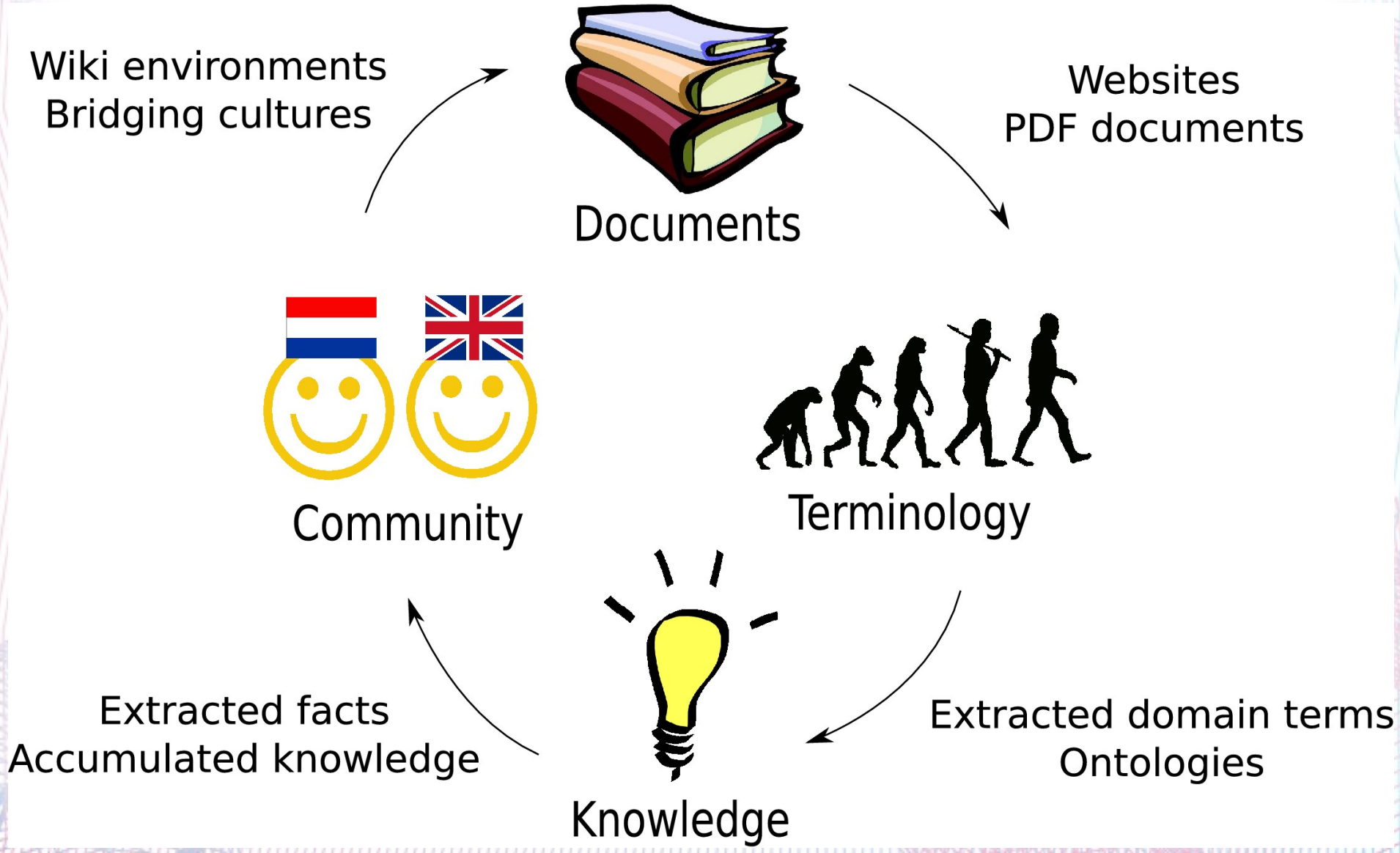
Language-neutral Term Extraction in the KYOTO-project

Wauter Bosma <w.bosma@let.vu.nl>
Piek Vossen <p.vossen@let.vu.nl>
Computational Lexicology and Terminology Lab
Faculty of Arts
VU University Amsterdam

Website: www.kyoto-project.eu

The KYOTO Knowledge Cycle



Semantics in Text

- Goal: domain modelling (*facts* & *concepts*)
- Example: *terrestrial species declined by 55%*
- Terms are components of facts:
  - Decline
  - 55%
  - Terrestrial species

Term extraction at the VU University

- We learn concepts from text rather than just terms, *e.g. lime tree, linden tree, basswood are different terms for the same concept*.
- A concept is defined by:
  - The set of terms that can refer to the same concept
  - The relations with other concepts, *e.g. migratory locust is a locust is a tree*
- Concept-structures are large semantic networks representing the full relational structure underlying a collection of domain text

Term extraction at the VU University

- We first extract all potential terms from text: maximizing recall;
- We then extract semantic relations between these terms to derive a coherent semantic model;
- Next, we select terms on the basis of relatedness and frequency

Strategies of Automatic Term & Relation Extraction

- Morpho-syntactic analysis (e.g., *terrestrial species* ⊂ *species*);
- Pattern-based analysis (e.g., *amphibious species such as frogs*);
- Distributional statistics (terms used similarly are similar, e.g. soup and sandwich are the object of eat);
- Concept merge (synonymous terms are represented once);
- Language alignment by means of wordnet mappings;
- Our strategy: use a combination of the above for extracting relations and ranking terms.

Step 1: Candidate Terms

- Nouns (or other POS) are candidate terms (e.g., *species*);
- The head of compound nouns are candidate terms (e.g. *landbouwbeleid*, *beleid*);
- Noun phrases are candidate terms (e.g., *vertebrate terrestrial species*);
- Reduced noun phrases are candidate terms. Modifiers are stripped one by one, towards the head:
  - vertebrate terrestrial species ⇢ terrestrial species ⇢ species
  - migration of species ⇢ migration of ⇢ migration

Step 2: Morpho-syntactic Analysis

- A noun phrase is a hyponym of derived reduced noun phrases (e.g., *terrestrial species* ⊂ *species*);
- A compound is a hyponym of its head (e.g., *landbouwbeleid* ⊂ *beleid* – *agricultural policy* ⊂ *policy*).

Step 3: Pattern-based Analysis

- Learning patterns from existing resources, eg. wordnets, species2000.
- Wordnet: hyponym(frog,amphibian)
- Corpus: *… amphibians such as frogs ...*
- Pattern: X such as Y
- Corpus: *… habitat for wading birds such as golden plover, lapwing and redshank*;

Enumerations

- … *golden plover*, *lapwing* and *redshank*.
- … *limiting the use of fertilisers, manures and pesticides;*
- Share a syntactic function;
- Share a common hypernym or attribute;
- Usually disjoint (*LREC attracted over 1000 researchers and people*);

Step 4: Distributional Statistics

WE SKIP THIS ONE

Step 5: Term concept merge

- Wordnets, term database and other resources provide relations within a language;
- For each term we determine the possible meaning in wordnet, e.g. is bird an animal or a woman?
- Infer which terms are synonyms within the document collection:
  - *lime tree, linden tree, basswood*
  - If *endangered* = *threatened*

    then *endangered species* = *threatened species*
- Group terms according to the wordnet hierarchy:
  - *Tundra swan*, *mute swan*, *common swan* and *whistling swan* are *swans* which are *aquatic birds*

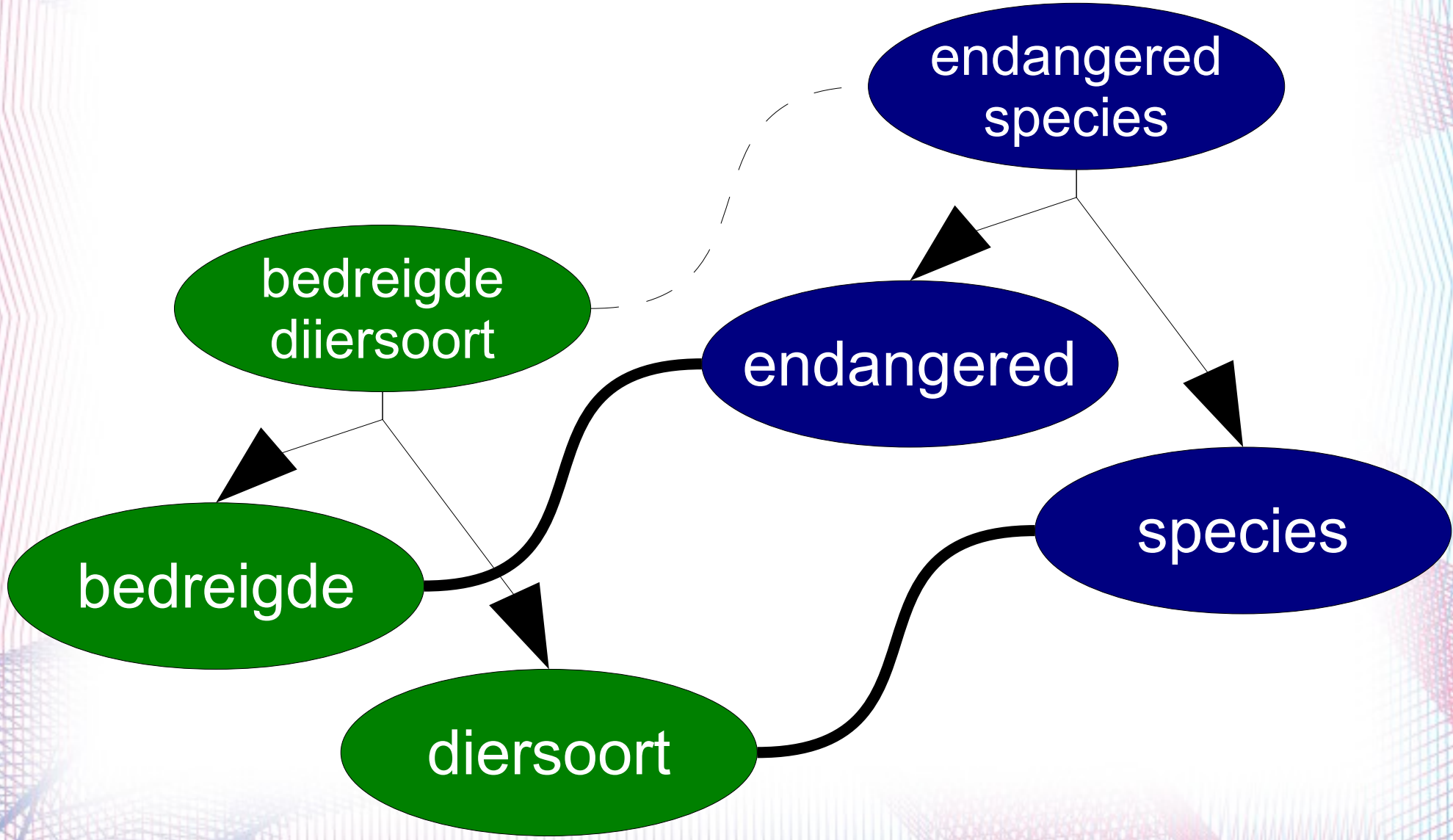
Step 6: Ranking Terms

- Distinguish domain-relevant terms from non-terms;
- (As opposed to distinguishing domain terms from generic terms;)
- No clear boundary;
- A confidence value is assigned to each candidate term, representing its 'termness';
- The confidence value is calculated from the term relation graph and occurrence frequency;
- Candidate terms above a certain confidence threshold may be regarded terms.

Step 7: Language Alignment

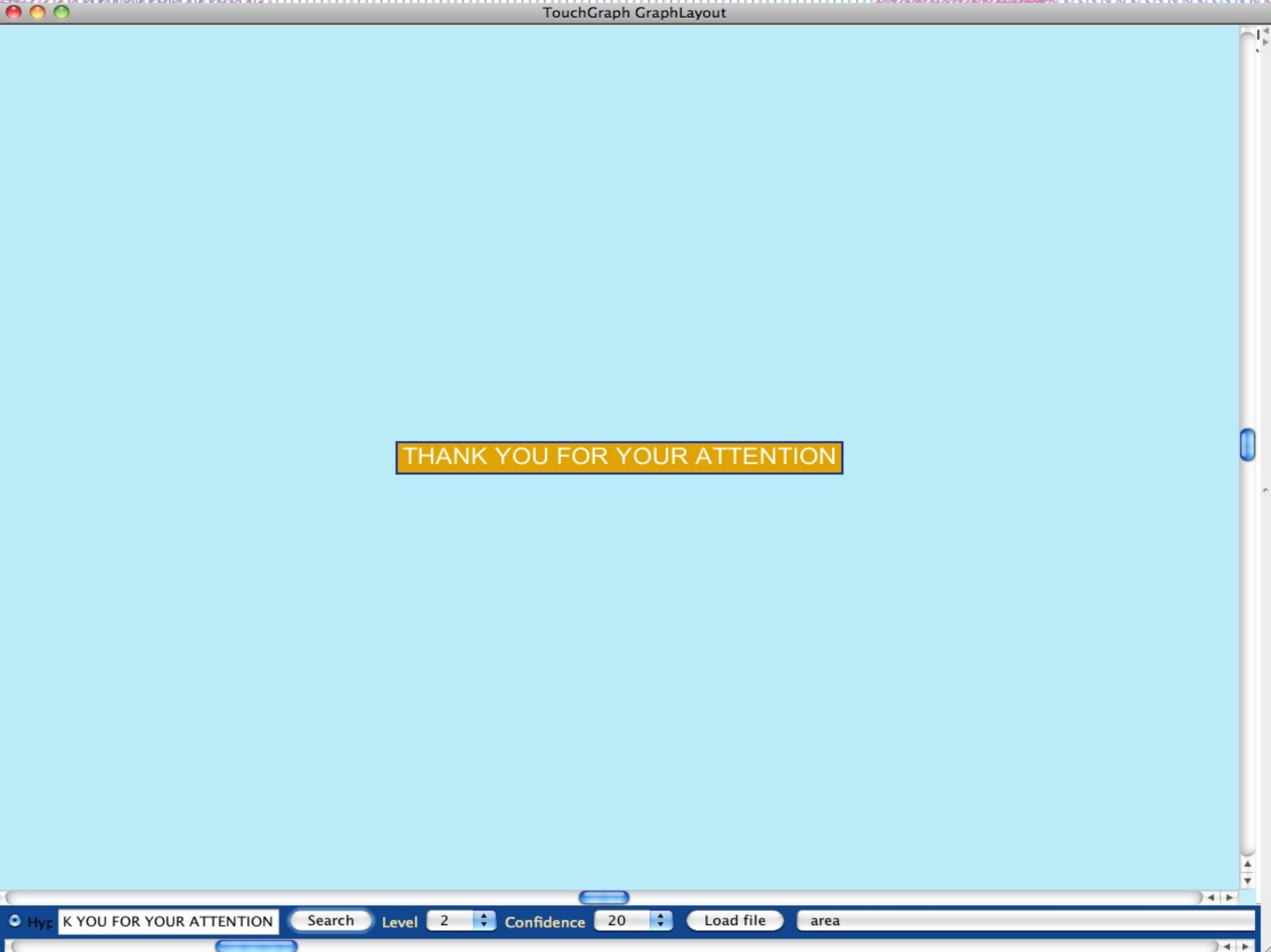
- Wordnet mappings provide relations between languages;
- Infer new relations between languages;

Language Alignment: Example



Advantages of concept approach

- Synonymous terms are represented as a single concept
- Opposition relations across semantically related concepts become clear
- Any semantic structure can be imposed on a set of target concepts with related terms
- Translation of concepts is easier than translating individual terms
- Term-concept structure can be used in Semantic web applications of the future
- Term-concept structures derived from different sources can be aligned more easily


TouchGraph GraphLayout
THANK YOU FOR YOUR ATTENTION
Hyp
K YOU FOR YOUR ATTENTION
Search
Level
2
Confidence
20
Load file
area