Wiktionary and NLP: Improving synonymy networks

ACL-IJCNLP

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Goals

- giving a method for improving synonymy networks;
- applying it to Wiktionary;
- in the meanwhile, investigate the possibilities of:
  - using Wiktionary as a resource for NLP;
  - using NLP for improving Wiktionary.

Summary

Wiktionary as a lexical resource

Lexical resources

- NLP requires lexical resources
- English: Princeton WordNet
- Some other languages (eg. French): non-satisfaying and/or non-free
- Some others: purely under-resourced

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Wiktionary

- multilingual
- freely available
- $\longrightarrow$ a perfect candidate?

Wiktionary: (very) short description

Collaborative editing

Non experts-led

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- etymology
- parts of speech
- definitions, examples
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- synonyms/antonyms
- hypernyms/hyponyms

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Middle English, from Old French *bote*

Noun

1. A heavy shoe
2. A blow with the foot; a kick.

Synonyms

* (*shoe*): buskin, mukluk
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Translations

shoe

* French: botte
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kick - see kick

Verb

1. To kick

   *I **booted** the ball*

2. To disconnect

   *I got **booted** from the chatroom*

Synonyms

* (*kick*): kick
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Translations [...]

Etymology 2

Akin to Old Norse *bót*

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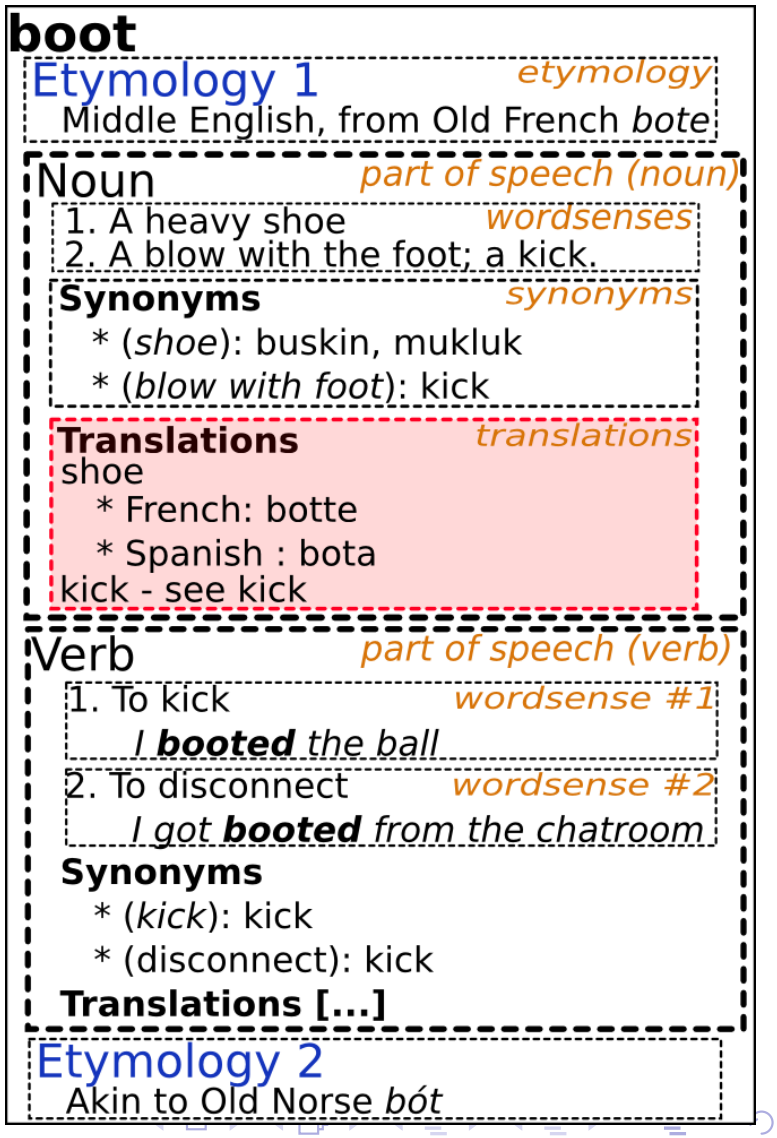

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The 'regular' case, but...

content&layout heterogeneous over languages and even within a given language

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1 Wiktionary

2 Synonymy networks
- Wiktionary graph
- Gold standards
- Comparison

3 Improving Wiktionary's network
- Exploiting its Small World structure
- Using translation links

Extracting Wiktionary's graph of synonymy

Modeling

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- one English entry's POS
  $\longrightarrow$ one vertex

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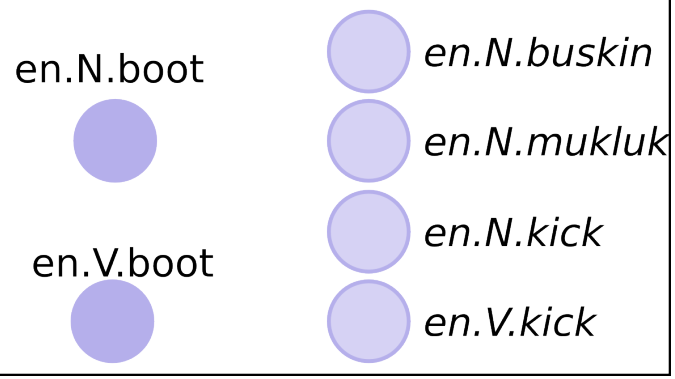

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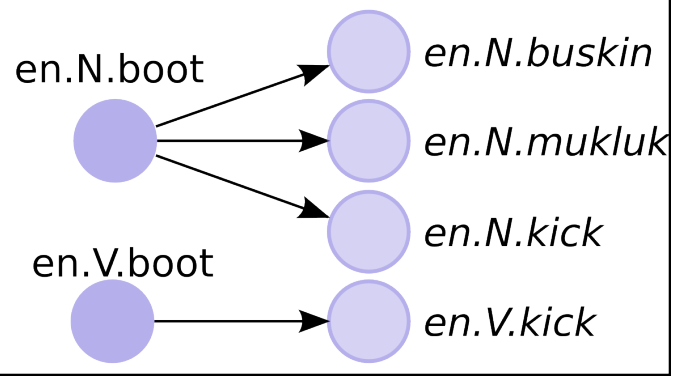

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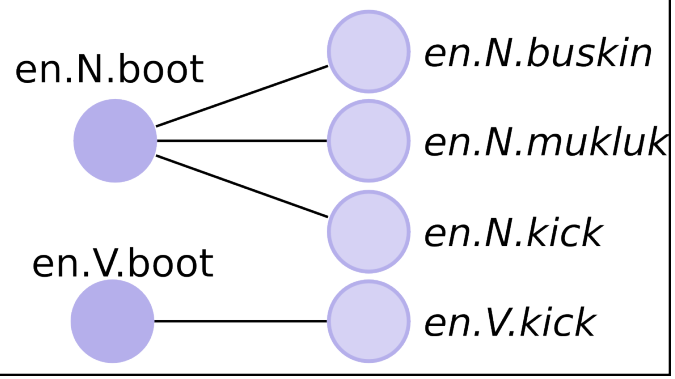

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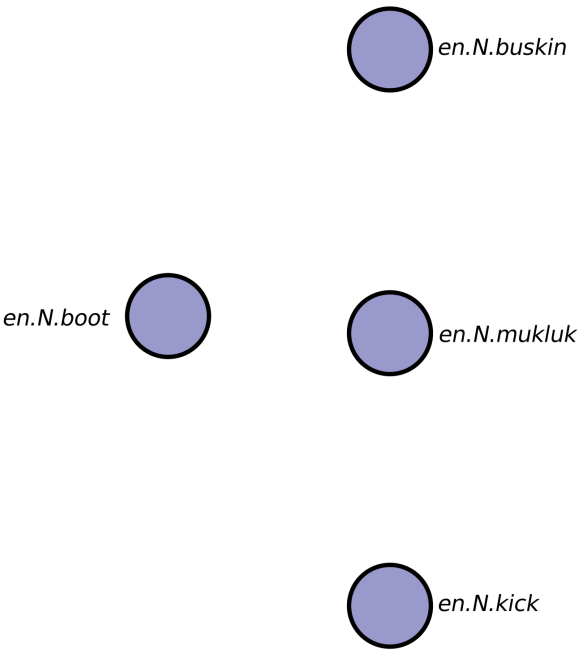

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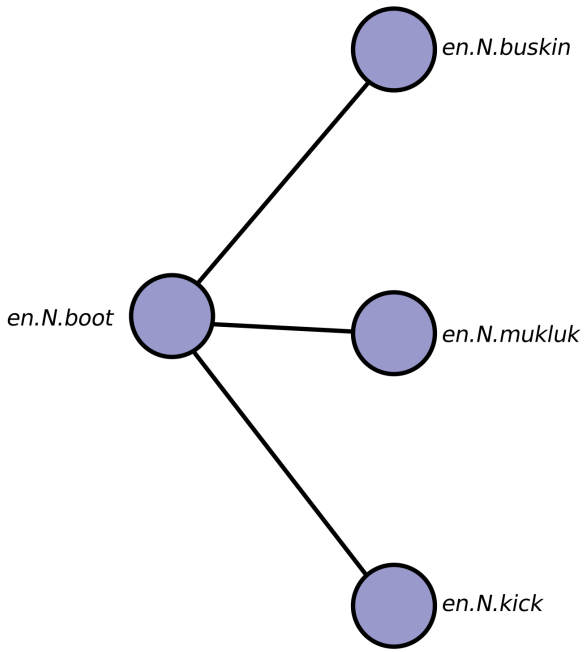

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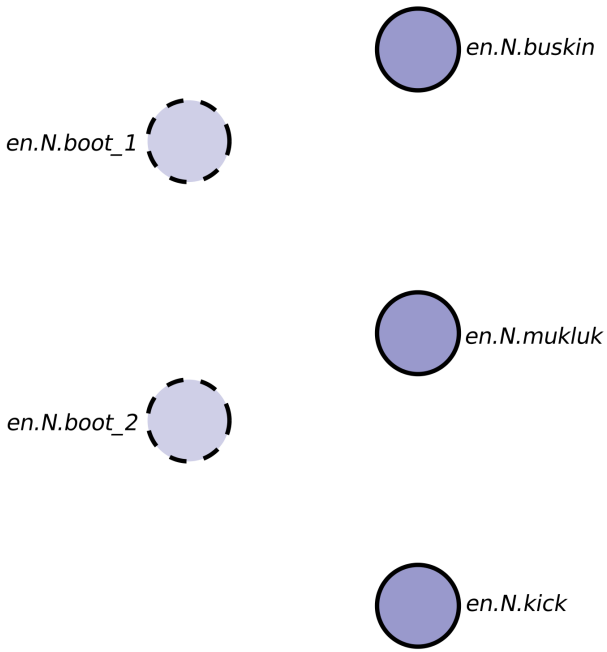

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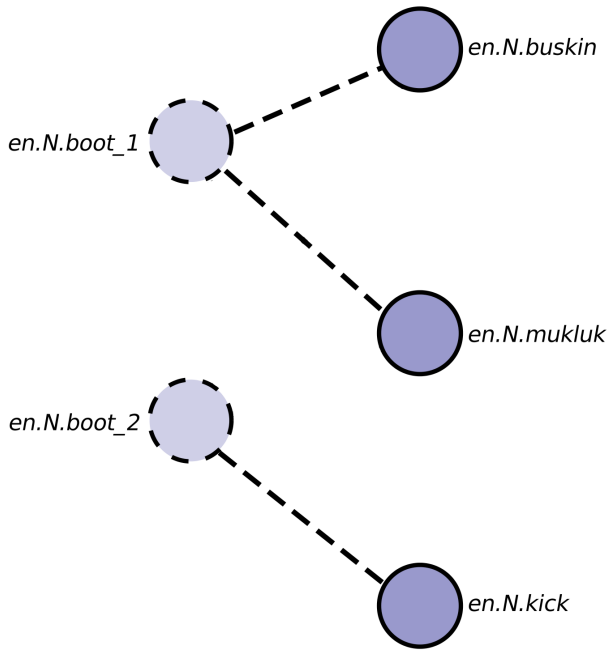

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1. A hit or strike with the leg or foot
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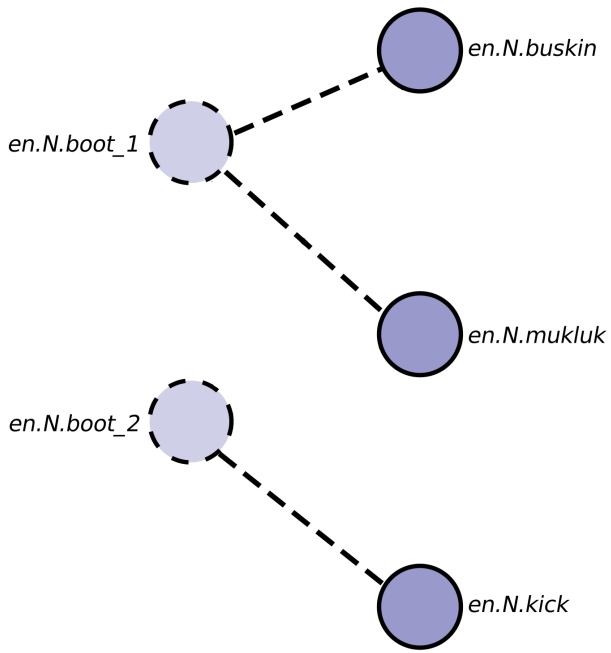

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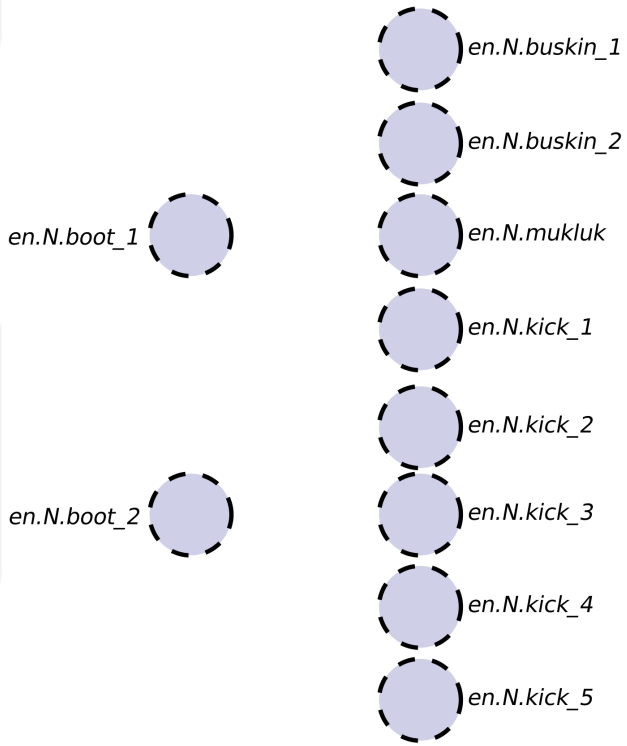

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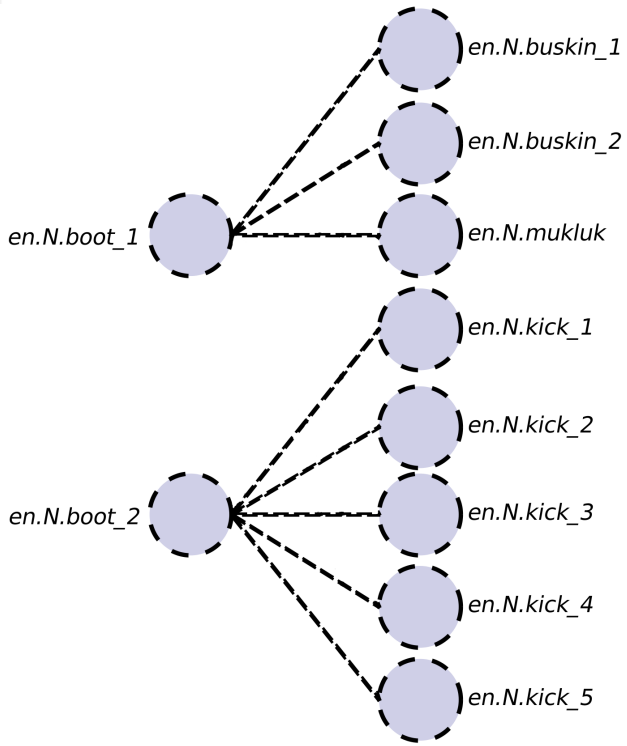

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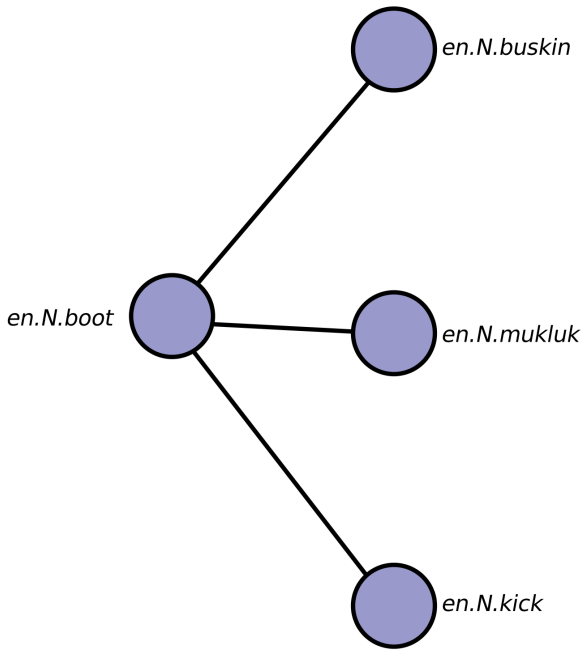

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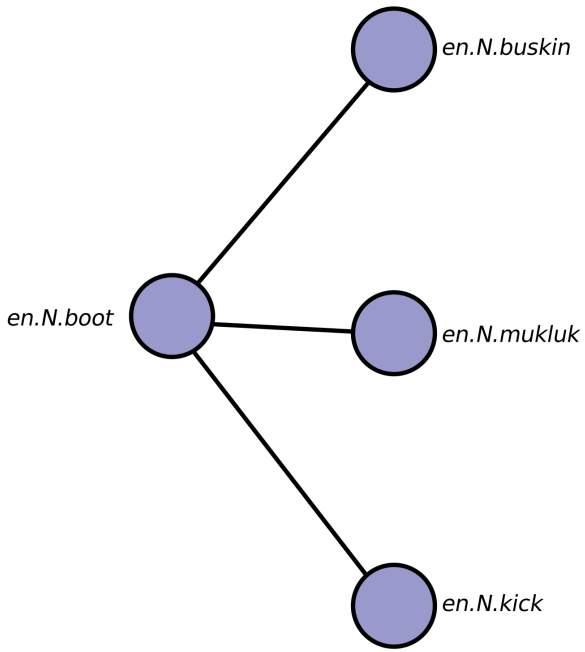


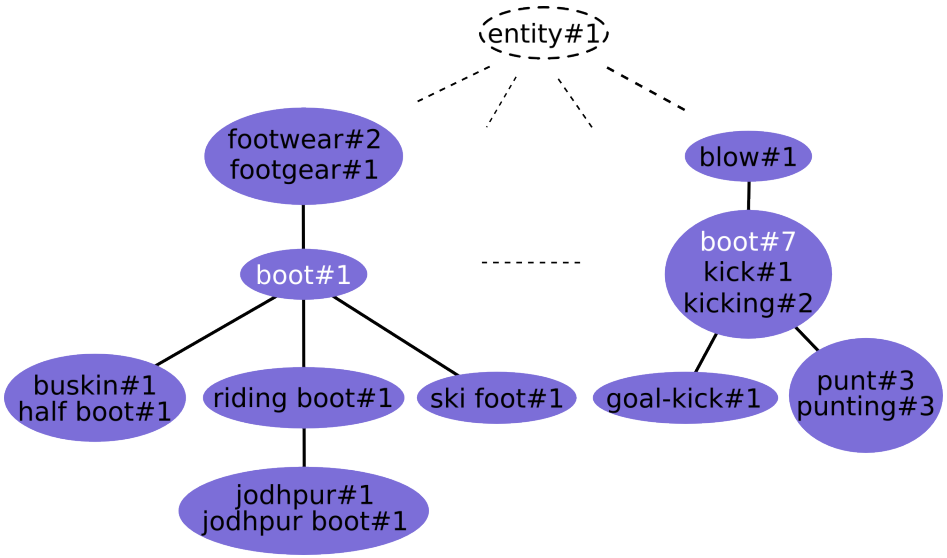
Another reason:

One of our gold standard (Dicosyn) has its wordsenses flattened

Extracting WordNet's synonymy network

WordNet

- synonymy between wordsenses
- relations already symmetric
- same POS in a given synset



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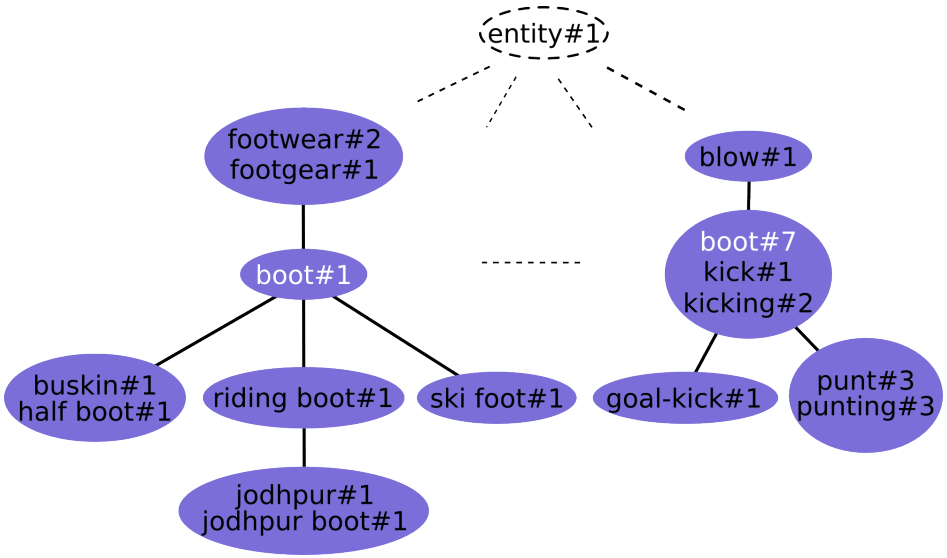

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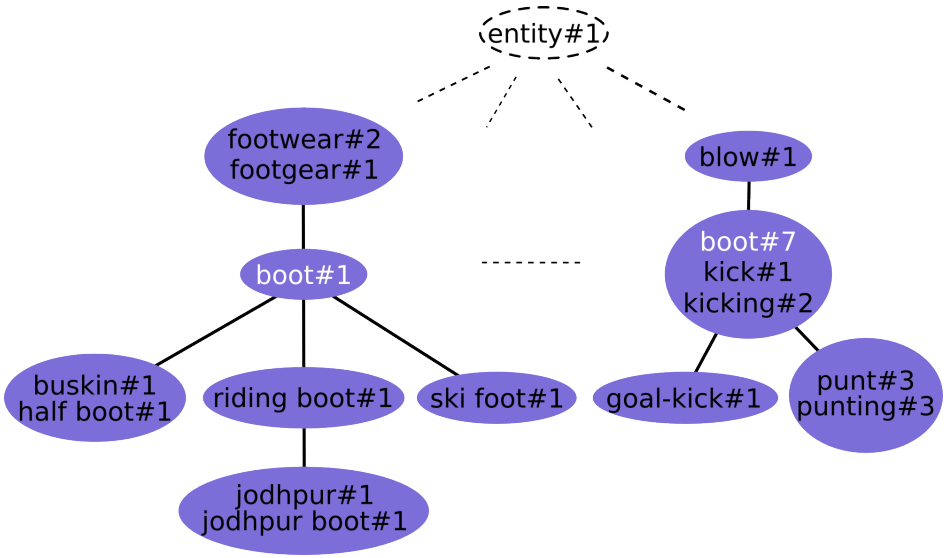

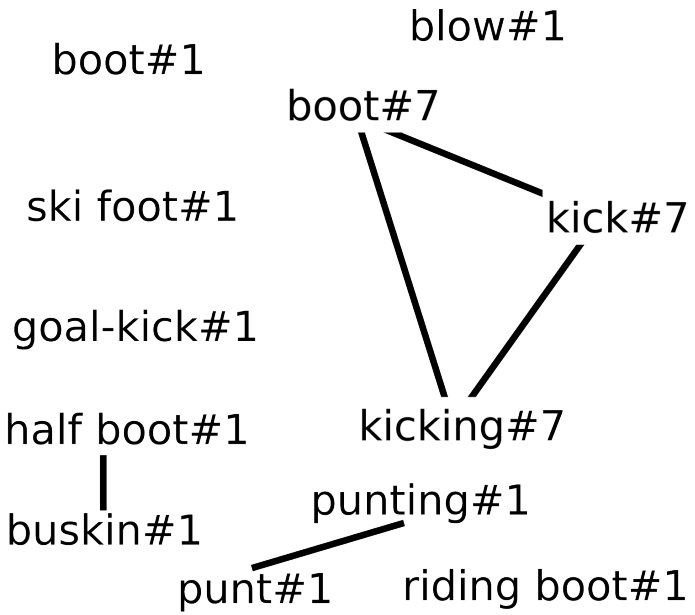

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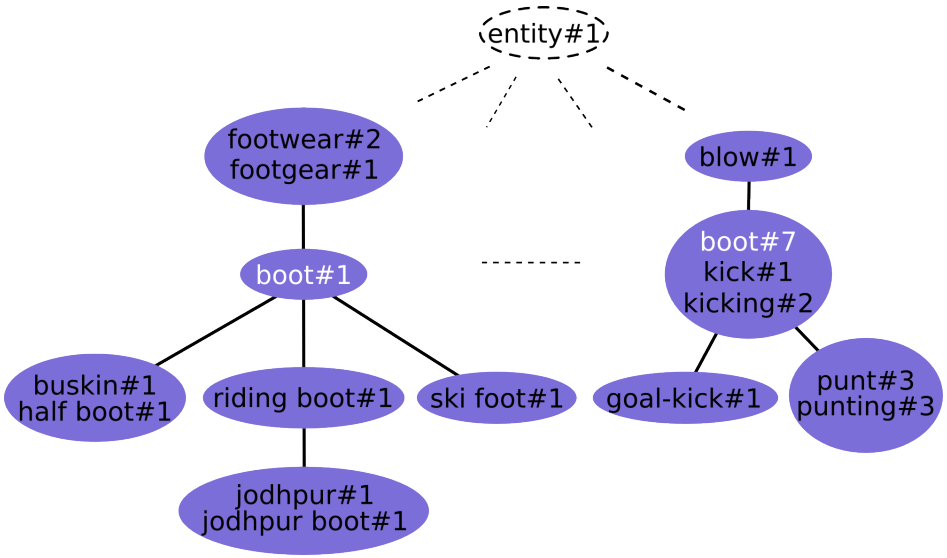

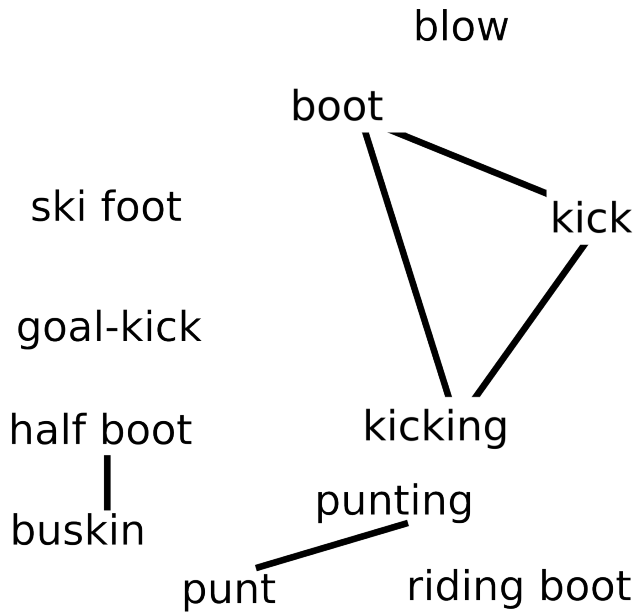

Extracting WordNet's synonymy network

WordNet

- synonymy between wordsenses
- relations already symmetric
- same POS in a given synset

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- vertices: words
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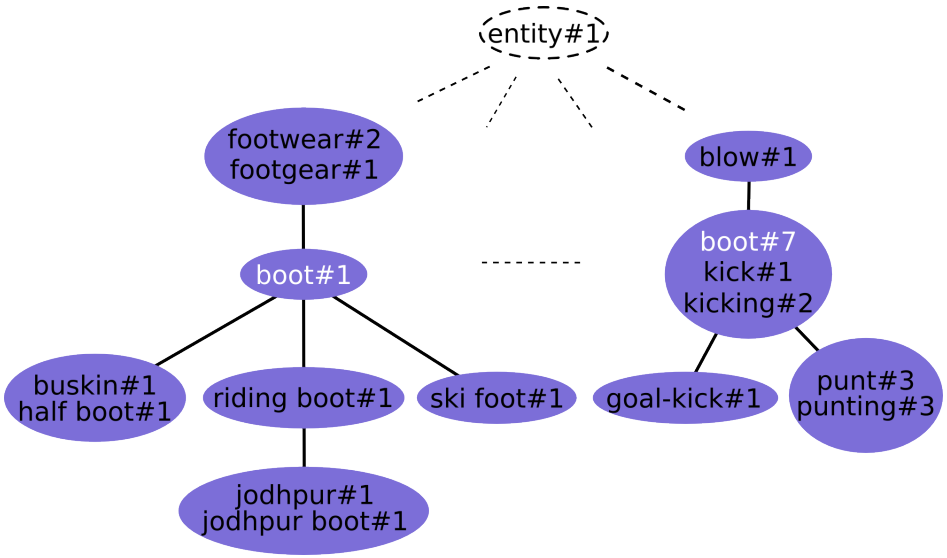

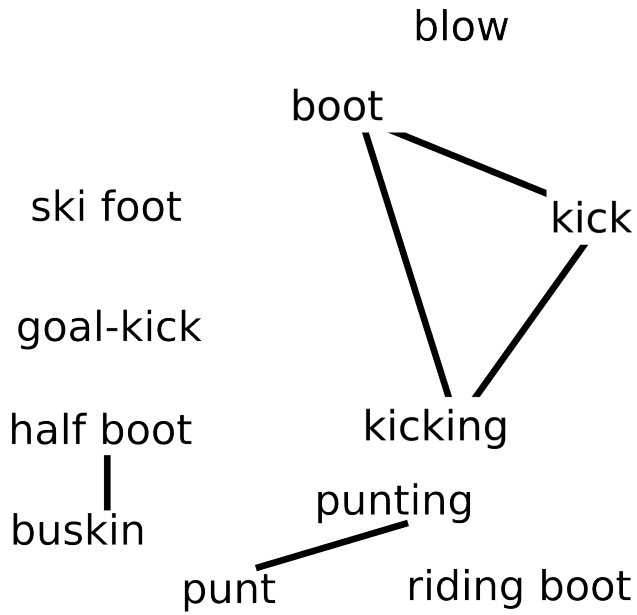

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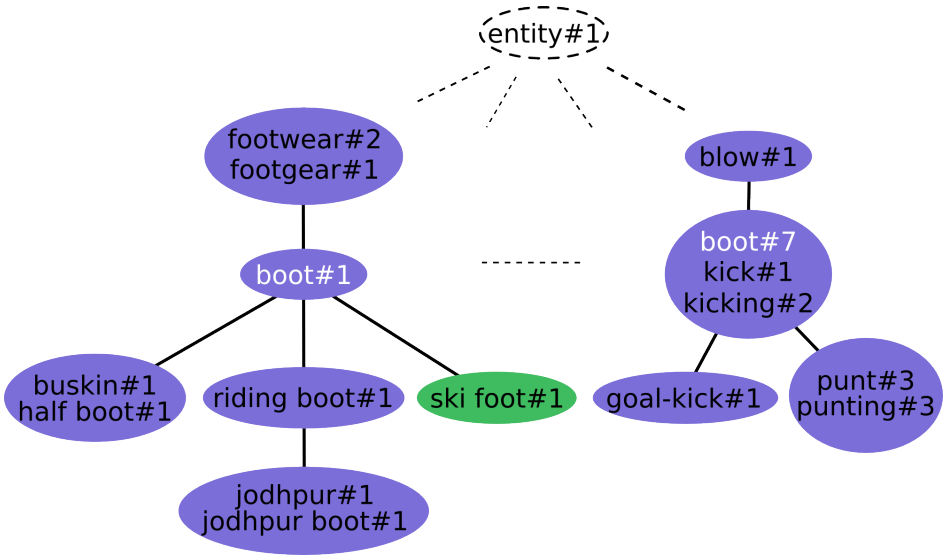

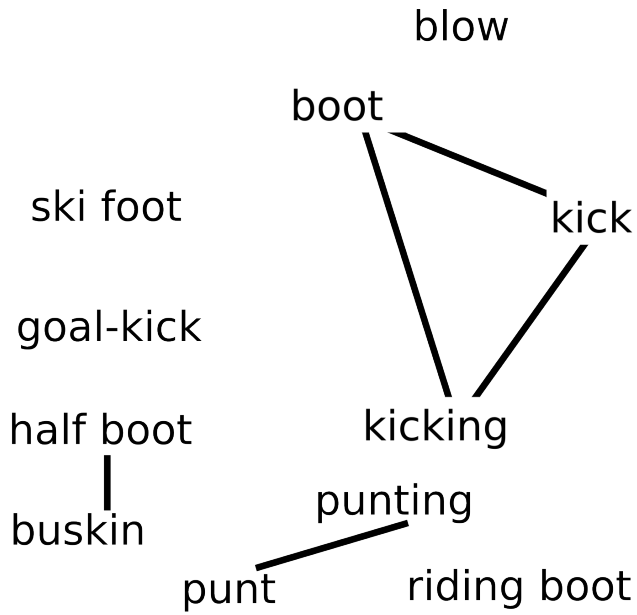

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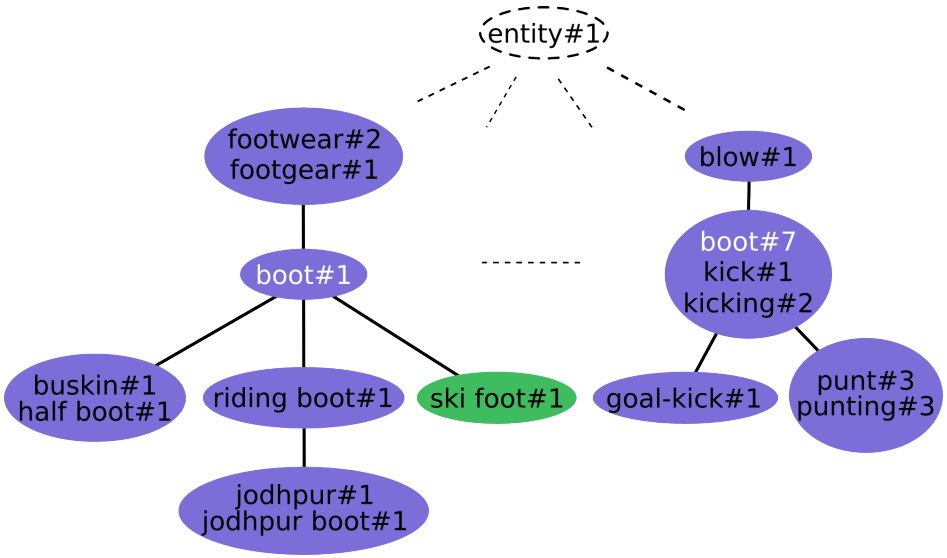

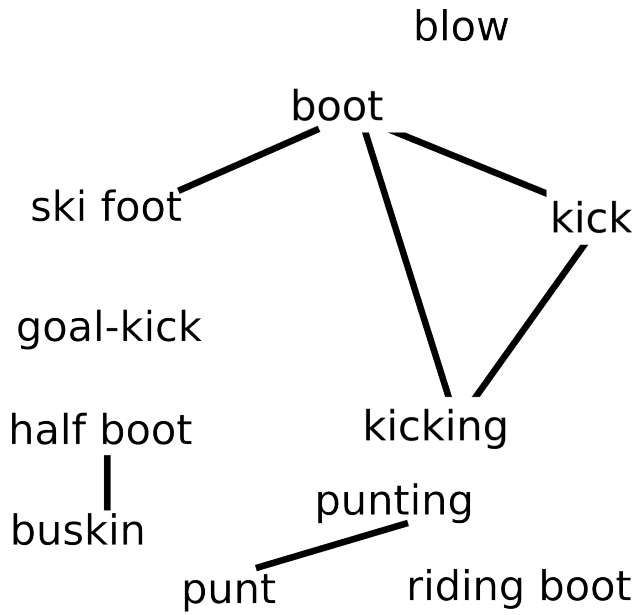

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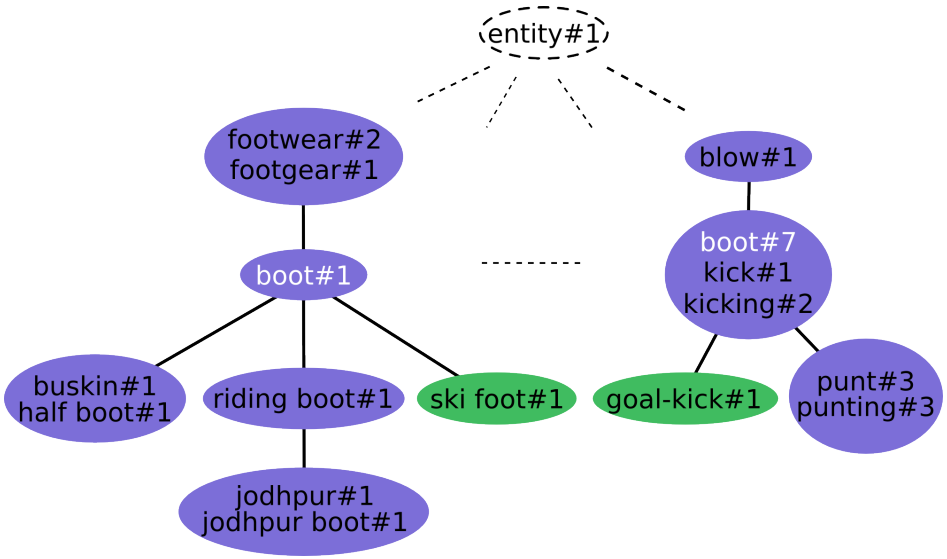

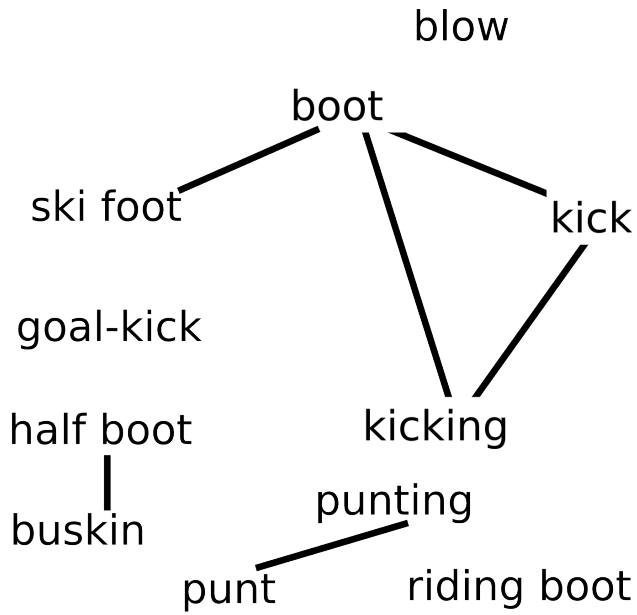

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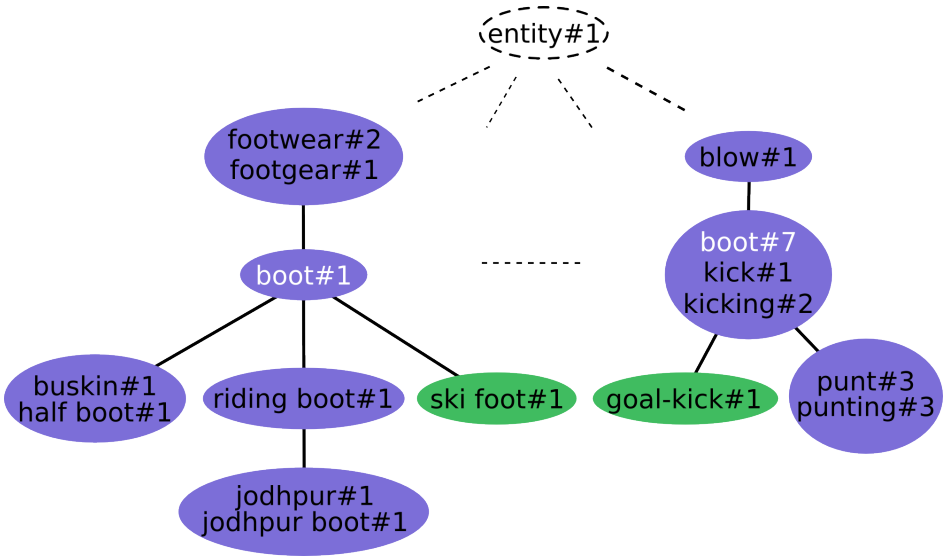

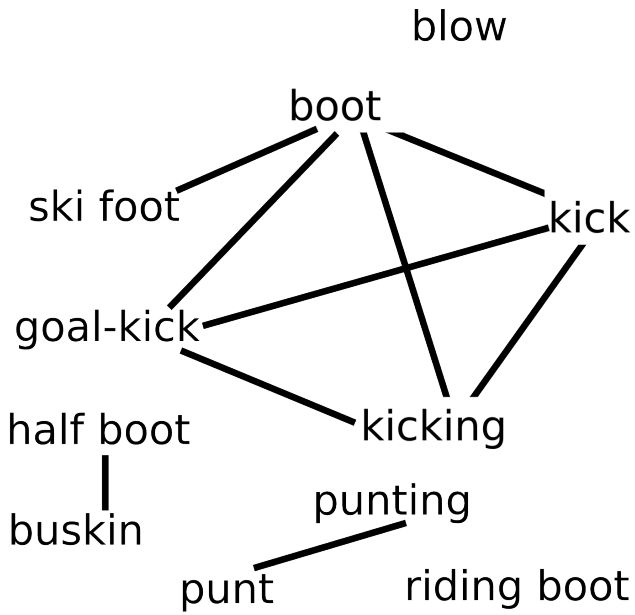

Extracting Dicosyn synonymy network

Dicosyn

- compilation of synonymy relations extracted from 7 dictionaries *(Bailly, Benac, Du Chazaud, Guizot, Lafaye, Larousse and Robert)* ;
- produced at ATILF, corrected at CRISCO lab: `http://elsap1.unicaen.fr/dicosyn.html`
- wordsenses are flattened ;
- network already built ;
- just need to be symmetrized.

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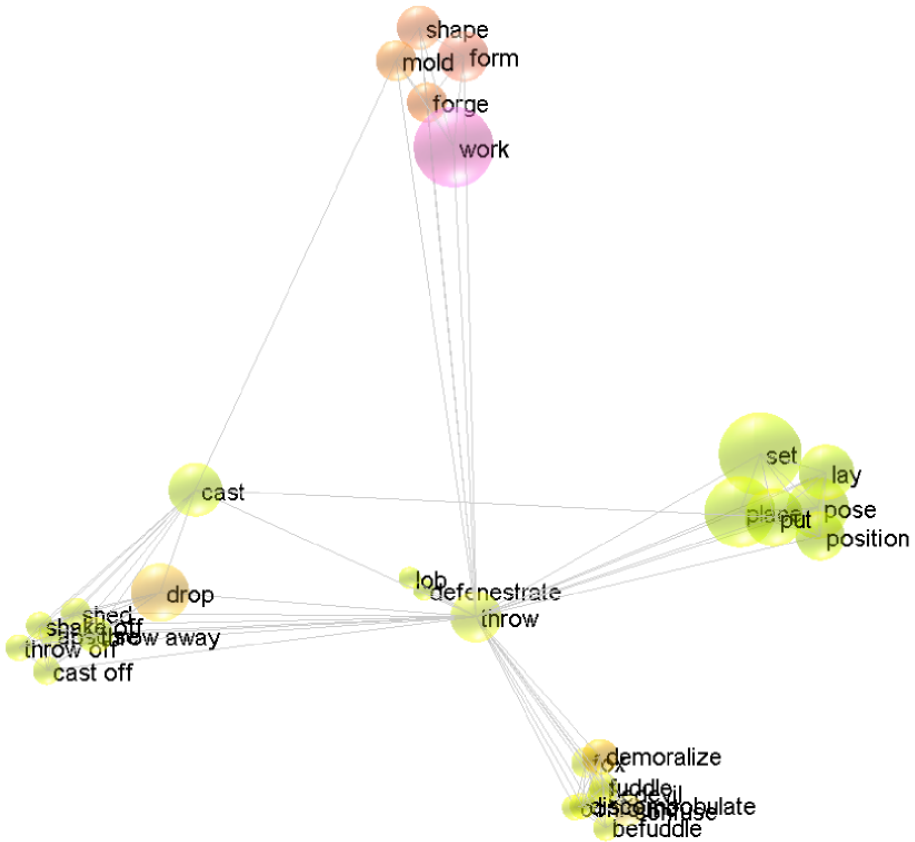

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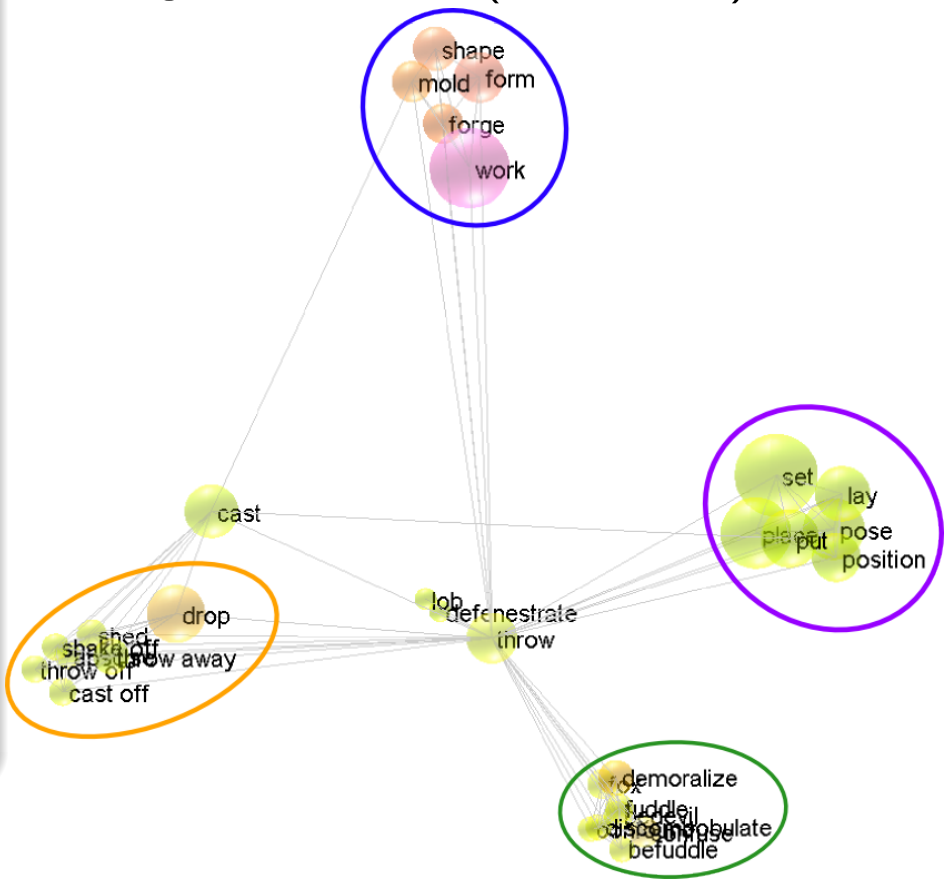

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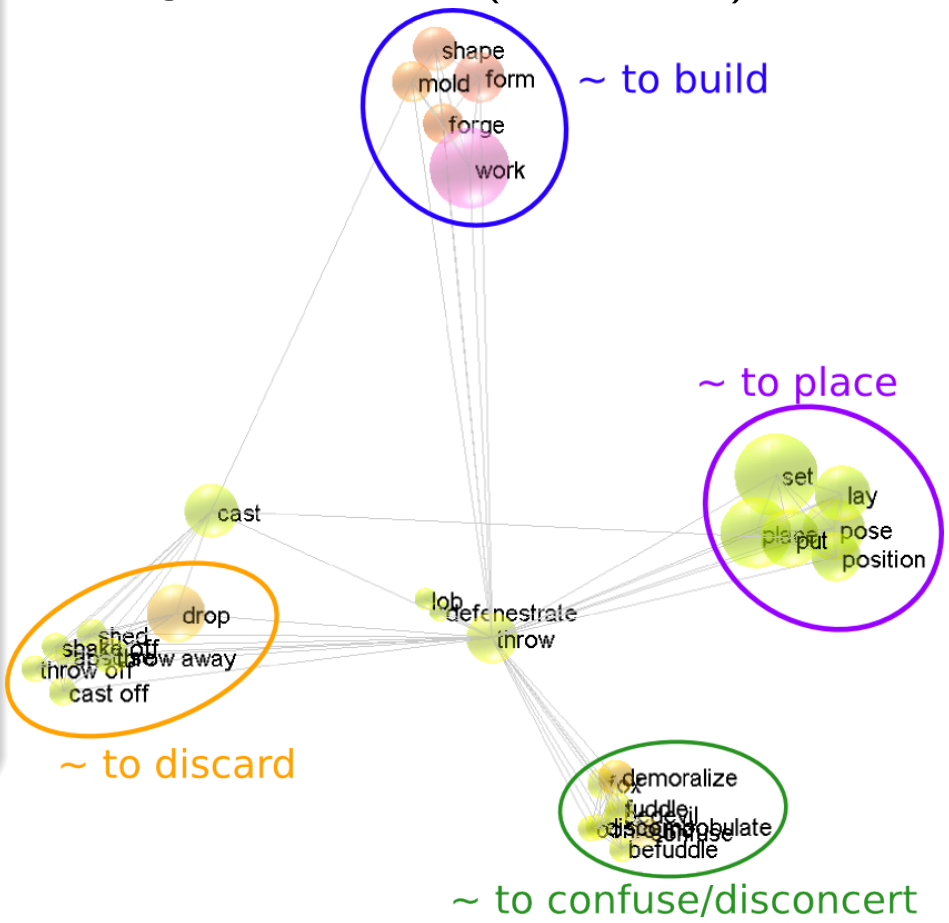

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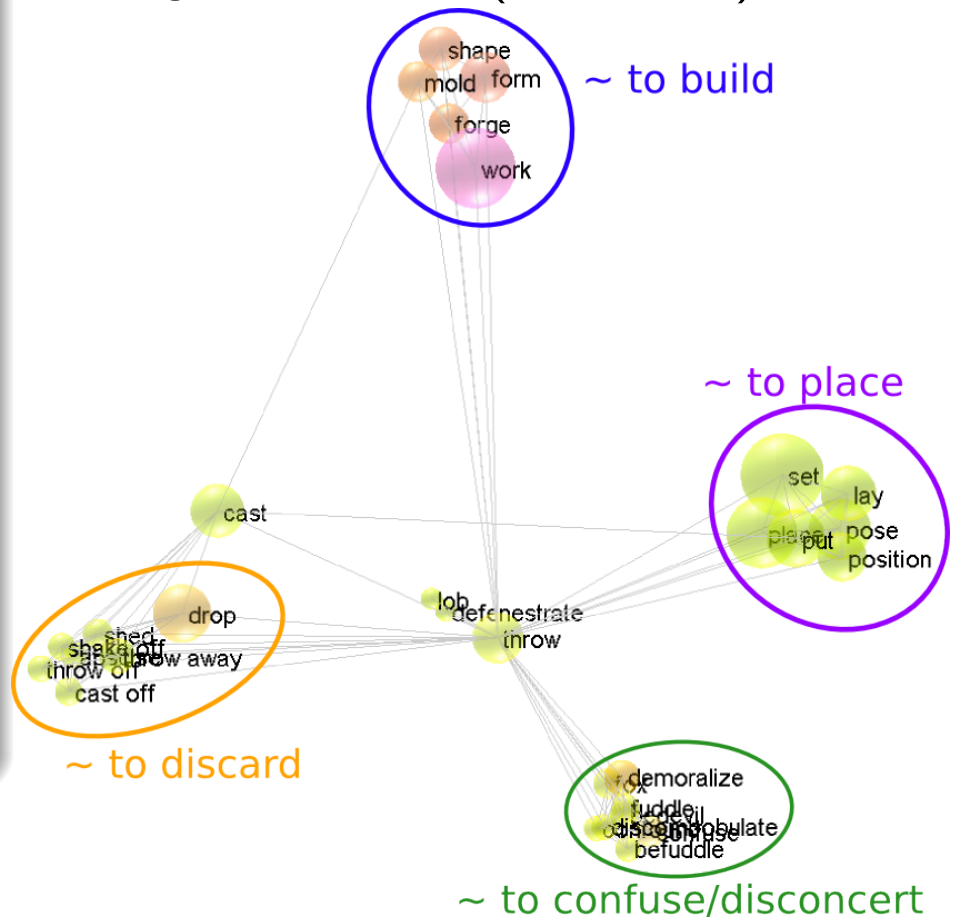

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- $\longrightarrow$ we can take advantage of SW's characteristics!

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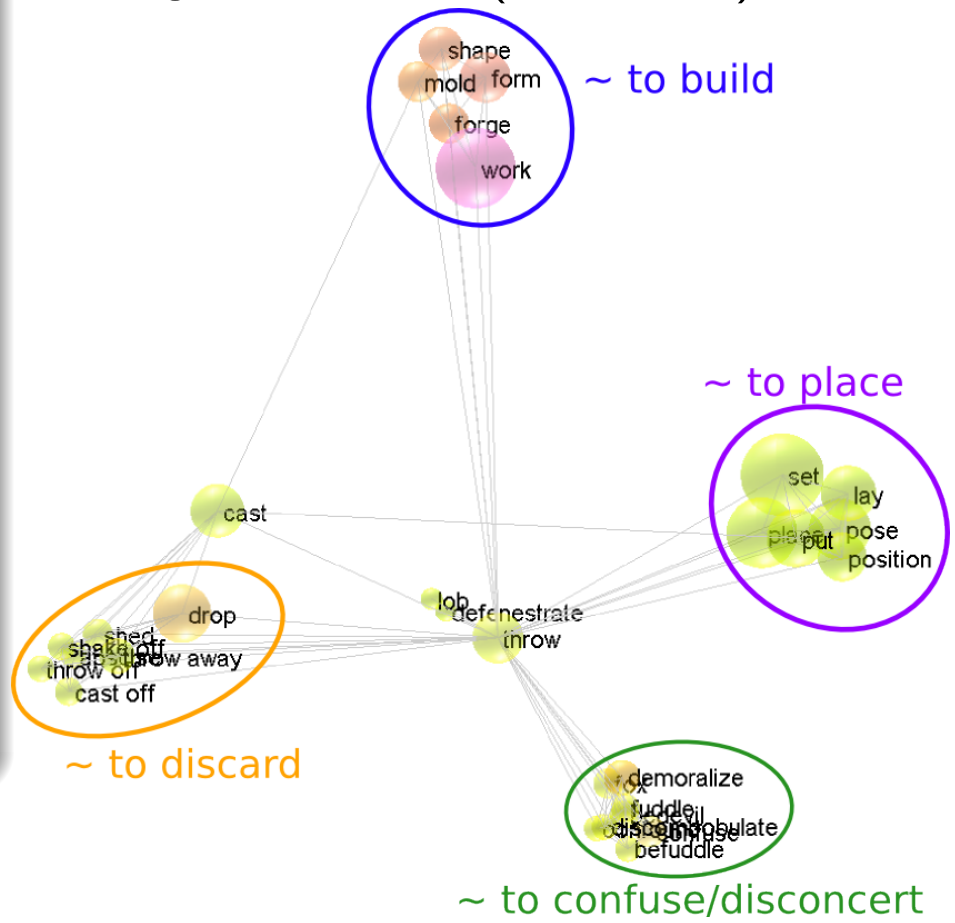

Wiktionary FR/Dicosyn

Lexical coverage/Synonymy network

	Words				
	Wikt.	DicoSyn	Shared	P	R
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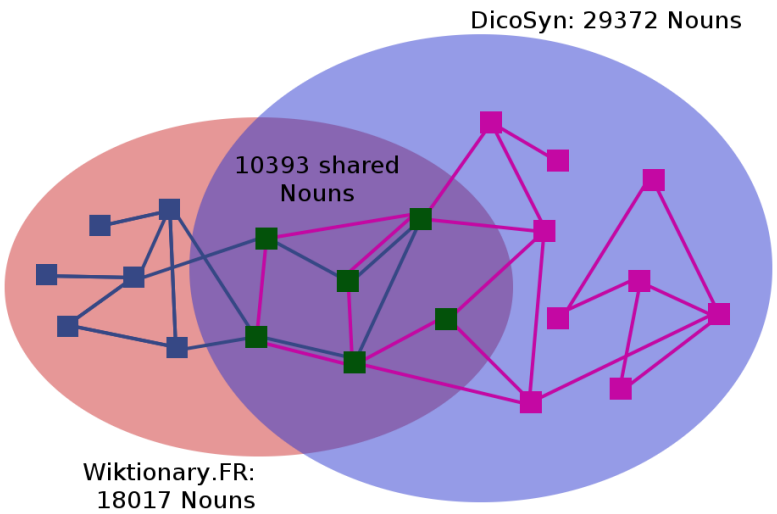

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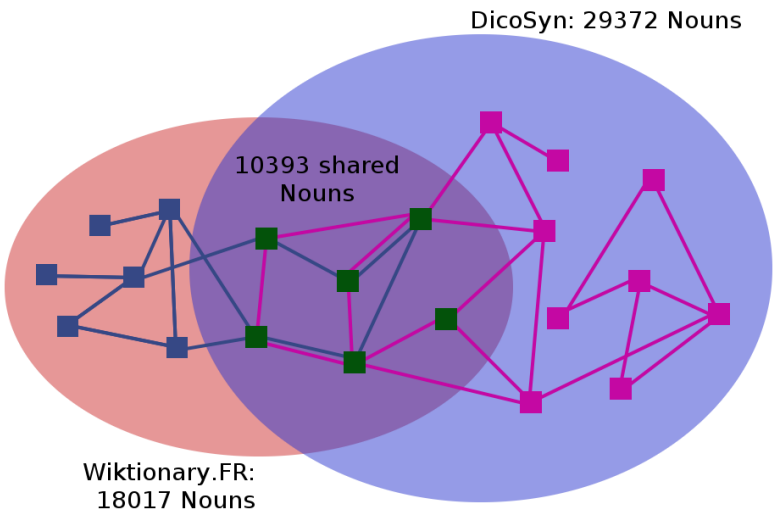

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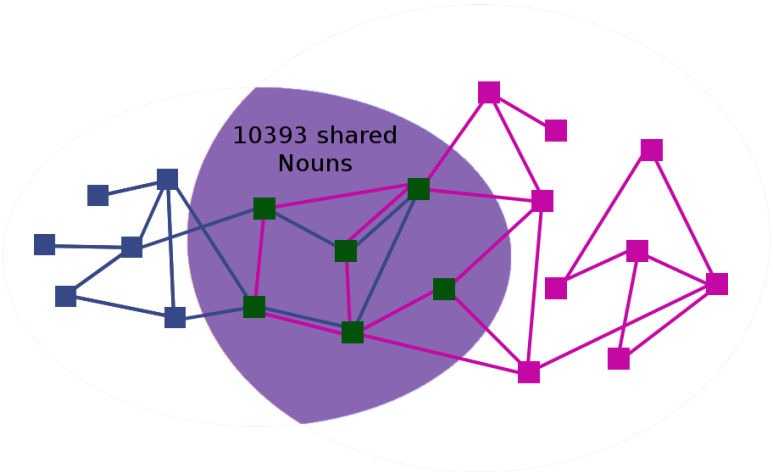

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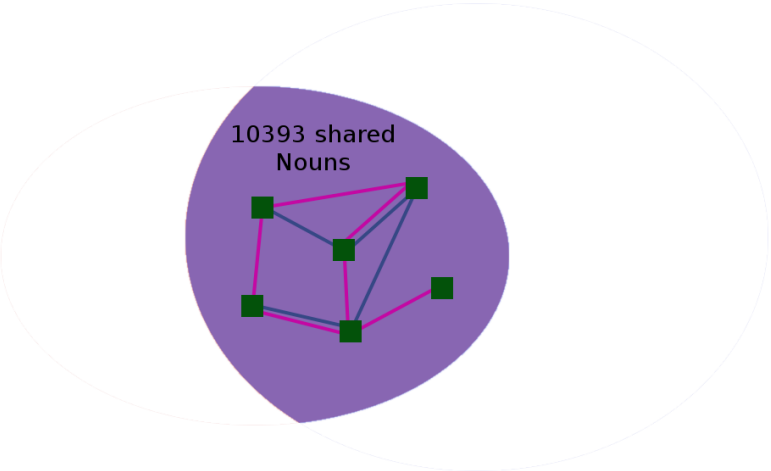

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A	1300	17404	1677	78%	7%
V	899	23968	1267	71%	4%

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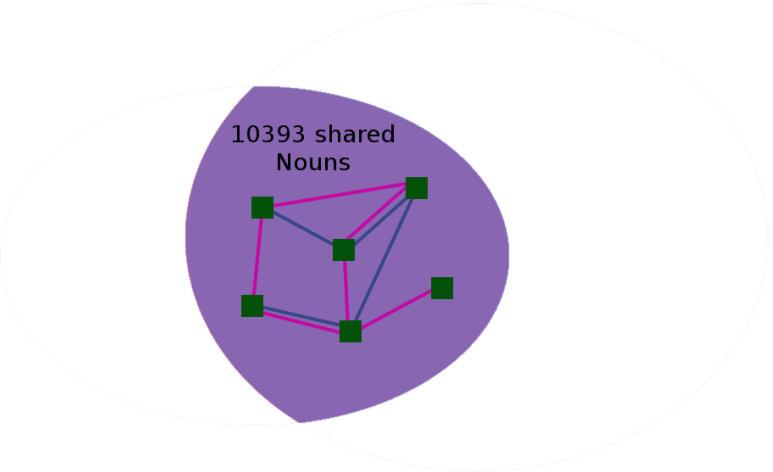

Wiktionary EN/WordNet

Lexical coverage/Synonymy network

	Words				
	Wikt.	WordNet	Shared	P	R
N	22075	117798	14120	64%	12%
A	8437	21479	5874	70%	27%
V	6368	11529	5157	81%	45%

	Relations				
	Wikt.	Wordnet	Shared	P	R
N	6453	18440	2763	43%	15%
A	3139	12792	1314	42%	10%
V	2667	18725	993	37%	5%

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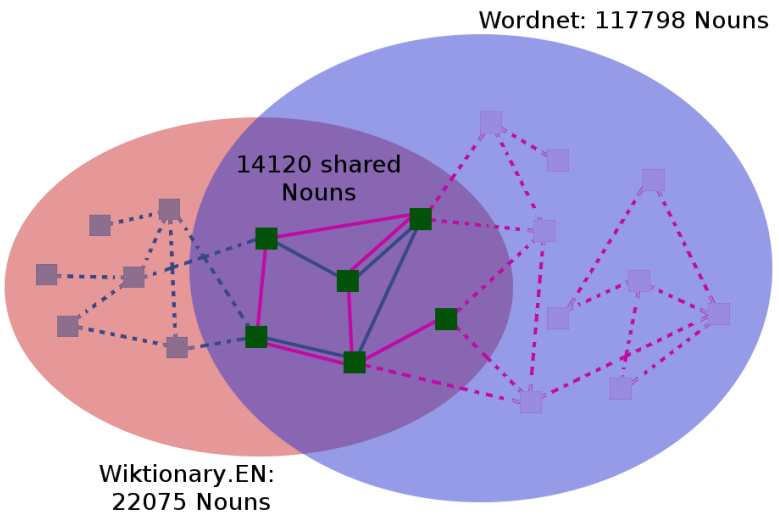

Comments. . .

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Intuition of transitivity

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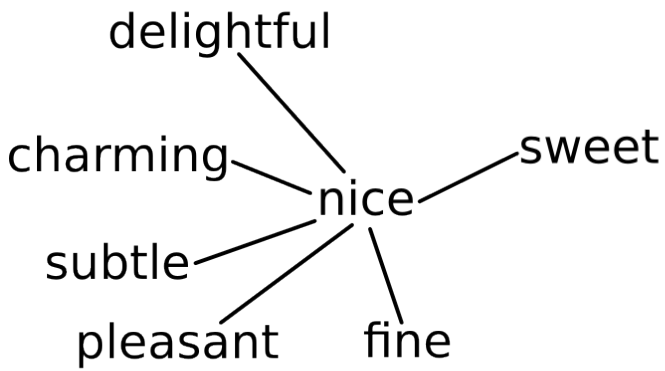

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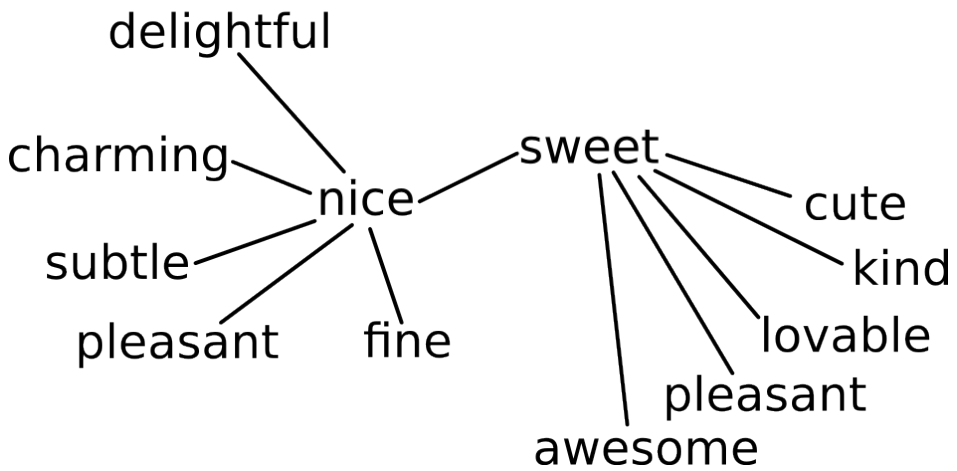

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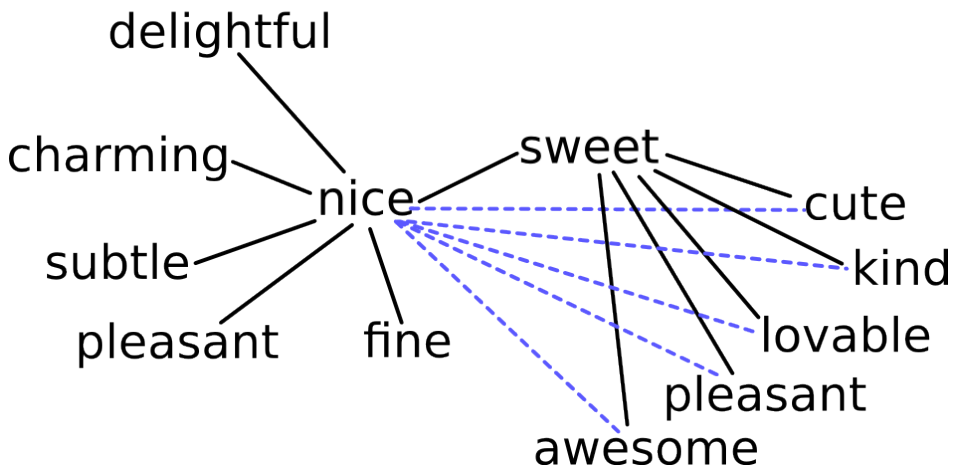

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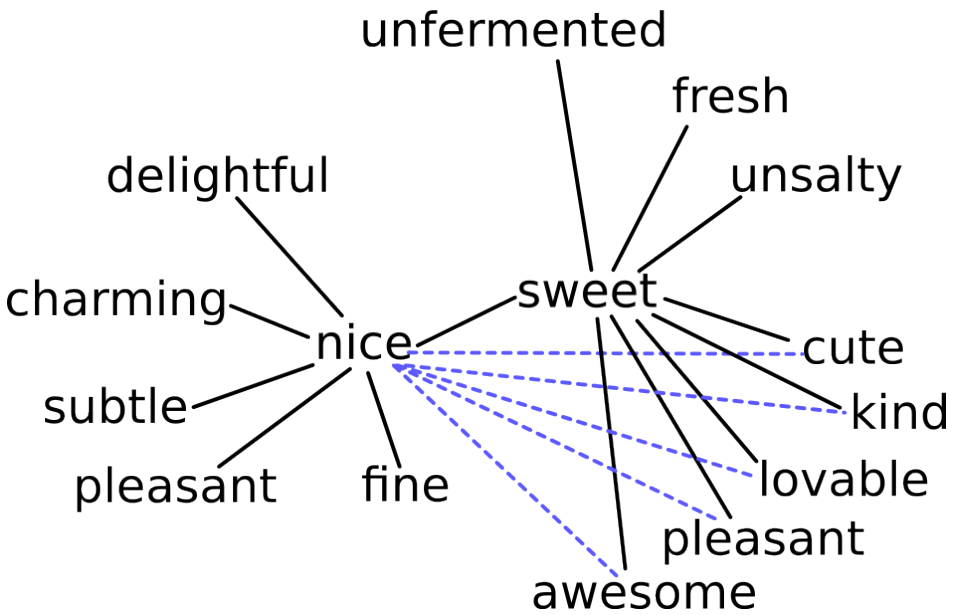

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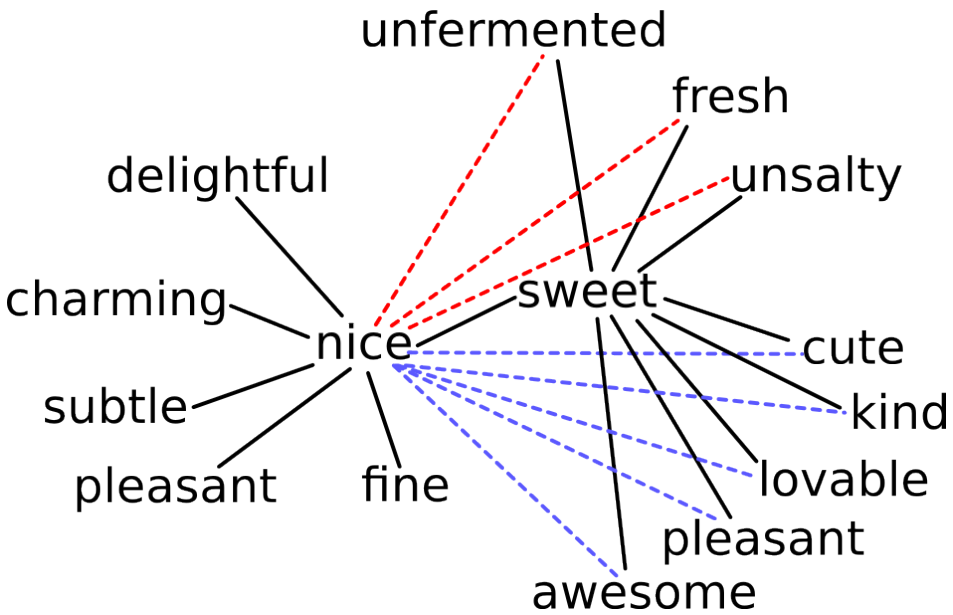
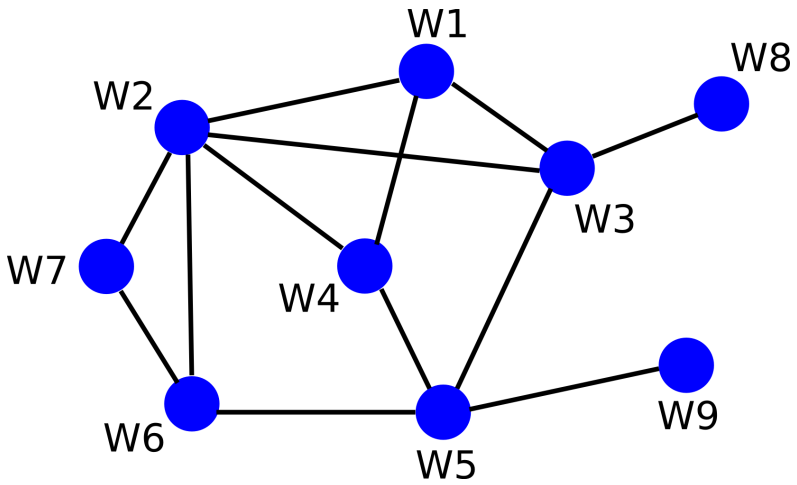


Prox method

Prox (Gaume et al.)

- A stochastic method designed to study Hierarchical SW
- Metrics: for any 2 vertices (`u`, `v`), computes *"the probability that a randomly wandering particle starting from u stands in v after k steps."*



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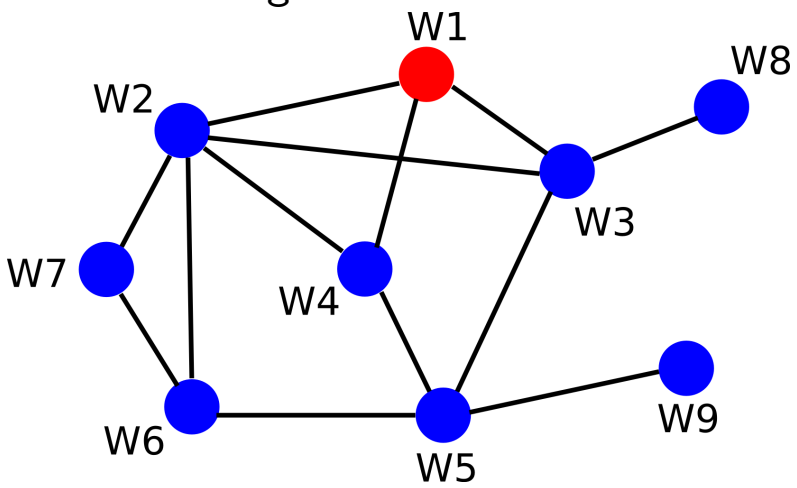
Eg. from Word1



	1	2	3	4	5	6	7	8	9
Initial	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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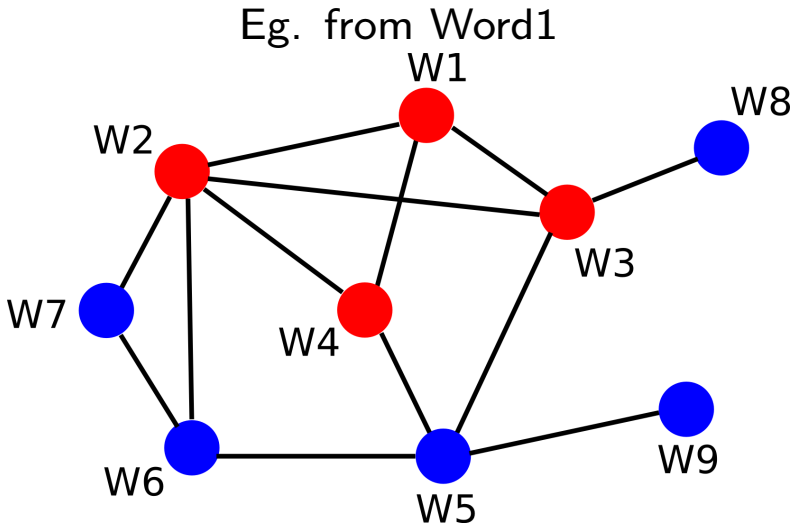

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Step 1	0.25	0.25	0.25	0.25	0.00	0.00	0.00	0.00	0.00

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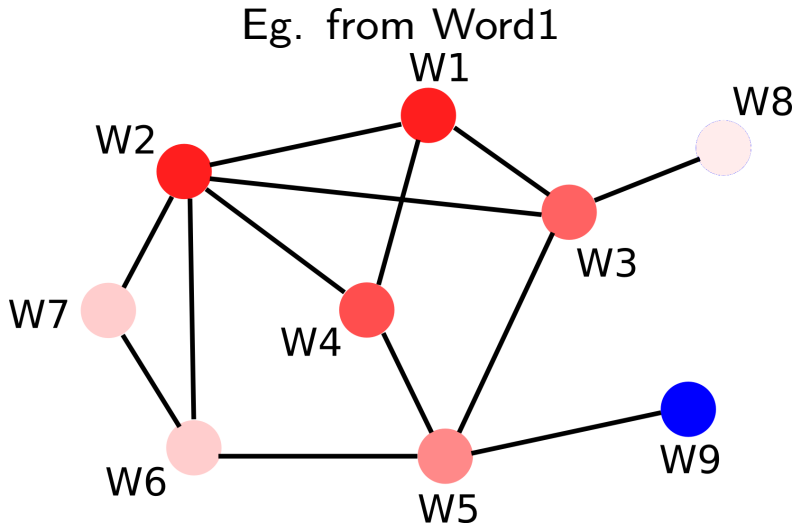

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Step 2	0.22	0.22	0.15	0.17	0.11	0.04	0.04	0.01	0.00

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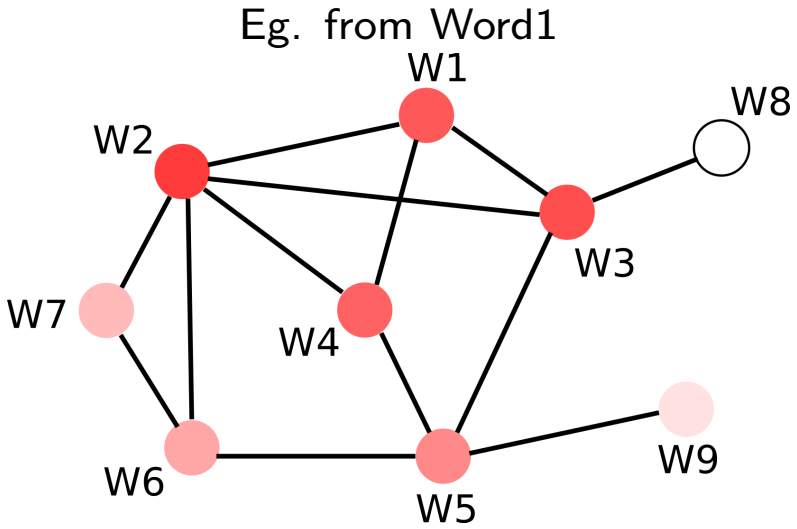

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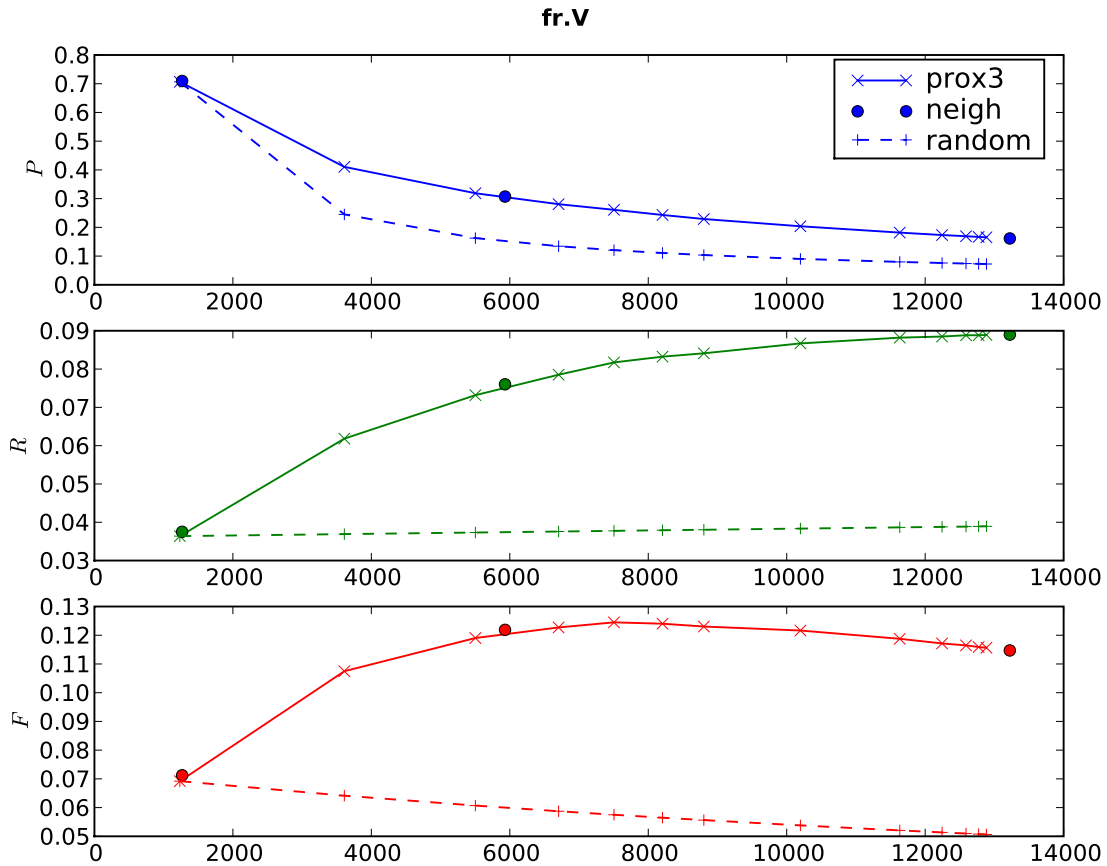
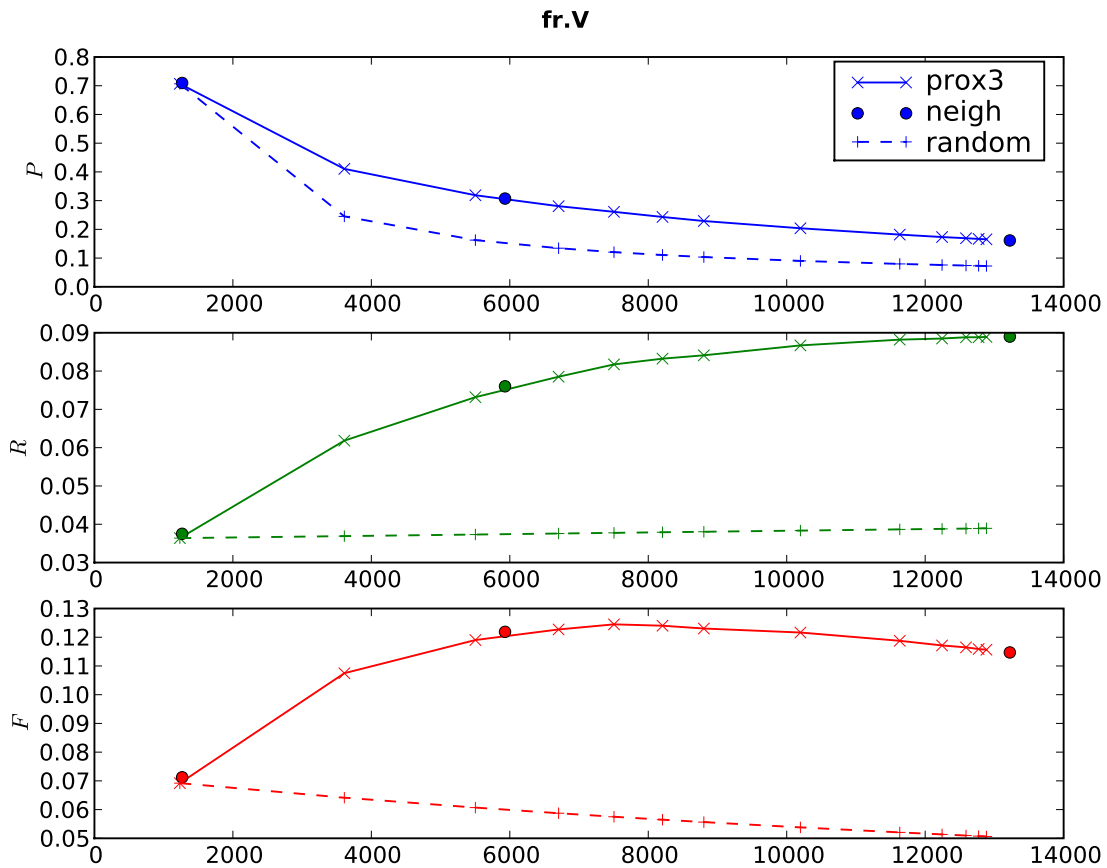
Step 3	0.16	0.19	0.17	0.15	0.11	0.08	0.06	0.00	0.02

Results


fr.V
prox3
neigh
random
P
R
F
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0
2000
4000
6000
8000
10000
12000
14000

Results



Comments

- Prox method provides (ordered) relevant links eg. *'to absolve'*↔*'to forgive'*, absent from WN
- false positives may be intersting to consider:
  - *'to uncover'*↔*'to peel'* (hypernymy)
  - *'to skin'*↔*'to peel'* ('inter-domain synonymy')

Translation links method

Intuition

2 words sharing many translations in different languages are likely to be synonymous

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$$Jaccard(w, w') = \frac{|T_w \cap T_{w'}|}{|T_w \cup T_{w'}|}$$

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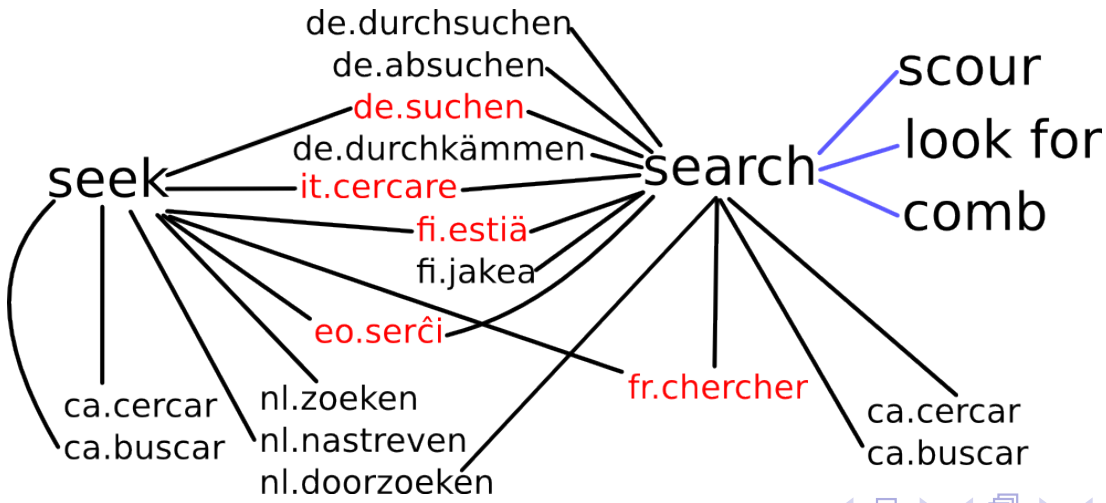
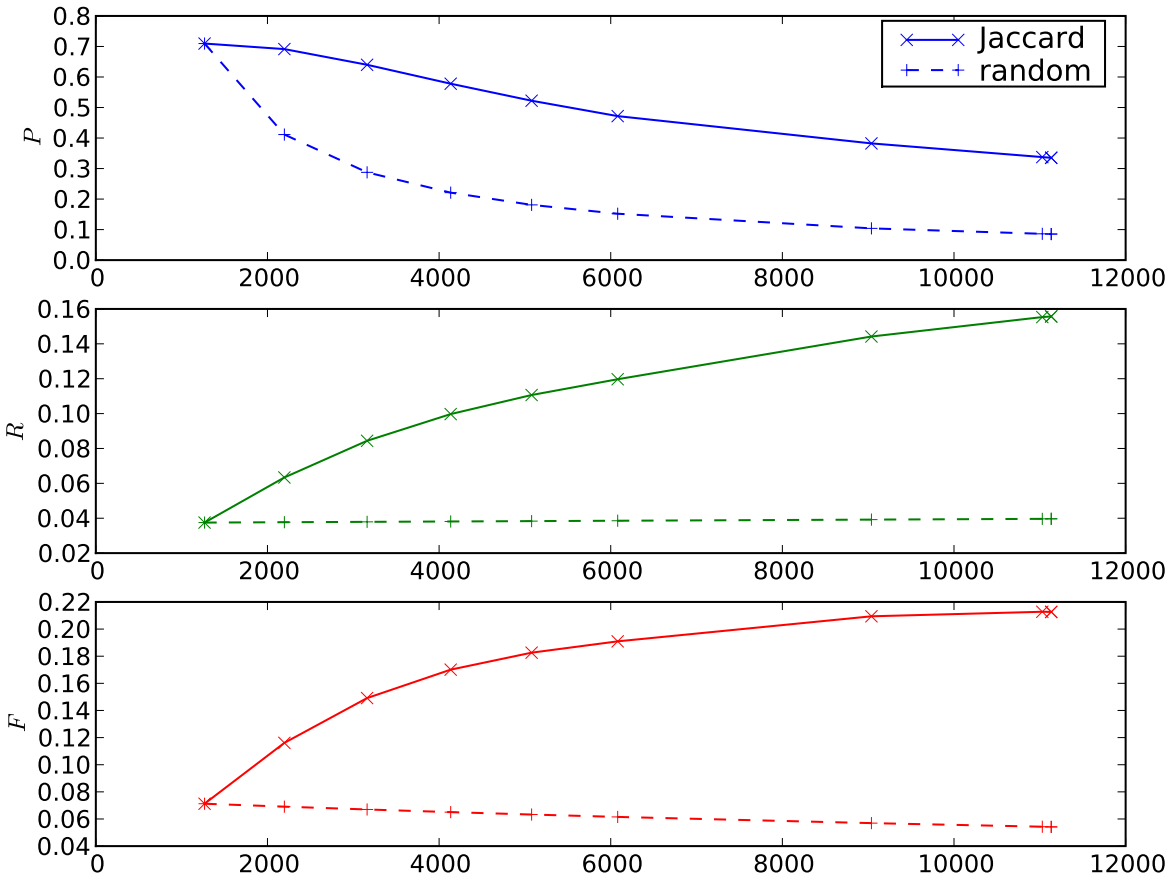
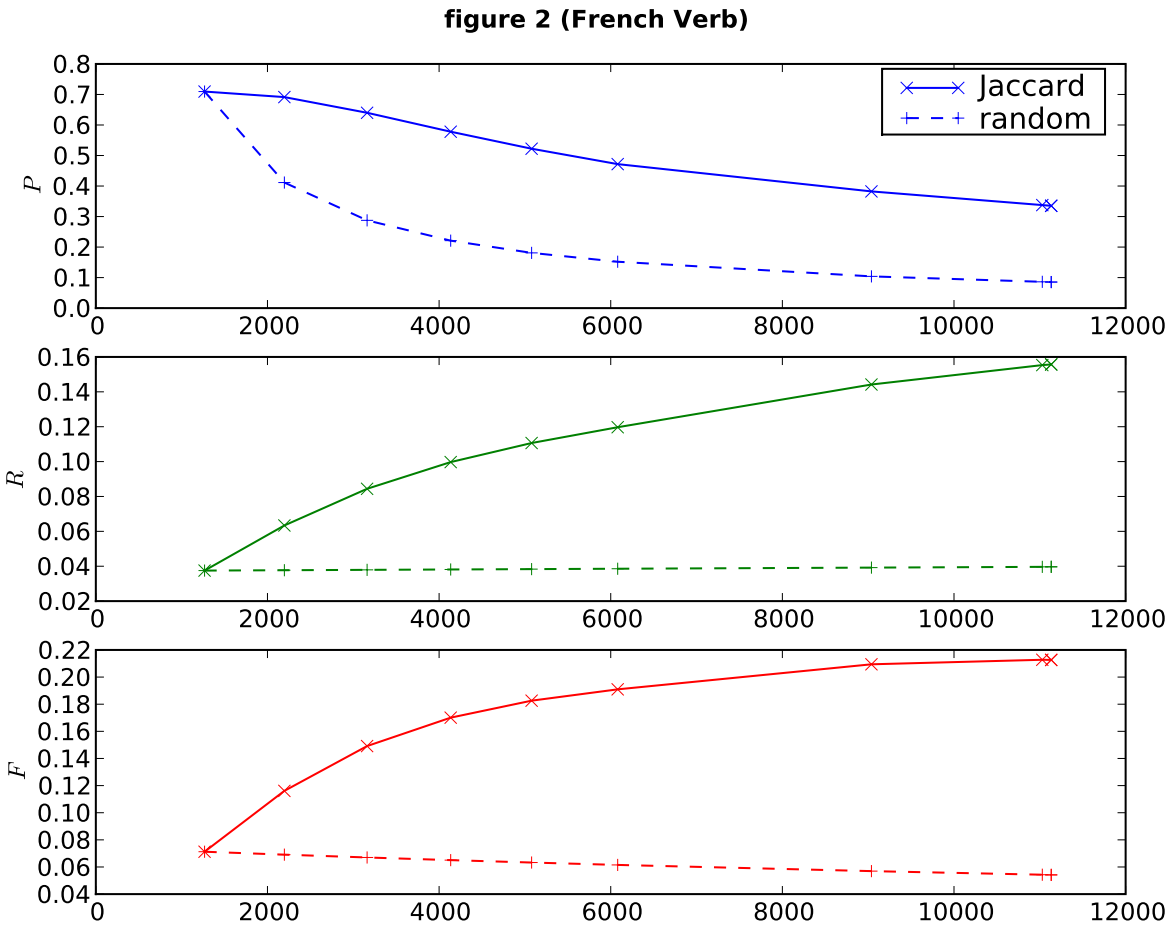


Results

figure 2 (French Verb)



Results



Comments

- adding first 1000 edges (+55%) → loss of only 2% precision
- added links are not the same as with Prox method

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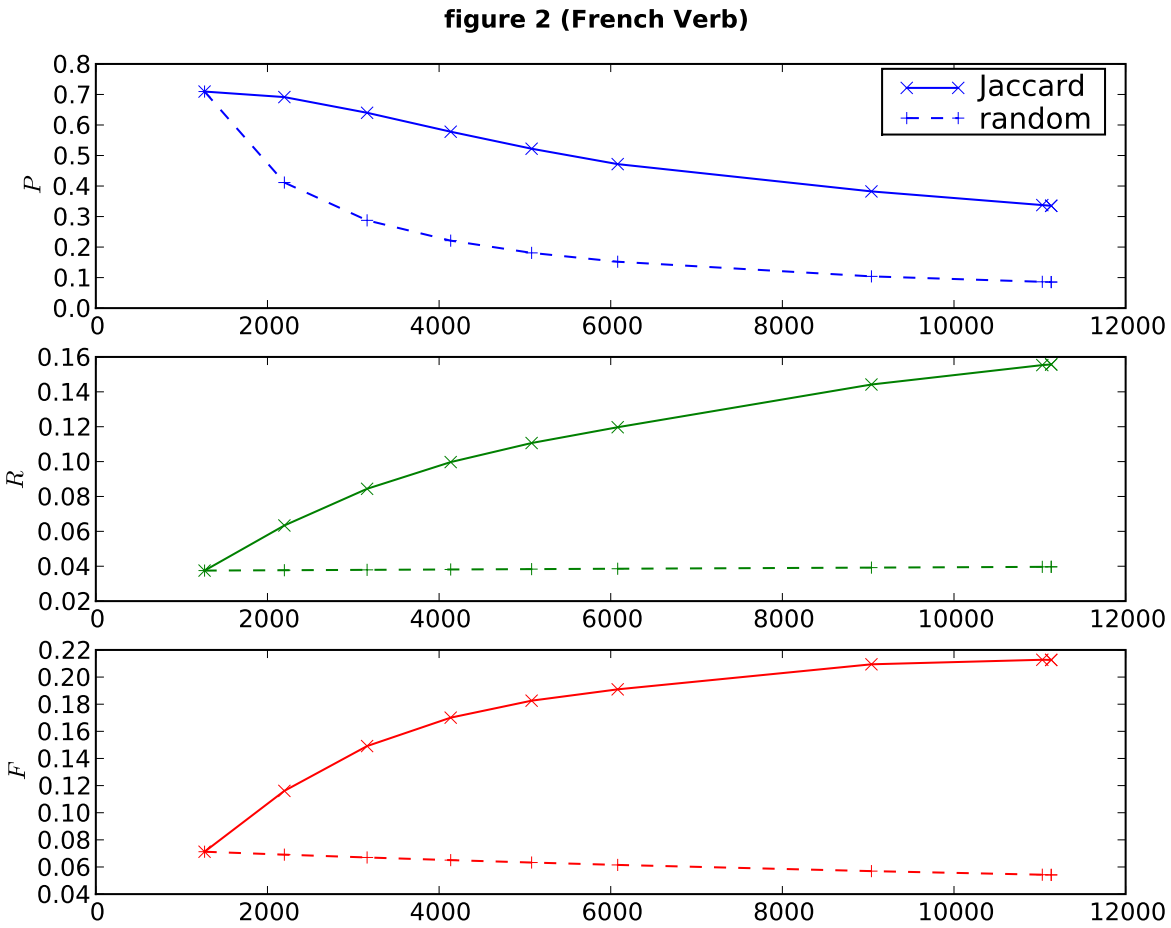

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Idea

- use translations method to densify the graph
- then use the clusters' structure (Prox)

Conclusion

Hypothesis are confirmed

- many missing links should be added among members of the same cluster
- words sharing many translations are likely to be synonymous

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- but there is room for improvement
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Direct application

- support for collaborative editing
- $\longrightarrow$ module to be included in Wiktionary's framework?
- a list of synonyms, ordered by relevancy may be provided to the contributor

Future work

Diachronic study

- study how wiktionaries evolve
- $\longrightarrow$ forsee contributors' NLP needs
- eg. when to apply the methods presented here

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Invariants and variability

- study of the (in)varibility of semantic pairings (Wiktionary as a multilingual synonymy networks)
- eg. *house/family*, *child/fruit*, *feel/know*

Thank you!

Questions?