

Corpus Linguistics (L615)

Application #4: Translation

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Translation: Applications

Corpus-based translation studies

- ▶ **Theory:** How is an idea from one language conveyed in another language?
 - ▶ Compare different linguistic features in comparable texts
- ▶ **Practice:** provide material for:
 - ▶ Training translators
 - ▶ Developing applications like machine translation (MT) and computer-assisted translation (CAT)

Multilingual corpora

Multilingual corpora are corpora with multiple languages (two or more)

- ▶ Gain new insights, as compared to monolingual corpora
- ▶ Highlight language-specific, typological, or cultural features
- ▶ Useful for lexicography

Multilingual corpora (cont.)

Three types of multilingual corpora:

- ▶ Type A: Source texts plus translations (e.g., Hansards)
- ▶ Type B: Monolingual subcorpora designed with the same sampling technique
- ▶ Type C: Combination of A&B (e.g., EMILLE)

Parallel corpus (for us) is Type A, and **comparable corpus** is Type B

- ▶ Corpora with different varieties of the same language (e.g., Brown, LOB) are **comparative corpora**

Parallel corpora

Parallel corpora can be uni- or multi-directional

- ▶ i.e., there could be translations in either or both directions

Parallel corpora are useful for a variety of purposes

- ▶ e.g., comparing the scopes of meaning of the progressive in Chinese & English
- ▶ e.g., training MT models for word translations
 - ▶ MT training is much harder with, e.g., comparable corpora

The direction of translation is particularly important, as it may affect the naturalness . . .

Translated language

In general, parallel corpora are limited by the direction of the translation

- ▶ Each translation represents only one person's interpretation
- ▶ This affects corpus searching and dramatically affects MT evaluation
 - ▶ i.e., there is no one "gold standard"

Also, a translation may contain distinctive features not found in regular use of that language, e.g.:

- ▶ Relatively lower proportion of lexical words over function words
- ▶ Relatively higher proportion of higher-frequency words
- ▶ Less variety in the words that are most frequently used

One solution is to use bidirectional corpora

Comparable corpora for translation

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- It turns out that corpus-aided translation has benefits
- ▶ Higher quality w.r.t. subject field understanding, correct term choice, & idiomatic expressions
 - ▶ Translators seem to make fewer mistakes
 - ▶ especially when translating from a mother tongue into a foreign tongue

Machine translation (MT)

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- Machine translation relies upon parallel corpora
- ▶ Example-based machine translation (EBMT): compare a new sentence to a database of aligned texts
 - ▶ Statistical machine translation (SMT): learn parameters from a parallel corpus

Alignment

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- An important step is to *align* corpus units
- ▶ at the level of the text, section, paragraph, sentence, and/or word
 - ▶ often useful to have a separate alignment file with pointers to, e.g., word IDs
- Basic methods for doing sentence alignment automatically:
- ▶ statistical: based on sentence length, in terms of words or characters
 - ▶ lexical/rule-based: exploit morpho-syntactic information to align
 - ▶ often more accurate, but slower, than statistical approaches
 - ▶ hybrid: integrate linguistic knowledge into a probabilistic system

Fairly accurate for sentence alignment of European language pairs

Recent trends in cross-linguistic lexical studies

Altenberg & Granger 2002

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- Contrastive linguistics characterized by:
- ▶ description of items to be compared; juxtaposition of cross-linguistic equivalents; & comparison between the items
 - ▶ Altenberg & Granger are interested in defining equivalence across languages
- Parallel corpora are useful for general definitions of word equivalence:
- ▶ There are different ways of defining equivalence between words
 - ▶ translation equivalence seems the most reliable
 - ▶ Judgment is not up to the researcher with translator equivalence

Inconsistencies in translation?

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- One way to deal with inconsistencies with different translations in determining equivalence:
- ▶ Only examine words which lead to the same back-translation
 - ▶ This could eliminate translator idiosyncrasies
 - ▶ Quantitatively, we can measure *mutual correspondence* between words: how often is word X translated as word Y, and vice versa?

Aspect marking in English and Chinese

McEnery, Xiao, & Mo 2003

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- Using *comparable* corpora, we can compare aspect marking across languages
- ▶ Aspect marking in English & Chinese
 - ▶ perfective aspect in Chinese marked by *-le*, *-guo*, verb reduplication, & resultative verb complements
 - ▶ imperfective aspect in Chinese marked by *zai*, *-zhe*, *-qilai*, & *-xiaqu*
 - ▶ In English: imperfect indicated by progressive & perfect progressive
 - ▶ Both languages show more aspectual marking in narrative texts

Some notable parallel corpora

- ▶ **MULTEXT-East**: for Bulgarian, Croatian, Czech, English, Estonian, Hungarian, Lithuanian, Resian, Romanian, Russian, Slovene, and Serbian. For most languages: Orwell's 1984.
- ▶ **Hansard Corpus**: from the official records (Hansards) of the 36th Canadian Parliament [1997-2000], 3 mio. words
- ▶ **Europarl**: extracted from the proceedings of the European Parliament; includes versions in 11 European languages: Romanic (French, Italian, Spanish, Portuguese), Germanic (English, Dutch, German, Danish, Swedish), Greek and Finnish. Ca. 20 mio. words.

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13 / 25

Working with multilingual corpora

On jones: /Volumes/Data/Corpora/multilingual/

Let's look specifically at the EUROPARL corpus (europarl/, <http://www.isi.edu/~koehn/europarl/>):

- ▶ parallel corpus extracted from the European Parliament web site by Philipp Koehn (USC/ISI)
- ▶ 25-30 million words per language pair
- ▶ main intended use is to aid statistical machine translation research

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14 / 25

Sentence aligner

From the README:

Sentence aligner

You can create any parallel corpus with the command

```
./sentence-align-corpus.perl L1 L2
```

where L1 and L2 can be any of the 11 languages
da de el en es fi fr it nl pt sv

The output is stored in the aligned/ directory

...
Creating a parallel corpus takes about half an hour
on a 2GHz Linux machine.

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15 / 25

Aligned text on jones

We have the English & German subcorpora aligned

- ▶ found in the aligned/en-de/ subdirectory

The text is broken up with meta-information

- ▶ <CHAPTER> tags indicate a new chapter
- ▶ <SPEAKER> tags indicate when a new person is speaking
- ▶ <P> marks paragraph boundaries

We can use these coarse structural boundaries to help us track down equivalencies we are interested in

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16 / 25

Translations for one

Let's say I'm interested in translations for *one* from English to German

1. Search the English corpora for all instances of *one*
 - ▶ Mark the structural unit in which each one occurs
2. Search the corresponding German corpora, looking for the specific locations where *one* occurred
 - ▶ Output those units in both English & German
 - ▶ If we knew all possible translational equivalents, we could restrict our attention to sentences of interest

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17 / 25

Implementation

Searching the English corpus

We loop over all the files in the English directory: see the perl code (one.pl) for more details on that

We have 3 main bookkeeping variables:

```
$unitnum = 1; # which structural unit we're on  
$found_one = 0; # whether we've found 'one' or not  
$previous_lines = ""; # all the lines to print out
```

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18 / 25

Implementation

Matching *one*

We search each line for the presence of *one* and keep track of every line within this structural unit:

```
# Store all the previous lines
else {
    $previous_lines .= $_;
}

# Test whether 'one' appears in this unit: if so,
# set $found_one to be some non-zero value
if (/\\bone\\b/i) {
    $found_one = $unitnum;
}
```

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19 / 25

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Implementation

Structural units

The corpus is aligned by structural units, such as paragraph and speaker

Thus, we define a simple function which tells whether we've hit one of those markers:

```
sub new_unit {
    if (</(CHAPTER|SPEAKER|P>)/) { return 1; }
    else { return 0; }
}
```

Then, if we hit a new unit and if we also have previously found *one*, we want to record that (see next slide)

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20 / 25

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Indexing the items

We store the index of this item + its content in a dictionary *En*

```
# new_unit indicates that we're starting
# a new unit of text
if (&new_unit($_)) {

    # The criterion for adding to the En hash is that
    # we've found the word we're looking for
    if ($found_one) {
        # make the original word more noticeable
        $previous_lines =~ s{\\b(one)\\b}{<ONE>$1</ONE>}ig;

        # store this position for later
        $key = $filename.'='.$unitnum;
        $En{$key} = $previous_lines;
    }
}
```

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21 / 25

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Searching the German corpus

The search through the German corpus is similar, but the criterion is no longer whether we've seen *one*

- ▶ but rather: is this the same structural unit as in the English corpus?

```
if (&new_unit($_)) {
    $key = $filename.'='.$unitnum;
    # The criterion for adding to the De hash is that
    # the corresponding English unit had the word
    # we're looking for
    if (exists $En{$key}) {
        $De{$key} = $previous_lines;
    }
    ...
}
```

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22 / 25

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Implementation

Outputting the items

```
@en_keys = keys %En;
foreach $key (@en_keys) {
    if (exists $De{$key}) {
        select EN_OUT;
        print "$key\n$En{$key}\n";

        select DE_OUT;
        print "$key\n$De{$key}\n";
    }
}
```

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23 / 25

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English output

```
ep-00-05-04.txt=140
<P>
```

It is equally obvious that responsibility must be shared fairly between international players and that there must be correct and effective mechanisms relating to how this is to take place .

In this regard , I nonetheless feel a certain unease . We are not getting more information about an unduly small proportion of the EU budgetary fact going to practical reconstruction and an extremely large proportion of these resources we have allocated for the year 2000 being spent on the Administration of the reconstruction bureau , which is also a significant item of expenditure , but here we are talking about budgetary aid and energy imports .

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24 / 25

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German output

ep-00-05-04.txt=140
<P>

Ebenso selbstverst?ndlich m?ssen die Lasten auf der Grundlage
deutlichen Vorschriften gerecht zwischen den verschiedenen in
ren verteilt werden .
In dieser Beziehung bin ich jedoch etwas beunruhigt , denn un
ehr Nachrichten dar?ber , da? ein zu kleiner Teil der EU-Hilf
rklich dem konkreten Wiederaufbau zugute kommt , w?hrend ein
r von uns f?r das Jahr 2000 veranschlagten Mittel f?r andere
d .
Die Verwaltung des B?ros f?r Wiederaufbau ist eine solche Auf
lich auch wichtig ist , aber es geht beispielsweise auch um Z
lt und Energieimport .

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