Learner Treebanks and CHILL (Chinese Intelligent Language Learning)

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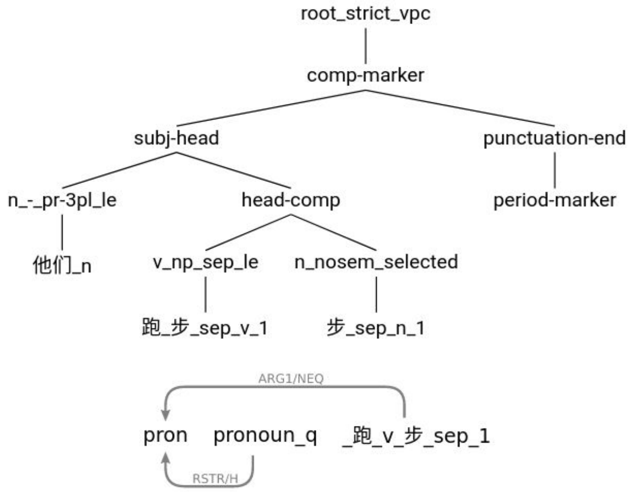
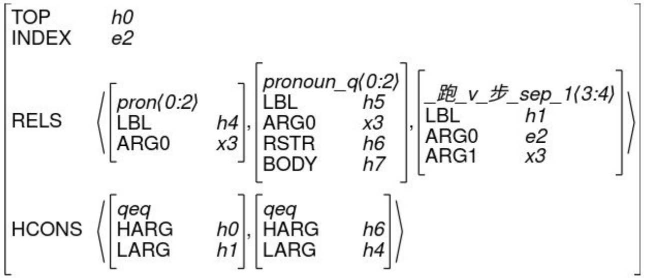
ZHONG: A Chinese HPSG Implemented Grammar

- The project started in 2015 (by Fan Zhenzhen), taken up as a small portion of my PhD
- Supposed to be “Meta-Chinese” grammar
- It handles well sentences syntactic structures in low proficiency materials (up to HSK 3)
- Some notable syntactic work includes:
  - 的 constructions (by Zhenzhen)
  - Verbal and adjectival Reduplication
  - Separable verbs (e.g. 生病, 生了病)
  - Aspect (and it’s interactions w/negation)



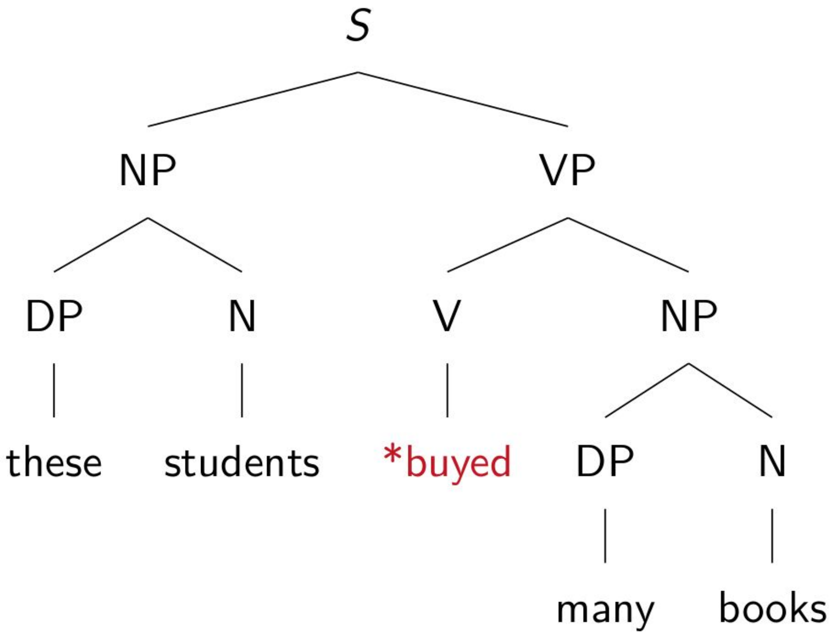


ZHONG: A Chinese HPSG Implemented Grammar

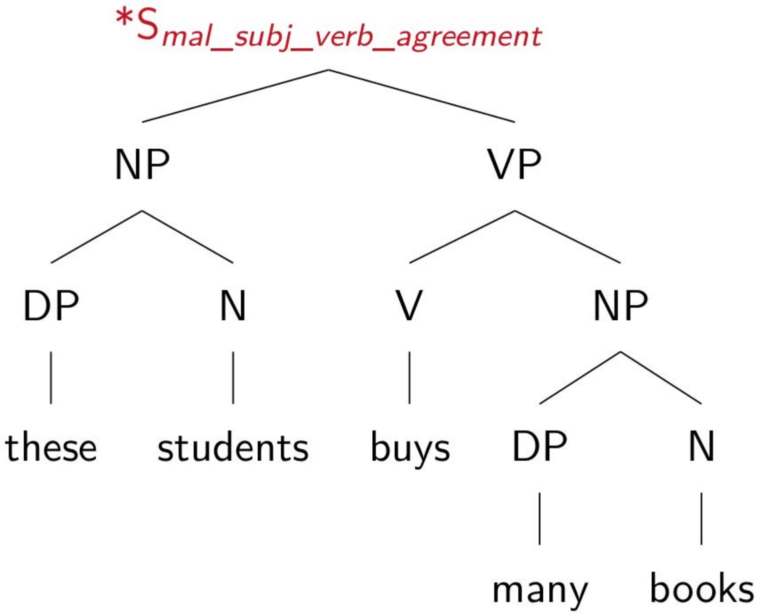
- **MSCA project** – CHILL (Chinese Intelligent Language Learning)
- The grammar should be able to handle up to **HSK 5 at the end of 2023**
- Focus on **NP structure** (quantification, deixis, and cognitive status) **& mal-rules**
- Also In the pipeline (or needing improving):
  - Better treatment of numeric phrase predication
  - Better treatment of passives
  - Comparatives
  - Argument Changing Complements (duration, state, result, potential)

Mal-Rules (Examples)

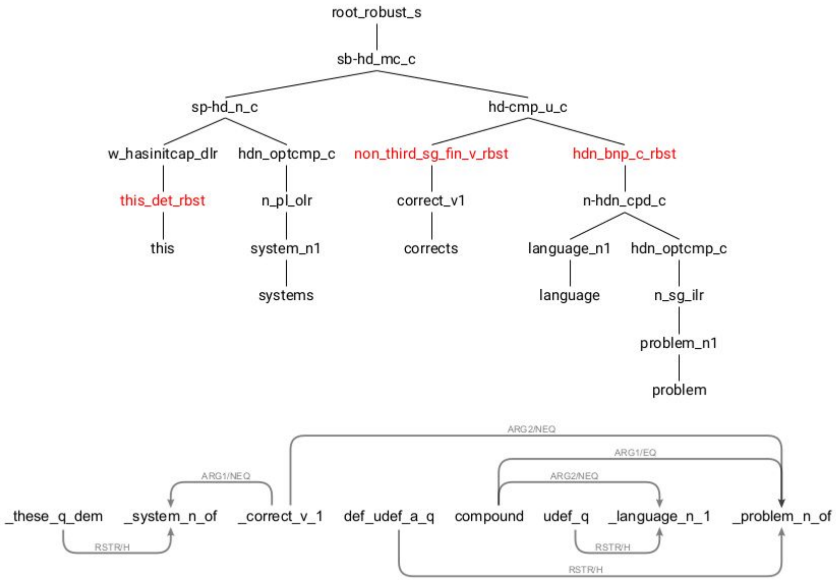
* These students buyed many books.

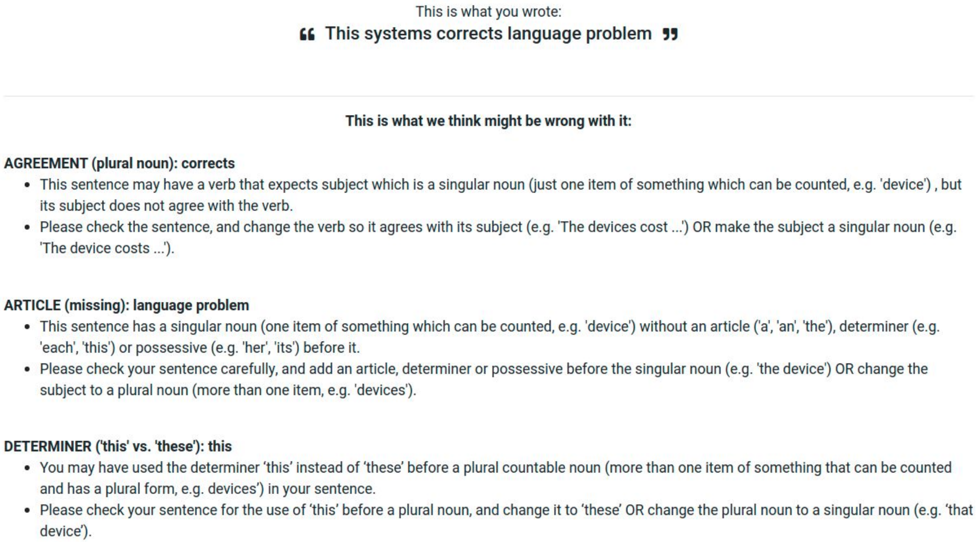


* These students buys many books.



Linking Mal-rules to Corrective Feedback





This is what you wrote:

❝ This systems corrects language problem ❞

This is what we think might be wrong with it:

AGREEMENT (plural noun): corrects

- This sentence may have a verb that expects subject which is a singular noun (just one item of something which can be counted, e.g. 'device') , but its subject does not agree with the verb.
- Please check the sentence, and change the verb so it agrees with its subject (e.g. 'The devices cost ...') OR make the subject a singular noun (e.g. 'The device costs ...').

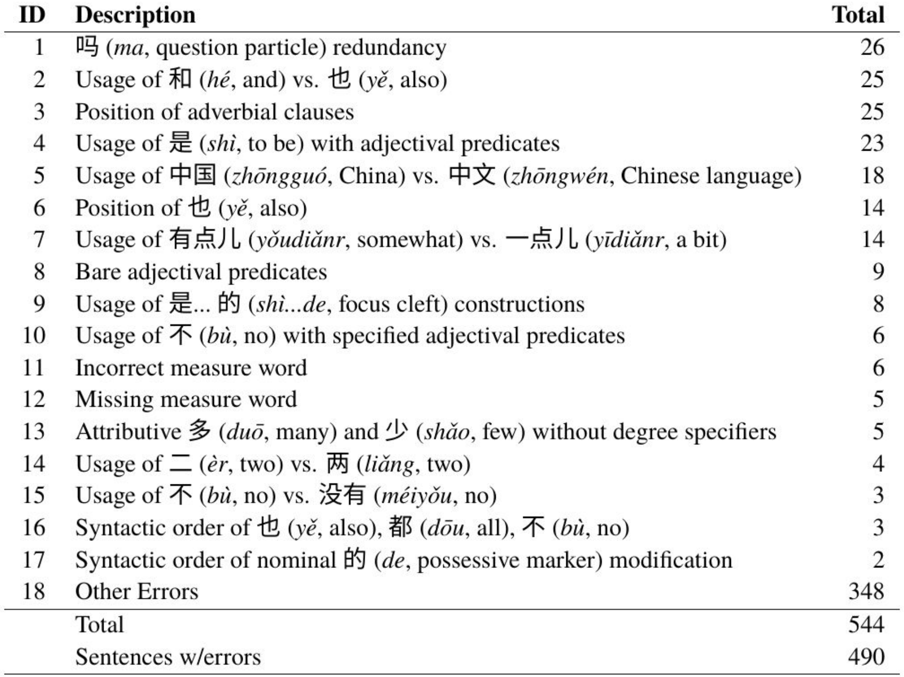
ARTICLE (missing): language problem

- This sentence has a singular noun (one item of something which can be counted, e.g. 'device') without an article ('a', 'an', 'the'), determiner (e.g. 'each', 'this') or possessive (e.g. 'her', 'its') before it.
- Please check your sentence carefully, and add an article, determiner or possessive before the singular noun (e.g. 'the device') OR change the subject to a plural noun (more than one item, e.g. 'devices').

DETERMINER ('this' vs. 'these'): this

- You may have used the determiner 'this' instead of 'these' before a plural countable noun (more than one item of something that can be counted and has a plural form, e.g. devices') in your sentence.
- Please check your sentence for the use of 'this' before a plural noun, and change it to 'these' OR change the plural noun to a singular noun (e.g. 'that device').

NTU Corpus of Learner Mandarin (NTUCLM)



ID	Description	Total
1	吗 (*ma*, question particle) redundancy	26
2	Usage of 和 (*hé*, and) vs. 也 (*yě*, also)	25
3	Position of adverbial clauses	25
4	Usage of 是 (*shì*, to be) with adjectival predicates	23
5	Usage of 中国 (*zhōngguó*, China) vs. 中文 (*zhōngwén*, Chinese language)	18
6	Position of 也 (*yě*, also)	14
7	Usage of 有点儿 (*yǒudiănr*, somewhat) vs. 一点儿 (*yīdiănr*, a bit)	14
8	Bare adjectival predicates	9
9	Usage of 是... 的 (*shì...de*, focus cleft) constructions	8
10	Usage of 不 (*bù*, no) with specified adjectival predicates	6
11	Incorrect measure word	6
12	Missing measure word	5
13	Attributive 多 (*duō*, many) and 少 (*shăo*, few) without degree specifiers	5
14	Usage of 二 (*èr*, two) vs. 两 (*liăng*, two)	4
15	Usage of 不 (*bù*, no) vs. 没有 (*méiyǒu*, no)	3
16	Syntactic order of 也 (*yě*, also), 都 (*dōu*, all), 不 (*bù*, no)	3
17	Syntactic order of nominal 的 (*de*, possessive marker) modification	2
18	Other Errors	348
	Total	544
	Sentences w/errors	490

- ≈5,600 sentences (≈2300 after merging repetitions)
- Most error classes were expected
- “Other Errors” included some interesting unexpected classes (e.g. NP predication)
- There is a **long tail of idiosyncratic errors** that are not interesting to name/model
- We are now **collecting data from Czech students** learning Mandarin

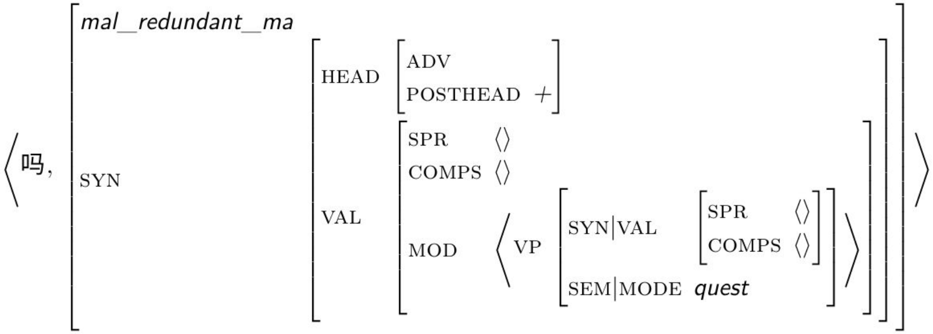
Mal-Rules in ZHONG (吗 Redundancy)

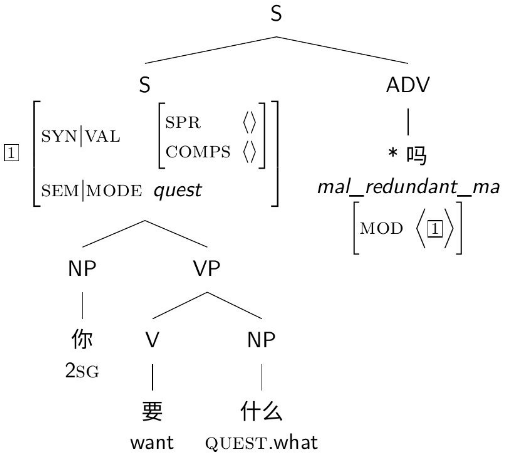
(1) 你 要 什么 ?
2SG want QUEST.what ?
'What do you want?'

(2) *你 要 什么 吗 ?
2SG want QUEST.what QUEST.polar ?
(intended) 'What do you want?'

(3) 你 有 没 有 中文 书 ?
2SG have not have Chinese.language book ?
'Do you have a Chinese textbook?'

(4) *你 有 没 有 中文 书 吗 ?
2SG have not have Chinese.language book QUEST.PART ?
(intended) 'Do you have a Chinese textbook?'



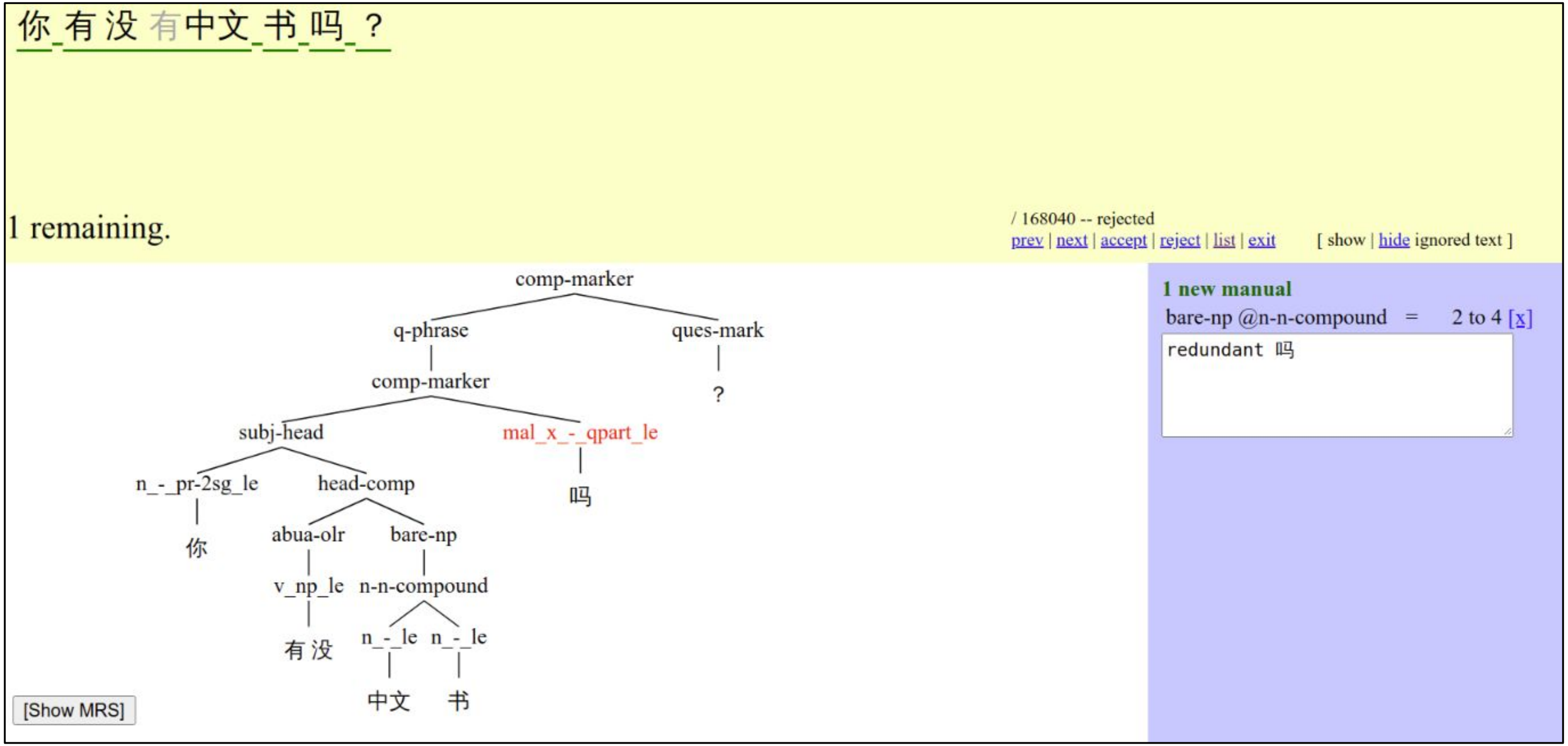


Mal-Rules in ZHONG

- ZHONG now detects more than **60 different mal-rules** (i.e., types of errors)
    - Cover about **50% of the errors** found in the NTUCLM, including:
        - 吗 (ma, question particle) redundancy
        - Clausal coordination with 和 (hé, and)
        - Incorrect position of 也 (yě, also) – e.g., pre-subject
        - 有点儿 (yǒudiǎnr, somewhat) vs. 一点儿 (yīdiǎnr, a bit) confusion
        - Bare NP Predication
        - Missing Measure Words / Classifiers
        - 不 (bù, no) vs. 没有 (méiyǒu, no) confusion
        - 二 (èr, two) vs. 两 (liǎng, two) confusion
        - **Misspellings** (Not sure if they should be handled by the grammar)
        - etc.
- Corrective feedback messages and web-app (for classrooms) is *in progress*

Grammar / Mal-rules Demo: https://www.luismc.com/itell/delphin_analyser

The Mandarin Learner Treebank



你_有没有中文_书_吗_？

1 remaining.

/ 168040 -- rejected
prev | next | accept | reject | list | exit [show | hide ignored text]

1 new manual

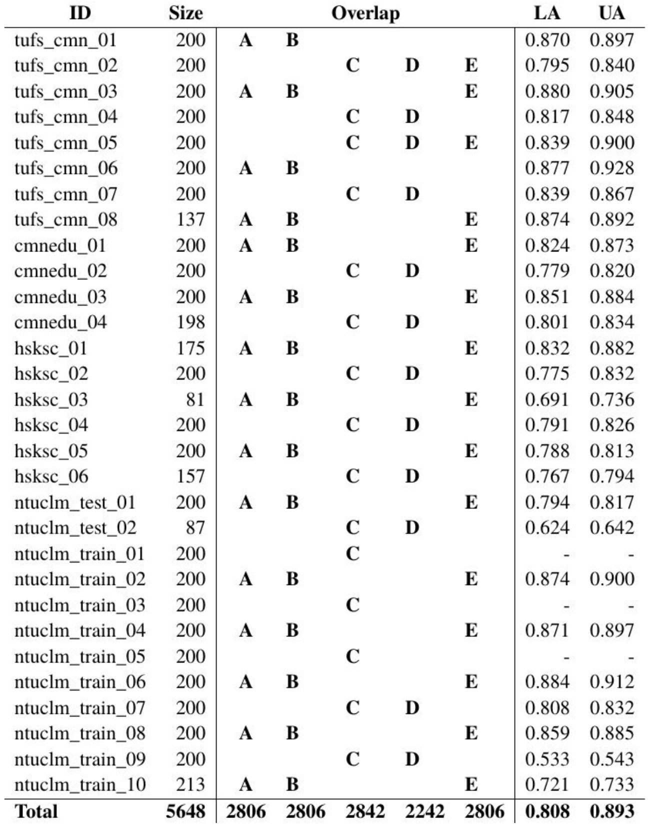
bare-np @n-n-compound = 2 to 4 [x]

redundant 吗

[Show MRS]

The Mandarin Learner Treebank

- Treebanked over 5600 sentences manually
- 5 trained student assistants (w/overlap)
- Includes **textbook and learner data**
- Trained a new parse-ranking model
- Improved Grammatical Error Detection
  - 88% Precision (top-parse), 41% Recall
- Improved Grammatical Error Diagnosis
  - 89% Precision (top-parse), 47% Recall
- Moving into Tatoeba



ID	Size	Overlap					LA	UA
tufs_cmn_01	200	**A**	**B**				0.870	0.897
tufs_cmn_02	200			**C**	**D**	**E**	0.795	0.840
tufs_cmn_03	200	**A**	**B**			**E**	0.880	0.905
tufs_cmn_04	200			**C**	**D**		0.817	0.848
tufs_cmn_05	200			**C**	**D**	**E**	0.839	0.900
tufs_cmn_06	200	**A**	**B**				0.877	0.928
tufs_cmn_07	200			**C**	**D**		0.839	0.867
tufs_cmn_08	137	**A**	**B**			**E**	0.874	0.892
cmnedu_01	200	**A**	**B**			**E**	0.824	0.873
cmnedu_02	200			**C**	**D**		0.779	0.820
cmnedu_03	200	**A**	**B**			**E**	0.851	0.884
cmnedu_04	198			**C**	**D**		0.801	0.834
hsksc_01	175	**A**	**B**			**E**	0.832	0.882
hsksc_02	200			**C**	**D**		0.775	0.832
hsksc_03	81	**A**	**B**			**E**	0.691	0.736
hsksc_04	200			**C**	**D**		0.791	0.826
hsksc_05	200	**A**	**B**			**E**	0.788	0.813
hsksc_06	157			**C**	**D**		0.767	0.794
ntuclm_test_01	200	**A**	**B**			**E**	0.794	0.817
ntuclm_test_02	87			**C**	**D**		0.624	0.642
ntuclm_train_01	200			**C**			-	-
ntuclm_train_02	200	**A**	**B**			**E**	0.874	0.900
ntuclm_train_03	200			**C**			-	-
ntuclm_train_04	200	**A**	**B**			**E**	0.871	0.897
ntuclm_train_05	200			**C**			-	-
ntuclm_train_06	200	**A**	**B**			**E**	0.884	0.912
ntuclm_train_07	200			**C**	**D**		0.808	0.832
ntuclm_train_08	200	**A**	**B**			**E**	0.859	0.885
ntuclm_train_09	200			**C**	**D**		0.533	0.543
ntuclm_train_10	213	**A**	**B**			**E**	0.721	0.733
Total	**5648**	**2806**	**2806**	**2842**	**2242**	**2806**	**0.808**	**0.893**

Some Challenges Lying Ahead

Some Current Challenges

- **Integrate Segmentation**
  - Integrate external segmenters / POS-taggers? (unknown word handling)
  - Character/pinyin-based parsing (I need some help with REPP)
- **Lexicon Management**
  - Tools to keep results of lexical tests and generate lexicon
  - Possibility of linking and or merging with the Chinese Open Wordnet
- **Treebanks / Release Cycle:**
  - Building, Formatting and Sharing Treebanks (SIG?), incl. tools (LTDB?)
- **Data Collection:**
  - Streamline learner data collection through some apps
- **End the “meta-chinese” approach:**
  - out-of-date, difficult to manageable, not aligned with current goals