Czech-to-English Translation:

MT Marathon 2009 Session Preview

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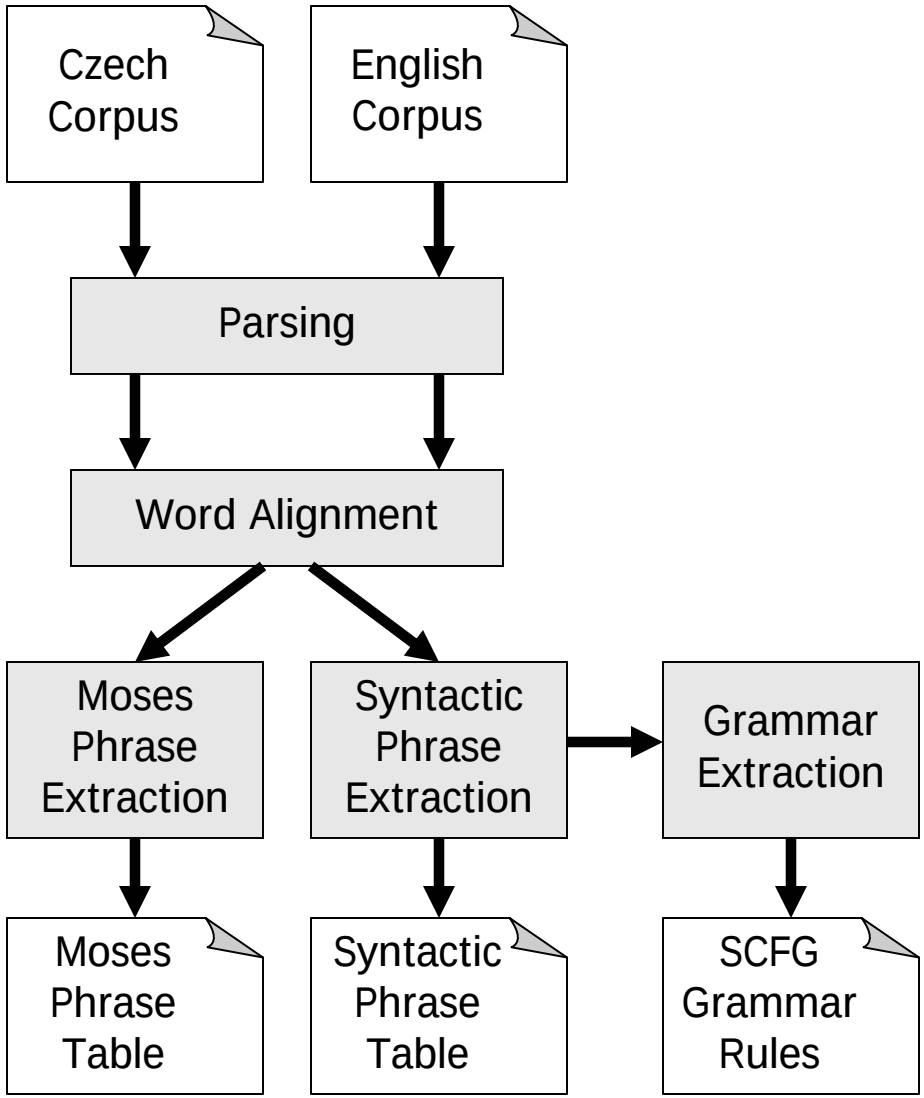
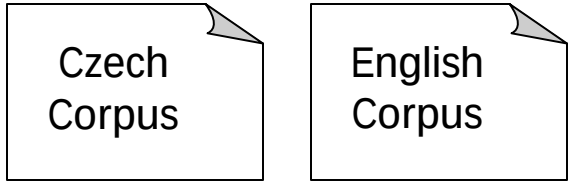
Outline

- Stat-XFER processing pipeline
- Processed Czech–English resources
- Possible workshop tasks
  - Syntactic phrase table combination methods
  - Synchronous grammar development
    - Selection of grammar rules
    - Exploration of label granularity
    - Development of manual grammars
  - Integration of morphological analysis

Stat-XFER Data Processing

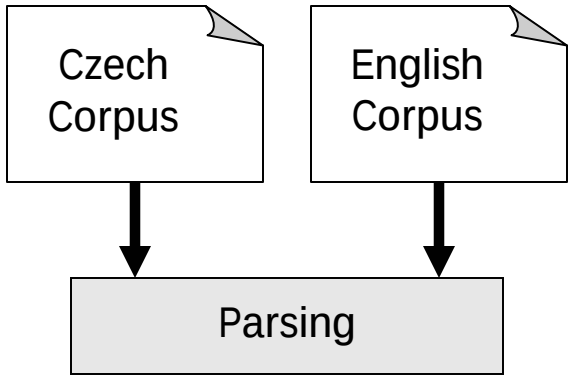


Stat-XFER Data Processing



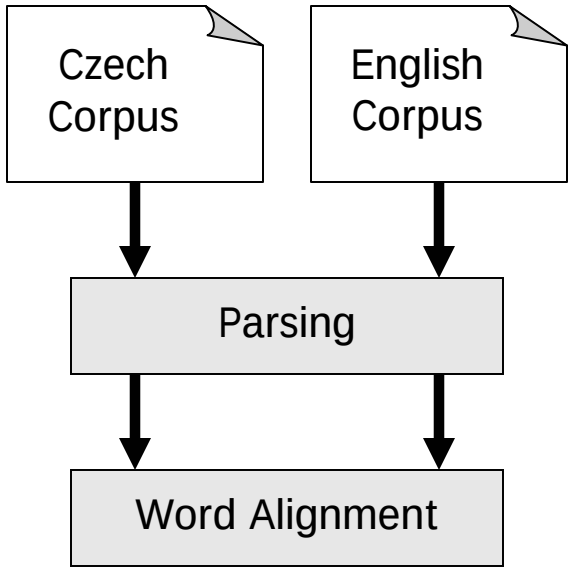
- Corpus:
  - Project Syndicate news data: portion of CzEng corpus (84,141 sentences)

Stat-XFER Data Processing



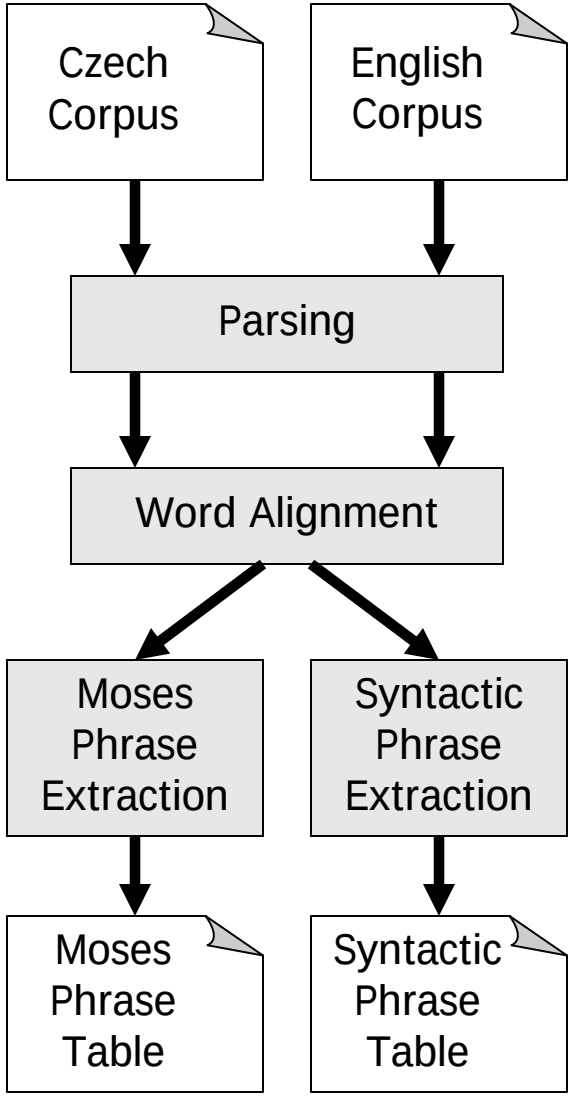
- Parsing:
  - Czech dependency parses by TectoMT; converted to projective c-structure
  - English c-structure parses by Stanford parser

Stat-XFER Data Processing



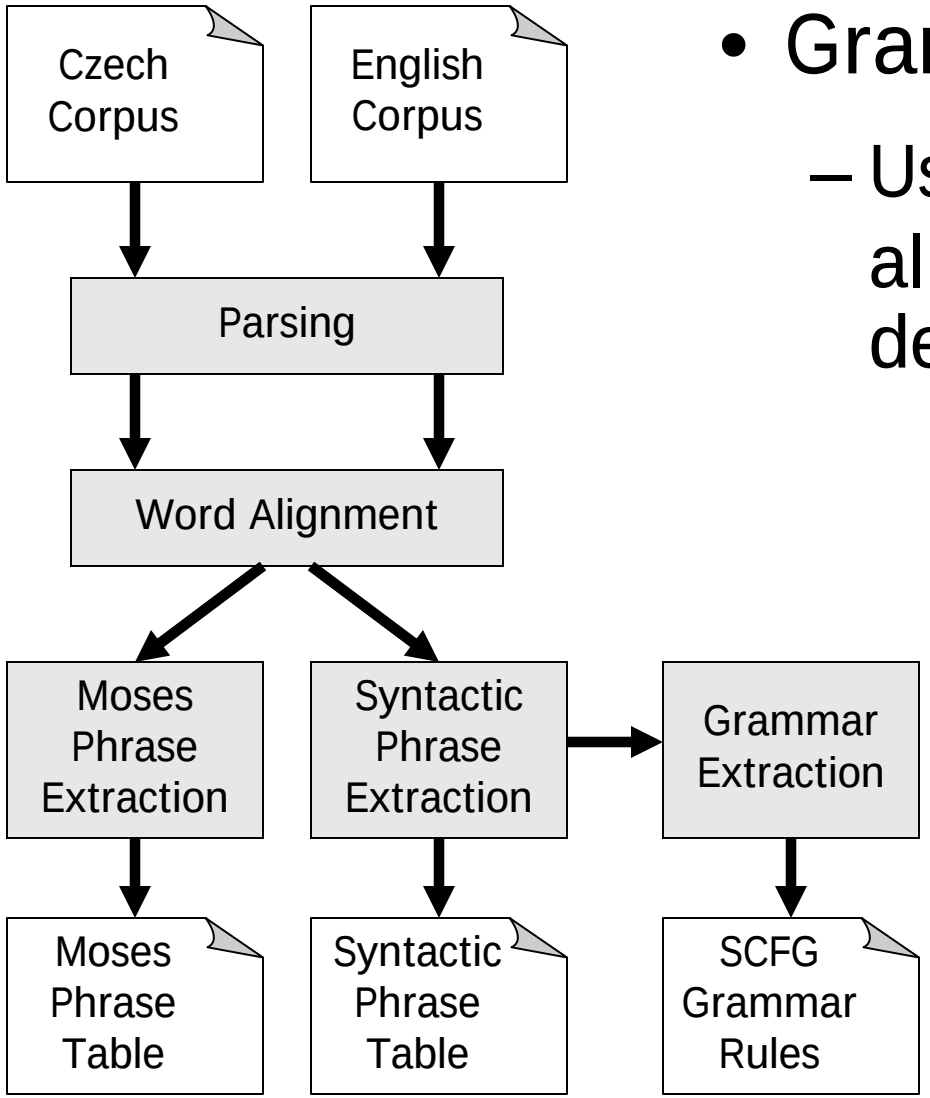
- Word alignment:
  - GIZA++ grow-diag-final alignment done in advance on tokenized corpus
  - Alignments computed on full CzEng corpus of 8 million sentences

Stat-XFER Data Processing



- Phrase extraction:
  - Syntactic extraction by PFA node alignment algorithm, t2ts mode
  - Non-syntactic extraction with Moses package

Stat-XFER Data Processing



- Grammar extraction:
  - Using syntactic node alignments as tree decomposition points

Final Result

- Two phrase tables, with counts:

1	NNS	NNS	rozumem	brains
3	NN	NN	rozumem	reason
4	NN	NN	rozumem	sense
1	NP	NP	rozumem	reason
1	NN	NN	rozumností	wisdom
1	JJ	JJ	rozumnou	sensible
1	ADJP	ADJP	rozumnou měrou jisté	reasonably certain
1	NP	NP	rozumnou politiku	sensible policy

1	PHR	PHR	rozumem	brains
3	PHR	PHR	rozumem	reason
4	PHR	PHR	rozumem	sense
2	PHR	PHR	rozumem .	sense .
1	PHR	PHR	rozumem , a že	brains ; and that
1	PHR	PHR	rozumem , pokud	sense if
1	PHR	PHR	rozumem , pokud ne	sense if not

Final Result

- Three suffix-array language models
  - Target side of Project Syndicate corpus
  - ... + more monolingual English data
  - ... + target side of public CzEng corpus
- WMT tuning, development, and test sets

- = Baseline Stat-XFER system ready to analyse and expand

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Phrase Table Combination

- Combination of non-syntactic and syntactic phrase pairs
  - Direct combination and syntax prioritization

Synchronous Grammars:
Rule Selection

- Rule learning yields huge grammars
- Decoding with millions of abstract rules is intractable
- Open Question: How do we select the best grammar rules with regard to translation quality and decoding speed?

Synchronous Grammars:
Label Granularity

- Rule learning assigns non-terminal and POS labels from input parse trees
- Input labels are believed appropriate...
  - For a given single language
  - According to a particular theory of grammar
- Open Question: How do we expand or collapse these labels so that they are appropriate for translating a particular language pair?

Synchronous Grammars:
Czech Example

- Subject moves in English translation
- Verbs in past tense cannot be associated with modifiers in present tense

Proti odmítnutí se zitra Petr
against dismissal AUX-REFL tomorrow Peter

v práci rozhodl protestovat
of work decided to protest

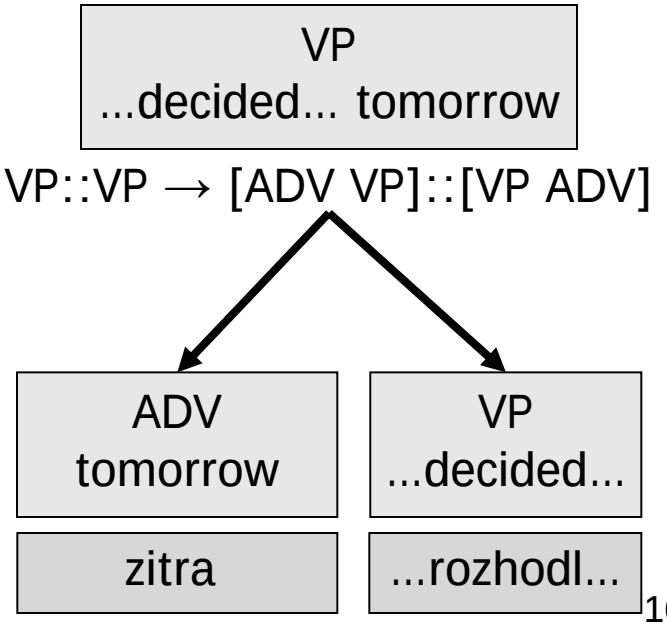
"Peter decided to protest against the dismissal of work tomorrow."

* Example from Bojar and Lopez, "Tree-based Translation," MT Marathon Presentation 2008

Synchronous Grammars:
Manual Grammar Writing

- Stat-XFER supports LFG-style unification
- Feature structures for unification can also be provided by the morphology server

```
VP::VP : [ADV VP] -> [VP ADV]
(
    (X1::Y2)
    (X2::Y1)
    (*tgsrule* 0.2)
    (*sgtrule* 0.6)
    ((X0 tense) = (X1 tense))
    ((X0 tense) = (X2 tense))
)
```



Czech Morphology: Example

- Czech words include clitics and inflectional morphology, marking meanings such as gender and number

nerozumím
ne+rozum+ím
NEG+understand+1SG
“I do not understand”

Czech Morphology in Stat-XFER

- Stat-XFER allows external morphology server to segment and annotate words at runtime
- Ambiguous word segmentations can be encoded as a lattice
- Must segment all training data, then rebuild phrase table & language model

(Your Idea Here)

- Any ideas about applying the statistical transfer framework to Czech–English translation are welcome!