based valency lexicon of Czech nouns (NomVallex)

Theoretical framework: valency theory of Functional Generative
Description (Panevová)

- valency frames
- valency complementations:
 - participants: Actor (ACT), Patient (PAT), Addressee (ADDR), Effect (EFF), Origin (ORIG)
 - obligatory free modifications: Direction (DIR), Location (LOC), Manner (MANN)
- Goal: 400-500 representative entries
- Valency of deverbal nouns
- Extension of two existing valency lexicons, VALLEX and PDT-Vallex

Vallex, PDT-Vallex, NomVallex

- Vallex
 - valency structure of Czech **verbs**
 - based on data of the Czech National Corpus, CNC
 - rich annotation of syntactic phenomena + a grammatical component
 - almost 5 000 Czech verbs in more than 10 800 lexical units, i.e., given verbs in the given senses (over 6700 lexical units when aspectual counterparts are grouped together)
- PDT-Vallex
 - a lexicon built during the tectogrammatical annotation of the Prague Dependency Corpora (PDT)
 - more than 7000 verbs in over 11000 lexical units, **3750 nouns** (4750 lexical units), 800 adjectives (950 lexical units)

Vallex, PDT-Vallex, NomVallex

- **NomVallex**
 - based on data of the CNC and Araneum Bohemicum Corpus
 - has adopted the design of **Vallex**
- **Vallex**
 - verbs
 - based on data of the Czech National Corpus, CNC
 - rich annotation of syntactic phenomena
 - grammatical component
- **PDT-Vallex**
 - annotation lexicon for the Prague Dependency Corpora
 - verbs, nouns, adjectives

Valency patterns in NomVallex

- **Lexeme**: an abstract unit associating all lexical forms of the noun with lexical units
- **Lexical units**: individual senses of the noun
- **Type** of the lexical unit: process – abstract result – concrete result
- **Gloss** describing the given meaning
- **Valency frame**: valency slots standing for individual valency complementations
- List of possible **morphemic forms** indicating surface expression of the given valency complementation
- Example providing **corpus evidence**
 - combinations of adnominal participants representing various valency patterns, as extracted from the CNC and Araneum Bohemicum Corpus
- **Semantic class** membership
- Control, reciprocity, references to light verbs with which the noun combines, special valency, links to VALLEX and PDT-Vallex...

NomVallex: Example of a nominal entry

* PLÁN 'PLAN'

: id: blu-n-plán-1

+ **ACT**(gen,poss;obl) **PAT**(gen,na+acc,o+loc,pro+acc,inf,aby,že,dcc; obl)

-derived: blu-v-plánovat-1

-gloss: *záměr, úmysl* 'intention, aim'

-example: *plány vystavět.PAT podnik* 'plans to construct a processing plant'

-control: **ACT**, ex

-class: mental action

-type: abstract result

: id: blu-n-plán-2

+ **AUTH**(gen,poss;typ) **PAT**(gen,poss; obl)

-derived: blu-v-plánovat-1

-gloss: *mapa, náskres* 'map, layout'

-example: *plán města.PAT* 'city plan'

-class: mental action

-type: concrete

Valency of Czech nouns

- Czech: highly inflectional language
- Forms of adnominal participants
 - a verb in the infinitive, a content clause, various prepositional phrases, prepositionless cases (GEN, DAT, INS)
 - deverbal nouns: typical (systemic) as well as special (non-systemic) shifts in surface forms of participants
- Polyvalent nouns
 - various combinations of participants

předání výrobku.**PAT** výrobcem.**ACT** jeho pověřenému zástupci.**ADDR**

handing-over product-GEN producer-INS his accredited representative-DAT

‘handing over of the product by the producer to his accredited representative’

Various factors influencing valency of Czech nouns

- Noun **podpora** 'support': What does the noun denote?

Process	Abstract result of the process	Concrete result of the process / physical object / place / person
podpora pacienta lékařem 'support of the patient by the doctor'	lékařova podpora pacientovi 'doctor's support to the patient'	podpora v nezaměstnanosti 'unemployment benefits'

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- Productively vs. non-productively derived nouns
 - *podporování / podpoření* 'supporting' vs. **podpora** 'support'
- Typical (systemic) vs. special (non-systemic) shifts
 - verbal nominative and accusative typically shift to nominal genitive
→ syntactic homonymy of some adnominal forms → alternative forms
 - **podpora** prezidenta.ACT/PAT 'support of the president'
- Semantic class membership
- Featuring in a complex predicate
 - *poskytnout někomu podporu* 'to provide sb with support'

Semantic classes in NomVallex

- Semantic class membership: carried over from Vallex
- Semantic classes in Vallex:
 - built strictly in a ‘bottom-up’ way, by grouping lexical units with similar syntactic properties and with respect to their semantics
 - an intuitive gathering of frames rather than a properly defined ontology
 - 22 semantic classes were established
 - appoint verb, cause motion, combining, communication, contact, emission, exchange, expansion, extent, change, intervention, location, mental action, modal verb, motion, perception, phase of action, phase verb, providing, psych verb, social interaction, transport
- NomVallex: focusing on **five semantic classes**
 - communication, e.g., *odpověď* ‘answer’
 - exchange, e.g., *dodávka* ‘delivery’
 - contact, e.g., *dotyk* ‘touch’
 - mental action, e.g., *obava* ‘fear’
 - psychological states, e.g., *dojem* ‘impression’
- Consistency across a whole semantic class

Current stage

- Focus on nouns of communication and mental action
- **Non-productively derived nouns** show a strong tendency for an **increased number of possible expressions** of their participants in comparison with their base verbs
 - *apelovat* 'to appeal'
 - ACT(NOM) ADDR(*na* 'at'+ACC) PAT(content_clause)
 - *apel* 'appeal'
 - ACT(GEN, possessive) ADDR(**DAT, *k* 'to'+DAT**, *na* 'at'+ACC) PAT(***k* 'to'+DAT, *proti* 'against'+DAT**, content_clause, inf)
- Non-systemic forms of participants
 - e.g., *apel komu*-DAT 'appeal to-sb'

Searching through corpora

CNC SYNv5, Araneum Corpus

- KonText, CQL queries
- Sketch Engine, Word Sketch
 - adjustment of Word Sketch grammar to specifically Czech adnominal forms
 - adnominal prepositionless dative and instrumental
- Tezaurus
 - checking polysemy

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Prague Dependency Treebank (PDT)

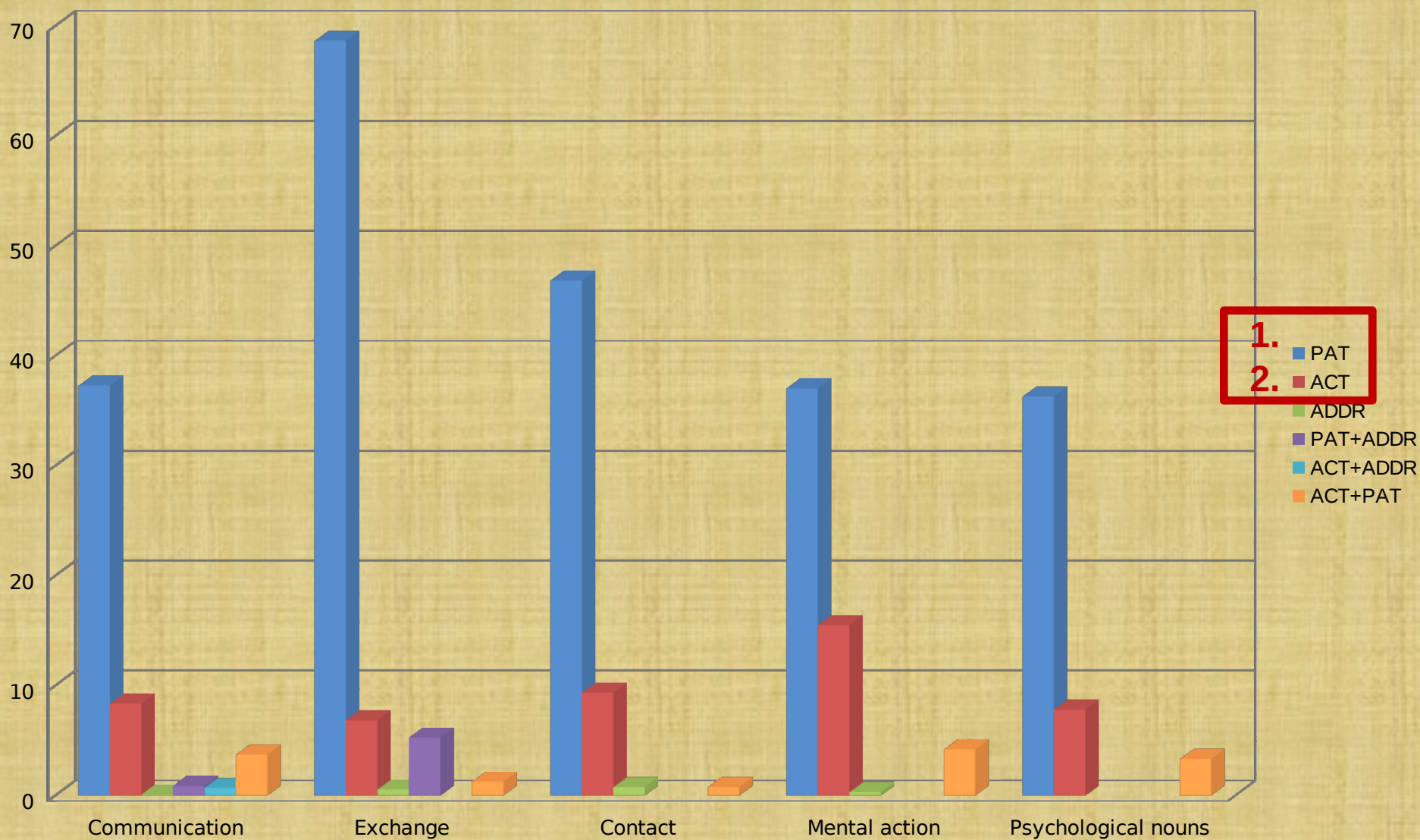
- PML-TQ
- Manual syntactic annotation
 - surface (1,5 MW)
 - **deep** (0,8 MW)
- Functors
 - syntactic-semantic relations of the given complementation to its governing word
 - Actor (ACT), Patient (PAT), Addressee (ADDR), Effect (EFF), Origin (ORIG)
- Deletions
 - unexpressed obligatory valency complementations are added

A quantitative analysis: PDT 3.0

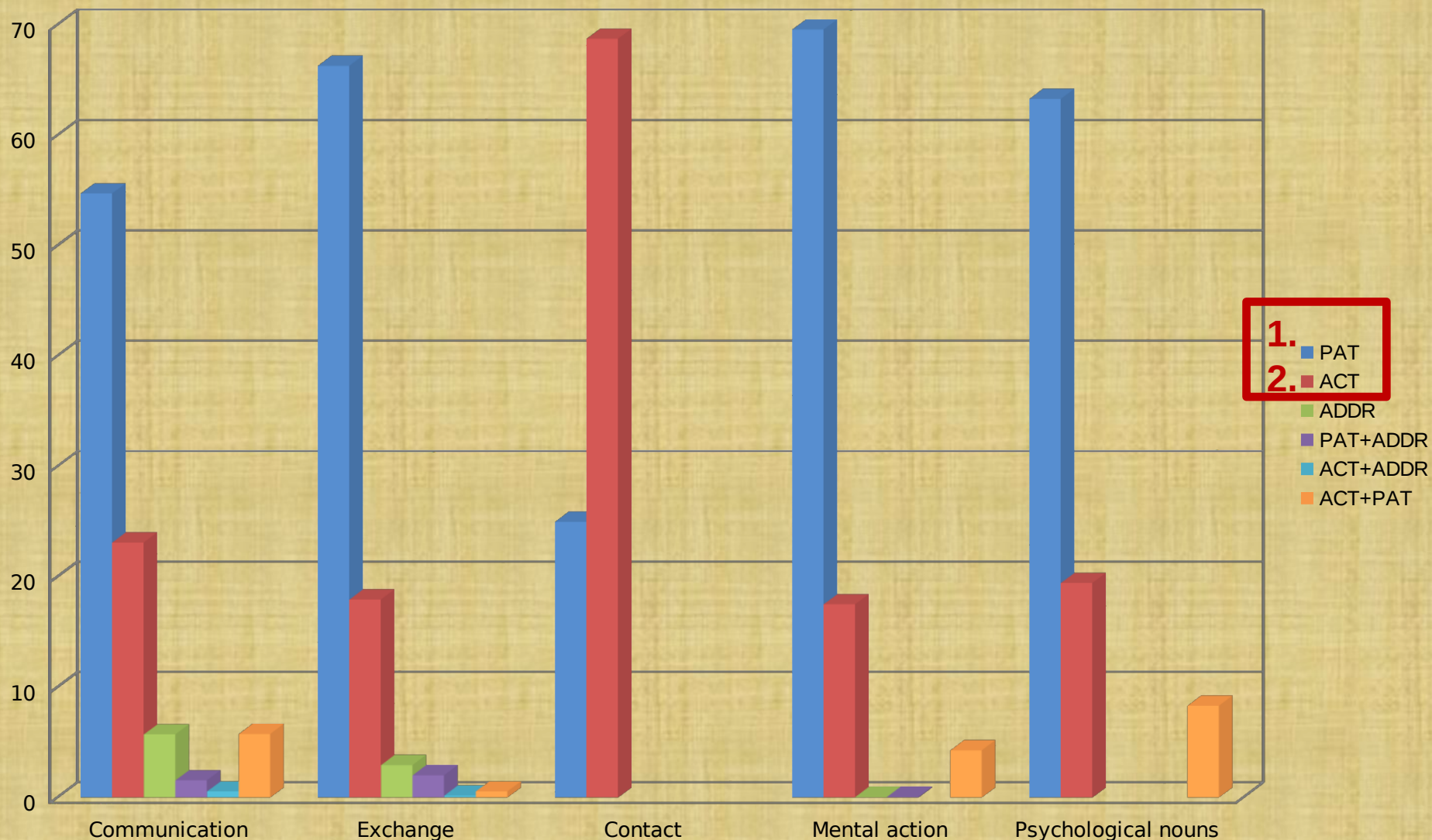
- Nouns representing the five selected semantic classes
 - communication, exchange, contact, mental action, psychological nouns
 - total number of nouns that occurred in the PDT 3.0: 623
- Relative frequencies of combinations of participants, including their forms
 - nouns modified in the PDT 3.0 by a participant expressed on surface
 - the analysis may then be used to optimize the search using Word Sketches

Type of the noun		Communi- cation	Exchange	Contact	Mental action	Psych. states	Total
<u>Productively derived</u>	Lemmas	145	94	30	107	29	405
	Occurrences	1552	699	128	1236	179	3794
<u>Non- productively derived</u>	Lemmas	102	34	10	54	18	218
	Occurrences	2163	540	16	1256	504	4479
Total	Lemmas	247	128	40	161	47	623
	Occurrences	3715	1239	144	2492	683	8273

Productively derived nouns: PDT 3.0



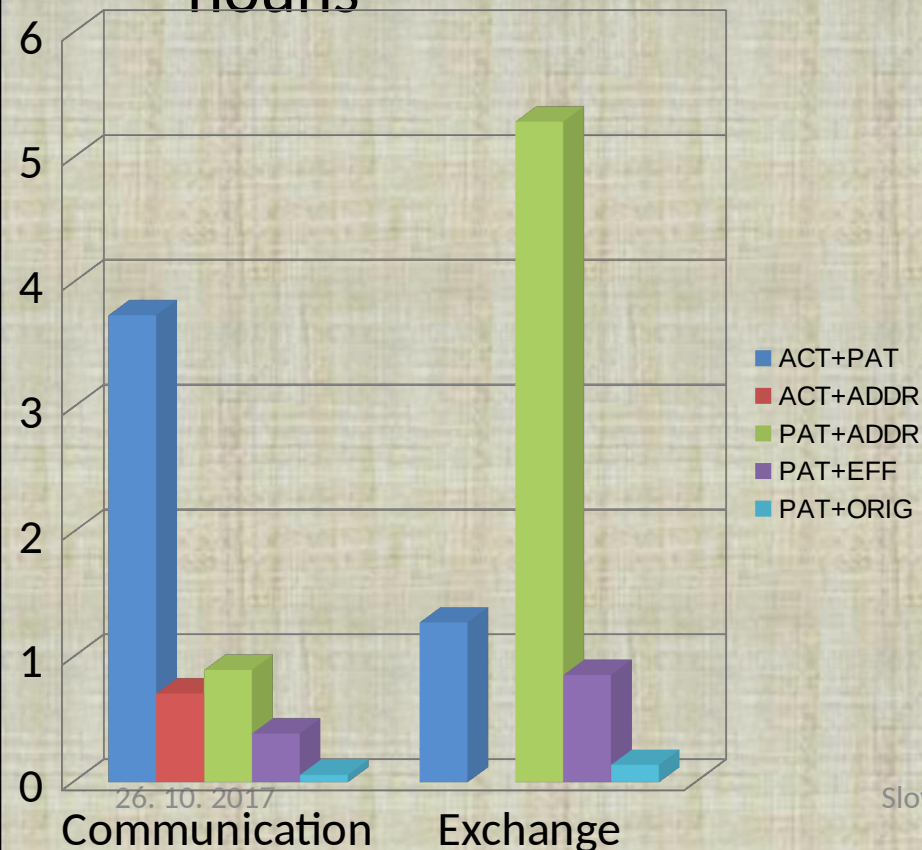
Non-productively derived nouns: PDT 3.0



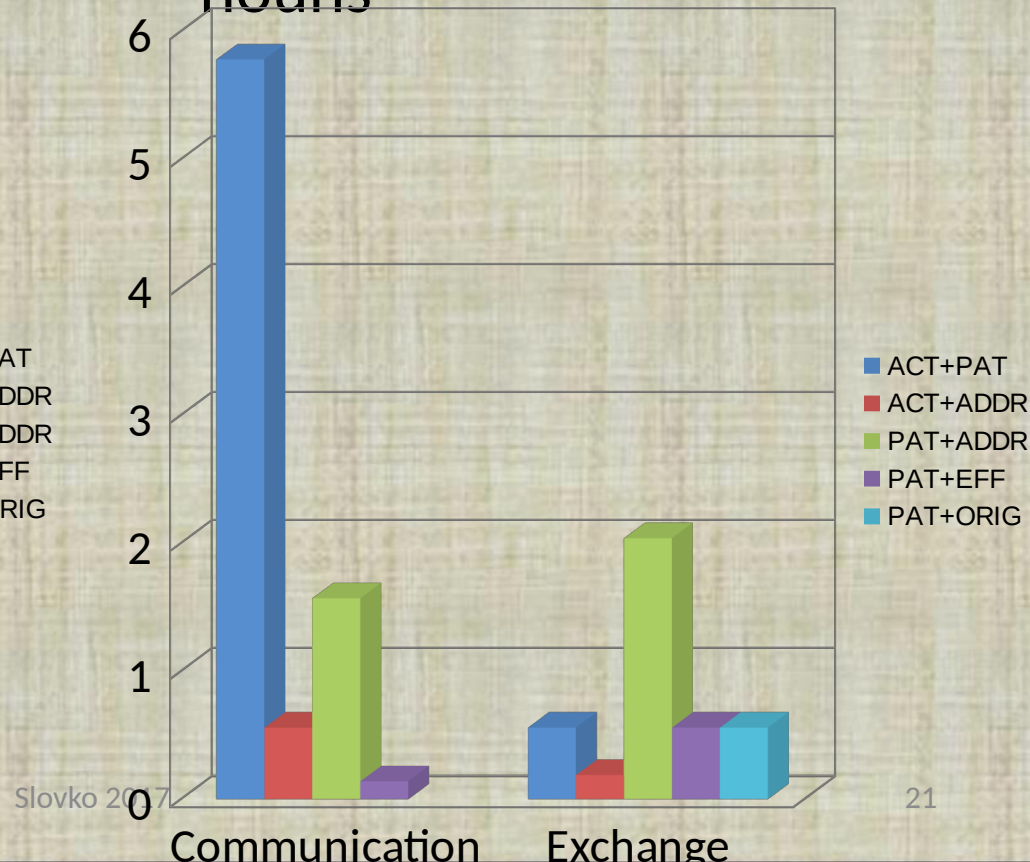
Combination of two participants

- Difference between the Exchange class and the Communication class
 - Communication: the most frequent combination is the combination ACT+ PAT
 - Exchange: the most frequent combination is the combination PAT+ ADDR

- Productively derived nouns



- Non-productively derived nouns



Combinations of forms

All productively derived nouns in the PDT

Combination	Relative frequency	Examples
Only Gen	~ 70 %	<i>zvyšování ceny</i> 'increasing of-the-price'
Only prepositional group (PG)	~ 9 %	<i>srovnávání s čím</i> 'comparison with sth'
Possessives	~ 6 %	<i>Clintonovo</i> 'Clinton's'
Gen + PG	~ 3 %	<i>měření sil se Švédy</i> 'pitting (one's) strength against the Swedes'
Indeclinable noun	~ 1,5 %	<i>rozdělení ČSFR</i> 'the division of ČSFR (i.e. Czechoslovakia)'
...		

Utility of WordSketches

- Dative complementations appear with less than 1% of noun instances in the examined PDT data
 - Yet they may still be found as statistically significant collocations of individual nouns:
- *předání*
'handing over'

<u>dat 1 short</u>	<u>480</u>	5.3
zdravotník	<u>9</u>	2.19
Čína	<u>17</u>	1.83
zákazník	<u>20</u>	0.89
uživatel	<u>7</u>	0.79

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PP postmodifiers:

2.64:4 k audit

2.62:4 v kancelář

2.11:4 na příslušnost

2.04:4 k platba

1.76:4 v forma

0.99:4 na náklad

0.71:4 na ohled

1:2 do evidence

1.95:1 do opatrování

- WordSketches cannot distinguish between valency and non-valency complementations

Utility of WordSketches

WordSketches search for collocations

(as a relationship between two **lexical** items)

- It is easy to create a rule that will give a table listing the complementations expressed by prepositional groups
- We need a separate rule for each of the other forms of complementations (especially prepositionless cases and infinitives) and these rules will only trigger when there is a lexical item that occupies the position with some level of statistical significance

→ we are interested in “syntactic collocations”

Conclusion

- NomVallex: Extension of Vallex lexicon
- Valency of nouns based on corpus data
 - CNC, Araneum Bohemicum Corpus
 - PDT: a quantitative analysis of data from the PDT can help to optimize the search using Word Sketches in the CNC
- Comprehensive description of valency patterns of Czech deverbal nouns
 - valency frames
 - sense identification
 - semantic class membership
 - corpus evidence
 - links to VALLEX and PDT-Vallex
 - additional information
 - special valency, light verbs with which the noun combines, ...

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NomVallex: Creation of a preliminary list of entries

vallex 3.0

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| [psych verb](#) | [social interaction](#) | [transport](#)

search (428 LUs)



apelovat 1
argumentovat 1
bavit se, bavívat se 2
blahopřát 1
bručet, bručívát 2
číst, čítat₁, čítávat 1
číst, čítat₁, čítávat 2
ctít, ctívát 5
definovat 1
deklarovat 1
děkovat 1
děkovat se 1
demonstrovat 1
diktovat, diktovávat 1
diktovat, diktovávat 2
diskutovat 1
dít₁ 1
dít₁ 2

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apelovat 1
argumentovat 1
bavit se, bavívat se 2
blahopřát 1
bručet, bručívat 2
číst, čítat₁₁, čítávat 1
číst, čítat₁₁, čítávat 2
ctít, ctívat 5
definovat 1
deklarovat 1
děkovat 1
děkovat se 1
demonstrovat 1
diktovat, diktovávat 1
diktovat, diktovávat 2
diskutovat 1
dít₁ 1
dít₁ 2
dít₁ 2

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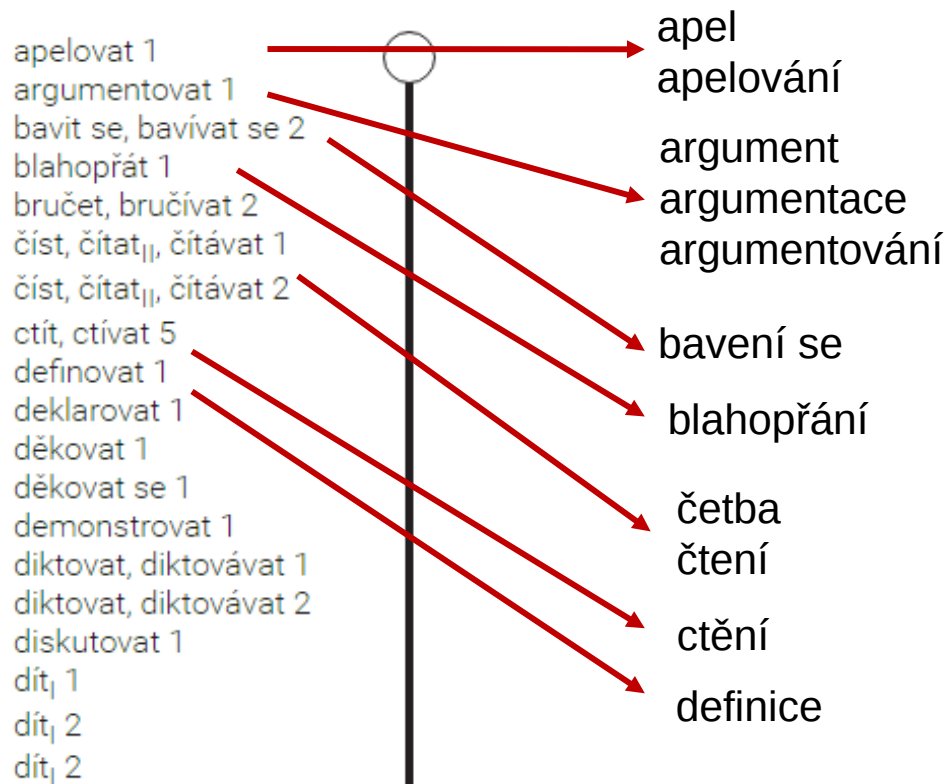
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Derivation of nouns



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Derivation of nouns

Sorting out of the list

apelovat 1
argumentovat 1
bavit se, bavívat se 2
blahopřát 1
bručet, bručívát 2
číst, čítat₁, čítávat 1
číst, čítat₁, čítávat 2
ctít, ctívat 5
definovat 1
deklarovat 1
děkovat 1
děkovat se 1
demonstrovat 1
diktovat, diktovávat 1
diktovat, diktovávat 2
diskutovat 1
dít₁ 1
dít₂ 2

apel
apelování

argument
argumentace
argumentování

bavení se
blahopřání

četba
čtení
ctění
definice

apel
apelování

argument
argumentace
argumentování

bavení se
blahopřání

četba
čtení
~~ctění~~
definice

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functors | forms | control | alternation | class | others | advanced search

appoint verb | cause motion | combining | **communication** | contact | emission | exchange | expansion | extent | change
| intervention | location | mental action | modal verb | motion | perception | phase of action | phase verb | providing
| psych verb | social interaction | transport

search (428 LUs)		<u>Derivation of nouns</u>	<u>Sorting out of the list</u>	<u>Adding new items</u>
apelovat 1	→	apel	apel	apel
argumentovat 1	→	apelování	apelování	apelování
bavit se, bavívat se 2	→	argument	argument	argument
blahopřát 1	→	argumentace	argumentace	argumentace
bručet, bručívát 2	→	argumentování	argumentování	argumentování
číst, čítat _{II} , čítávat 1	→			
číst, čítat _{II} , čítávat 2	→	bavení se	bavení se	bavení se
ctít, ctívat 5	→	blahopřání	blahopřání	blahopřání
definovat 1	→			
deklarovat 1	→	četba	četba	četba
děkovat 1	→	čtení	čtení	čtení
děkovat se 1	→	ctění	ctění	debata
demonstrovat 1	→			debatování
diktovat, diktovávat 1	→	definice	definice	definice
diktovat, diktovávat 2	→			
diskutovat 1	→			
dít _I 1	→			
dít _I 2	→			

Searching through VALLEX / NomVallex Lexicon

quest.ms.mff.cuni.cz/vallex/

Hledání ve slovníku VALLEX [\(napoveda\)](#)

Co hledat?

pole text

Atributy sloves i jmen

lexeme_lemmas plán

frame_lemmas

frame

synon

example

class

use

note

recipr

Atributy sloves

reciprex

reflex

control

limit

Atributy přidané ve verzi 3.0

id

diat

split

conv

multiple

Atributy jmen

derived

*** PLÁN** [n-vallex-shared-other.txt]

~ no-aspect: plán [blu-n-plán-1]

+ ACT(2,pos;obl) PAT(2,na+4,o+6,pro+4,inf,aby,že,cont;obl)

-synon: záměr, úmysl

-example: Národním stadionem ale plány developerů.ACT na zastavění.PAT Letné nekončí.

Šaronův.ACT plán je diametrálně odlišný a pro Palestince zjevně neakceptovatelný.

O plánech rozvoje.PAT letiště ani nemukli.

Ropný trh reagoval po oznámení plánu o ukončení.PAT bojů v Libyi.

Existují plány pro evakuaci.PAT lidí?

Je velmi pravděpodobné, že i plány vystavět.PAT podnik na zpracování jaderného odpadu m

To já jsem vymyslela plán, (aby mě v noci odvezl do Godrikova Brodu).PAT.

Dejme tomu, že si nyní připravuje plán, (že vás zavraždí).PAT.

Jasný plán, (co bude dál).PAT, není.

-recipr:

-control: ACT, ex

-class: mental action

-derived: blu-v-plánovat-1

-pdt-vallex: v-w3458f1 plán PAT(2,na+4,inf,cont;obl) ACT(2,pos;opt)

%plán Spojených států.ACT uspořádat.PAT manévry%

%plány nacistů.ACT na obranu.PAT Karpat%

%plán legislativních prací.PAT vlády%

%palestinský plán, aby na to dohlížela.PAT skupina%

-specval: PAT(na+4,o+6,pro+4), chybí ACT(7)

-type: abstraktní výsledek děje

-lvc: blu-v-uskutečnit-uskutečňovat-1, blu-v-pojímat-pojmout-2

~ no-aspect: plán [blu-n-plán-2]

+ AUTH(2,pos;typ) PAT(2,pos;obl)

-synon: mapa, nákres

-example: Za pomoci plánu města.PAT jsem to místo našel docela snadno;

Měl u sebe svůj.APP vlastní plán města.PAT - dostal ho od Paddyho.;

Zřejmě nejsložitějším územím v ČR je hlavní město Praha. Jeho.PAT platný územní plán z rok

Sedmikostelí je sice oslavou gotické Prahy a jejího.PAT velkolepého urbanistického plánu, ale

Trochu to připomíná pointu vtipu o popletených stavitelích, kteří drželi architektovy.AUTH plá

budovali věž.;

V plánech architekta.AUTH je už také zakreslena vycházková trasa po pěší zóně.;

Zatím si plány architekta.AUTH připevnili na zdi a odškrtávají na nich, co si již pořídili.;

-recipr:

-control:

Coverage of semantic classes in NomVallex

- Preliminary list of entries: 1230 lemmas of nouns
- Goal: 400-500 representative entries
 - Communication (140), Exchange (80), Mental action (100), Contact (40), Psychological nouns (40)

Vallex	Communication	Exchange	Contact	Mental action	Psychological states	Total
Verbs	454	277	170	378	129	1317
NomVallex						
Productively derived nouns	335	171	117	257	104	984
Non-productively derived Nouns	110	38	14	56	28	246
Total	445	209	131	313	132	1230

Surface expression of Actor (ACT)

- Gen > Pron_{poss} > Adj_{poss} / Instr > od 'from'+Gen
- Productively derived nouns
- Non-productively derived nouns

