Slide 1

On Linguistically Analyzing Interlanguage

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Slide 2

Overview

- ▸ Motivations behind analyzing learner language and points of contact with computational linguistics
- ▸ Aspects of a linguistic analysis of interlanguage: POS
  - ▸ Interlanguage: systematic nature of language acquisition
- ▸ Issues in error annotation/analysis
  - ▸ Target hypotheses
  - ▸ Inter-annotator agreement and available gold-standards
  - ▸ The relevance of the task and learner modeling

Slide 3

Why Analyze Learner Language?

Second Language Acquisition (SLA)

- ▸ SLA research is aimed at understanding how second languages are acquired (and how language works)
- ▸ research on **instructed** SLA studying the effect of instructional interventions
  - ▸ targeting different aspects of language, and
  - ▸ supporting different kinds of feedback or learner interaction

Foreign Language Teaching (FLT)

- ▸ develop, adapt, advance, and test effectiveness of intervention methods from SLA for teaching practice
- ▸ design and use language tests

Slide 4

Contact Points with Computational Linguistics

- ▸ **Learner corpora**: representation and annotation
  - ▸ can provide empirical insights for SLA research
  - ▸ provide insights into typical student needs in FLT

  annotation = off-line analysis

- ▸ **Writer's aid tools**: on-line analysis of learner language to provide immediate feedback *aimed at producing text*.

- ▸ **Intelligent Tutoring Systems**: analysis of learner language on the fly
  - ▸ to provide immediate, individualized feedback
    - ▸ in a form-focused activity
    - ▸ or incidental focus-on-form in a meaning-based activity
    - ▸ feedback on meaning (very rare in ILTS)
  - ▸ to determine progression through pedagogical material

  aimed at supporting language acquisition.

Data in SLA research

Clahsen & Muysken (1986)

- ▸ They studied word order acquisition in German by native speakers of Romance languages
- ▸ Stages of acquisition:
  1. S (Aux) V O
  2. (AdvP/PP) S (Aux) V O
  3. S V[+fin] V[–fin]
  4. XP V[+fin] S O
  5. S V[+fin] (Adv) O
  6. *dass* S O V[+fin]

  Stage 2 example: *Früher   ich kannte den Mann*
  earlier_{AdvP}   I_S knew_V [the man]_O

  Stage 4 example: *Früher   kannte   ich den Mann*
  earlier_{AdvP}   knew_{V[+fin]} I_S [the man]_O

- ▸ How is the data characterized?
  - ▸ lexical and syntactic categories and functions
  - ▸ some acquisition stages are well-formed, others ill-formed

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Annotation: Error Annotation and Beyond

- ▸ The annotation of learner corpora has focused on *errors* made by the learners (e.g., Granger 2003; Díaz-Negrillo & Fernández-Domínguez 2006; Lüdeling et al. 2008).
- ▸ Yet, SLA research essentially observes correlations of linguistic properties, whether erroneous or not.
- ▸ Even research focusing on learner errors needs to identify correlations with linguistic properties, e.g., to identify
  - ▸ overuse/underuse of certain patterns
  - ▸ measures of language development
    - ▸ CAF: Complexity, Accuracy, Fluency; Developmental Sentence Scoring; Index of Productive Syntax, . . .

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Annotation of Linguistic Properties

- ▸ Annotation schemes have been developed for a wide range of linguistic properties, including
  - ▸ part-of-speech and morphology
  - ▸ syntactic constituency or lexical dependency structures
  - ▸ semantics (word senses, coreference), discourse structure
- ▸ Each type of annotation typically requires an extensive manual annotation effort → gold standard corpora
- ▸ Automatic annotation tools learning from such gold standard annotation are becoming available, but
  - ▸ quality of automatic annotation drops significantly for text differing from the gold standard training material
- ▸ Interdisciplinary collaboration between SLA and CL crucial to adapt annotation schemes and methods to learner language
  - ▸ Surprisingly little research on this (Meunier 1998; de Haan 2000; de Mönnink 2000; van Rooy & Schäfer 2002, 2003).

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Annotation quality

- ▸ An annotation scheme is only as good as the distinctions it reliably supports making based on available evidence.
  - ▸ E.g., particle vs. preposition dropped in Penn Treebank tagset since often not enough evidence available.
  - ▸ Note: More classes can be more reliable if they are more coherent (cf. CLAWS7 annotation, followed by mapping to CLAWS5 in BNC Tag Enhancement Project).
- ▸ How can high quality gold standards be obtained?
  - ▸ Keep only reliably and consistently identifiable distinctions, described in detailed manuals, including appendix on hard cases (Voutilainen & Järvinen 1995; Sampson & Babarczy 2003)
  - ▸ Annotate corpus several times and independently, then test interannotator agreement (Brants & Skut 1998)
  - ▸ Detection of annotation errors through automatic analysis of comparable data recurring in the corpus → DECCA (Dickinson & Meurers 2003a,b, 2005; Boyd et al. 2008)

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A Case Study in Linguistic Annotation of Learner Language

- The NOCE learner corpus (Díaz-Negrillo 2009)
- POS analysis of learner language
  - Exploring automatic POS annotation
  - What does it mean to POS-annotate learner language?

Reporting on joint work with Ana Díaz-Negrillo, Salvador Valera, and Holger Wunsch
  - cf. Díaz-Negrillo, Meurers, Valera & Wunsch (to appear)

The NOCE Learner Corpus (Díaz-Negrillo 2009)

- Participants
  - Writing by 1st and 2nd year students of English at the universities of Granada and Jaén
  - Corpus includes meta-information on learner: age, level, L2 exposure, motivation, etc.
- Task
  - Written text, around 250 words
  - Topics chosen from 3 suggestions or free writing
- Corpus structure and size
  - 3 text collections per acad. year, for 4 years
  - 998 texts, 337.332 tokens (149.256 types)
- Annotation:
  - Editorial (struck-out units, insertions, reordering)
  - Error (179 texts, 39.165 tokens, 5.285 errors, 357 types)
- How about adding linguistic information?

Automatic POS-Tagging of NOCE

Setup

- Used 3 POS taggers trained on WSJ newspaper text, using Penn Treebank tagset
  - TreeTagger, TnT tagger, Stanford tagger
- Tagged the error-annotated section in NOCE

Results

- Manually evaluated POS tags assigned by taggers to 10 texts by 10 different participants (1.850 words)
  - Evaluation performed by Ana Díaz Negrillo
- Accuracy of automatically assigned tags
  - TreeTagger: 94.95%
  - TnT Tagger: 94.03%
  - Stanford Tagger: 88.11%

Automatic POS-Tagging of NOCE
Aspects of a qualitative analysis

Found lower performance for expressions which do not exist in English (cf. also de Haan 2000; van Rooy & Schäfer 2002).

Spelling

(1) *I think that university teaches to people* [. . .]

Word boundaries

(2) *They can't pay their studies and more over they have to pay a flat* [. . .]

- But is tagging learner language really just a robustness issue, like adapting taggers to another domain?
- What does it mean for a POS tag to be correct for learner language?!

Three Sources of Evidence for POS analysis

Lemma/Lexical entry: *of* ⇒ preposition

(3) *I was surprised by the word **of** the day.*

Morphology: *-ion* ⇒ noun

(4) *There is a lot of **construction** going on here.*

Distribution: adj __ verb ⇒ noun

(5) *The old **man** left.*

Case 1: Stem-Distribution mismatch

Stem   Distribution   Morphology

(6) *[…] you can find a big **vary** of beautiful beaches* […]

Stem	Distribution	Morphology
verb	noun	?

(7) *[…] they are very kind and **friendship**.*

Stem	Distribution	Morphology
noun	adjective	?

Case 1: Stem-Distribution mismatch

Stem   Distribution   Morphology

(8) *[…] that's the reason **because** I went to Tunisia twice.*

Stem	Distribution	Morphology
conjunction	wh-pronoun	?

(9) *RED helped him **during** he was in the prison.*

Stem	Distribution	Morphology
preposition	conjunction	?

Case 2: Stem-Distrib./Stem-Morph. mismatch

Stem   Distribution   Morphology

(10) *[…] one of the favourite places to visit for many **foreigns**.*

Stem	Distribution	Morphology
adjective	noun	noun / verb 3rd sg

(11) *[…] to be **choiced** for a job* […]

Stem	Distribution	Morphology
noun / adjective	verb	verb

On Linguistically Analyzing Interlanguage

Detmar Meurers
Universität Tübingen

Introduction

Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality

A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
  1. Stem–Distribution
  2. Stem–Distrib.–Morph.
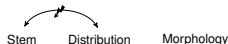 3. Stem–Morphology
  4. Distribution–Morph.
Systematic Categories for Learner Language
Mismatch-free Errors

Error annotation
Target hypothesis
Importance of activity and learner modeling
Towards task-specific learner corpora

Conclusion

Case 3: Stem-Morphology mismatch

(12) [...] *this film is one of the **bests** ever customes* [...]

Stem	Distribution	Morphology
adjective (noun / verb)	adjective	noun / verb 3rd sg

(13) [...] *television, radio are very **subjectives*** [...]

Stem	Distribution	Morphology
adjective / noun	adjective	noun / verb 3rd sg

Case 4: Distribution-Morphology mismatch

(14) [...] *for almost every **jobs** nowadays* [...]

Stem	Distribution	Morphology
noun	noun sg	noun pl / verb 3rd sg

(15) [...] *it has **grew** up a lot specially after 1996* [...]

Stem	Distribution	Morphology
verb	verb past participle	verb past tense

Case 4: Distribution-Morphology mismatch

(16) [...] *if he **want** to know this* [...]

(17) *This first year **have** been wonderful* [...]

Stem	Distribution	Morphology
verb	verb 3rd person sg	verb non-3rd sg

Systematic Categories for Learner Language

- A single, standard POS tag **fails to systematically identify properties of learner language**.
  - Mismatching evidence from distribution, stem, morphology

- Alternative: The annotation schemes for learner language should encode minimal observations.
  - POS: tripartite encoding of distribution, stem, morphology
  - Syntax: separate encoding of dependency, topology, chunk-internal word order (instead of constituency)

- Some errors in learner language are **epiphenomena of mismatches** in linguistic encoding.
  → Identify such errors through linguistic annotation, not error annotation.

- There also are "mismatch-free" errors, for which error annotation can help identify interesting instances.

Mismatch-free errors

On Linguistically
Analyzing
Interlanguage
Detmar Meurers
Universität Tübingen

Introduction
Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality
A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem-Distribution
2. Stem-Distrib.-Morph.
3. Stem-Morphology
4. Distribution-Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors
Error annotation
Target hypothesis
Importance of activity and
learner modeling
Towards task-specific
learner corpora
Conclusion

Realization using wrong allomorph

(18) *The majority of people that die in Irak are* **childs** […]

(19) *He* **runned** *to buy one* […]

Realization using wrong stem

(20) […] *the 11th March* **cames** *to our minds.*

Duplicate inflection

(21) **Childrens** *spend so much time* […]

(22) […] *it* **stresseses** *me a lot.*

Mismatch-free leaner language

On Linguistically
Analyzing
Interlanguage
Detmar Meurers
Universität Tübingen

Introduction
Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality
A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem-Distribution
2. Stem-Distrib.-Morph.
3. Stem-Morphology
4. Distribution-Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors
Error annotation
Target hypothesis
Importance of activity and
learner modeling
Towards task-specific
learner corpora
Conclusion

Inappropriate word-formation rules

(23) […] *internet can* **modificate** […]

(24) […] *different* **socialities** *and ways of life.*

Creative lexis

(25) […] *people shouldn't be* **menospreciated** *because of the music they listen to* […]

(*menospreciados (span.)*: undervalued)

(26) […] *for many* **raisons**.

Error annotation

On Linguistically
Analyzing
Interlanguage
Detmar Meurers
Universität Tübingen

Introduction
Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality
A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem-Distribution
2. Stem-Distrib.-Morph.
3. Stem-Morphology
4. Distribution-Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors
Error annotation
Target hypothesis
Importance of activity and
learner modeling
Towards task-specific
learner corpora
Conclusion

- ▸ Error annotation involves (implicitly or explicitly):
  - a) Determining what the learner wanted to say (**target**).
  - b) Identifying
    - i. the **location** of the error, and
    - ii. the **nature** of the error corresponding to the difference between the learner sentence and the target hypothesis.
  - c) **Annotating** the error in the corpus

- ▸ Each of these steps can present ambiguity:
  - a) multiple possible target hypotheses
  - b) i. different locations in which the error can be rooted
       ii. different types of errors divergence can be attributed to
  - c) different ways to mark an error location & type in corpus

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Error annotation schemes: Desiderata

On Linguistically
Analyzing
Interlanguage
Detmar Meurers
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Introduction
Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality
A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem-Distribution
2. Stem-Distrib.-Morph.
3. Stem-Morphology
4. Distribution-Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors
Error annotation
Target hypothesis
Importance of activity and
learner modeling
Towards task-specific
learner corpora
Conclusion

- ▸ An annotation is only relevant and useful if it provides a uniform, reliable index to relevant classes of data.
- ▸ Traditionally every researcher develops their own error annotation scheme. (cf. Díaz-Negrillo & Fernández-Domínguez 2006)
- ▸ Alarmingly, there does not seem to be a single study showing what level of inter-annotator agreement can be reached for which type of distinctions.
- ▸ Freely available gold standard annotations for error annotation schemes supporting high inter-annotator agreement levels are crucially needed.
- ▸ Without an available gold standard, no evaluation and comparison of NLP tools for error analysis is possible.
- ▸ Promising first steps: some comparable approaches and progress for some subclasses (articles, prepositions). (e.g., Lee & Seneff 2006; Tetreault & Chodorow 2008; De Felice 2008)

Target hypotheses

On Linguistically
Analyzing
Interlanguage

Detmar Meurers
Universität Tübingen

Introduction

Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality

A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem–Distribution
2. Stem–Distrib.–Morph.
3. Stem–Morphology
4. Distribution–Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors

Error annotation
Target hypotheses
Importance of activity and
learner modeling
Towards task-specific
learner corpora

Conclusion

- Anke Lüdeling has argued for making the target hypothesis an explicit part of error annotation (Lüdeling et al. 2005; Hirschmann et al. 2007; Lüdeling 2008).

- Fitzpatrick & Seegmiller (2004) report unsatisfactory levels of agreement in determining the learner targets.
  - Keeping the target hypothesis implicit results in error annotation which diverge even more unsatisfactorily.

- If target hypothesis is explicit, at least the second step from target hypothesis to error tag might be realizable with high reliability.

Difficulty of determining target hypotheses

On Linguistically
Analyzing
Interlanguage

Detmar Meurers
Universität Tübingen

Introduction

Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality

A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem–Distribution
2. Stem–Distrib.–Morph.
3. Stem–Morphology
4. Distribution–Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors

Error annotation
Target hypotheses
Importance of activity and
learner modeling
Towards task-specific
learner corpora

Conclusion

- What are the target forms for the sentences taken from the Hiroshima English Learners' Corpus (Miura 1998):

  (27) *I didn't know*
  (28) *I don't know his lives.*
  (29) *I know where he lives.*
  (30) *I know he lived*

  They are taken from a translation task, for the Japanese of

  (31) *I don't know where he lives.*

- How can one obtain a better handle on target hypotheses?
  - focus on more advanced learners
  - take explicit task context into account
  - support targets other than fully explicit surface forms
  - take more learner strategies into account
    - Learners sometimes use known L2 chunks instead of trying to express appropriate meaning!

Constraining the search space of interpretation

On Linguistically
Analyzing
Interlanguage

Detmar Meurers
Universität Tübingen

Introduction

Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality

A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem–Distribution
2. Stem–Distrib.–Morph.
3. Stem–Morphology
4. Distribution–Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors

Error annotation
Target hypotheses
Importance of activity and
learner modeling
Towards task-specific
learner corpora

Conclusion

- All approaches to modeling errors, such as
  - *mal*-rules
  - constraint relaxation
  - statistical modeling
  must model the space of **well-formed and ill-formed variation** that is possible given
  - a particular activity, and
  - a given learner.

- For example, without task and speaker context, how would you interpret the following?

  (32) *I will not buy this record it is scratched*

  (33) *My hovercraft is full of eels.*

Exemplifying interpretation in context

On Linguistically
Analyzing
Interlanguage

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Introduction

Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality

A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
1. Stem–Distribution
2. Stem–Distrib.–Morph.
3. Stem–Morphology
4. Distribution–Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors

Error annotation
Target hypotheses
Importance of activity and
learner modeling
Towards task-specific
learner corpora

Conclusion

Monty Python: Hungarian Phrase Book sketch
http://www.youtube.com/watch?v=akbflkF_1zY

On Linguistically
Analyzing
Interlanguage

Detmar Meurers
Universität Tübingen

Introduction

Learner Corpora
Data in SLA Research
Error annotation & beyond
Linguistic Annotation
Annotation Quality

A Concrete Case
NOCE Corpus
Automatic POS-Tagging
Three Sources of Evidence
Mismatching Evidence
  1. Stem-Distribution
  2. Stem-Distrib.-Morph.
  3. Stem-Morphology
  4. Distribution-Morph.
Systematic Categories for
Learner Language
Mismatch-free Errors

Error annotation
Target hypotheses
Importance of activity and
learner modeling
Towards task-specific
learner corpora

Conclusion

Towards task-specific learner corpora

- Explicit task and learner models included as meta-information in a corpus can provide crucial constraining information for interpreting learner language.
  - E.g., it's easier to infer what a learner wanted to say if one knows the text they are answering questions about.
- Most current learner language corpora consist of essays, yet learners produce language in a wide range of contexts, naturalistic or instructed, e.g.,
  - email and chat messages
  - answering reading or listening comprehension questions
  - asking questions in information gap activities
- To obtain corpora which are interpretable and representative of learner language, we need language from a variety of contexts, including longitudinal data.

Conclusion

- We discussed the different motivations for analyzing learner language in SLA, FLT, and their connection to CL
- We motivated linguistic annotation to support effective querying for SLA patterns and discussed an approach to the POS analysis of learner language separating
  - lexical, morphological, and distributional information to obtain a systematic classification of POS properties capturing native-like text as well as learner innovations.
- Turning to error annotation, we argued for inter-annotator agreement as crucial for establishing which distinctions are replicable based on the available information.
- We explored the nature of target hypotheses and argued for explicit task and learner modeling to constrain the search space of interpretation.
- Well-defined analysis subtasks on widely available corpora are needed for sustained progress.

Our Background

Analyzing language for learners

- Input enhancement of texts for learners (Meurers et al. 2010b)
- Search engine for language learners (Ott & Meurers submitted)
- Prediction of functional elements (Elghafari, Meurers & Wunsch 2010)

Analyzing learner language

- Intelligent Tutoring System TAGARELA for Portuguese (Amaral & Meurers 2008, 2009, submitted; Amaral et al. to appear)
- Linguistic analysis of NOCE corpus of English written by Spanish learners (Díaz-Negrillo, Meurers, Valera & Wunsch to appear)
- Automatic analysis of learner language (Meurers 2009)
- Word order errors (Metcalf & Meurers 2006b) → Adriane Boyd's PhD
- Content assessment of answers to reading comprehension questions (Bailey & Meurers 2008) → SFB 833 A4 (Ziai/Ott)
  - Longitudinal corpus collection using WELCOME (Meurers, Ott & Ziai 2010a) → KU/OSU collaboration

References

Amaral, L., V. Metcalf & D. Meurers (2006). Language Awareness through Re-use of NLP Technology. Pre-conference Workshop on NLP in CALL – Computational and Linguistic Challenges. CALICO 2006. May 17, 2006. University of Hawaii. URL http://purl.org/net/icall/handouts/calico06-amaral-metcalf-meurers.pdf.

Amaral, L. & D. Meurers (2008). From Recording Linguistic Competence to Supporting Inferences about Language Acquisition in Context: Extending the Conceptualization of Student Models for Intelligent Computer-Assisted Language Learning. Computer-Assisted Language Learning 21(4), 323–338. URL http://purl.org/dm/papers/amaral-meurers-call08.html.

Amaral, L. & D. Meurers (2009). Little Things With Big Effects: On the Identification and Interpretation of Tokens for Error Diagnosis in ICALL. CALICO Journal 27(1). URL http://purl.org/dm/papers/amaral-meurers-09.html.

Amaral, L. & D. Meurers (submitted). On Using Intelligent Computer-Assisted Language Learning in Real-Life Foreign Language Teaching and Learning. ReCALL URL http://purl.org/dm/papers/amaral-meurers-10.html.

Amaral, L., D. Meurers & R. Ziai (to appear). Analyzing Learner Language: Towards A Flexible NLP Architecture for Intelligent Language Tutors. Computer-Assisted Language Learning URL http://purl.org/dm/papers/amaral-meurers-ziai-10.html.

Bailey, S. & D. Meurers (2008). Diagnosing meaning errors in short answers to reading comprehension questions. In J. Tetreault, J. Burstein & R. D. Felice (eds.), Proceedings of the 3rd Workshop on Innovative Use of NLP for Building

Educational Applications, held at ACL 2008. Columbus, Ohio: Association for Computational Linguistics, pp. 107–115. URL http://aclweb.org/anthology-new/W08-0913.

Boyd, A., M. Dickinson & D. Meurers (2008). On Detecting Errors in Dependency Treebanks. Research on Language and Computation 6(2), 113–137. URL http://purl.org/dm/papers/boyd-et-al-08.html.

Brants, T. & W. Skut (1998). Automation of Treebank Annotation. In Proceedings of New Methods in Language Processing. Sydney, Australia. URL http://www.coling.uni-sb.de/acl/W/W98/W98-1207.pdf.

Clahsen, H. & P. Muysken (1986). The availability of Universal Grammar to adult and child learners: a study of the acquisition of German word order. Second Language Acquisition 2, 93–19. URL http://slr.sagepub.com/cgi/reprint/2/2/93.pdf.

De Felice, R. (2008). Automatic Error Detection in Non-native English. Ph.D. thesis, St Catherine's College, University of Oxford.

de Haan, P. (2000). Tagging non-native English with the TOSCA-ICLE tagger. In Mair & Hundt (2000), pp. 69–79.

de Mönnink, I. (2000). Parsing a learner corpus. In Mair & Hundt (2000), pp. 81–90.

Díaz-Negrillo, A. (2009). EARS: A User's Manual. Munich, Germany: LINCOM Academic Reference Books.

Dickinson, M. & W. D. Meurers (2003a). Detecting Errors in Part-of-Speech Annotation. In Proceedings of the 10th Conference of the European Chapter of the Association for Computational Linguistics (EACL-03). Budapest, Hungary, pp. 107–114. URL http://purl.org/dm/papers/dickinson-meurers-03.html.

Birmingham. URL http://www.linguistik.hu-berlin.de/institut/professuren/korpuslinguistik/neu2/mitarbeiter-innen/anke/pdf/HirschmannDoolittleLuedelingCL2007.pdf.

Lee, J. & S. Seneff (2006). Automatic Grammar Correction for Second-Language Learners. In INTERSPEECH 2006 – ICSLP. URL http://groups.csail.mit.edu/sls/publications/2006/IS061299.pdf.

Lüdeling, A. (2008). Mehrdeutigkeiten und Kategorisierung: Probleme bei der Annotation von Lernerkorpora. In P. Grommes & M. Walter (eds.), Fortgeschrittene Lernervarietäten, Tübingen: Niemeyer, pp. 119–140.

Lüdeling, A., S. Doolittle, H. Hirschmann, K. Schmidt & M. Walter (2008). Das Lernerkorpus Falko. Deutsch als Fremdsprache 45(2), 67–73.

Lüdeling, A., M. Walter, E. Kroymann & P. Adolphs (2005). Multi-level error annotation in learner corpora. In Proceedings of Corpus Linguistics. Birmingham. URL http://www.corpus.bham.ac.uk/PCLC/Falko-CL2006.doc.

Mair, C. & M. Hundt (eds.) (2000). Corpus Linguistics and Linguistic Theory. Amsterdam: Rodopi.

Metcalf, V. & D. Meurers (2006a). Generating Web-based English Preposition Exercises from Real-World Texts. URL http://purl.org/net/icall/handouts/eurocall06-metcalf-meurers.pdf. EUROCALL 2006. Granada, Spain. September 4–7, 2006.

Metcalf, V. & D. Meurers (2006b). When to Use Deep Processing and When Not To – The Example of Word Order Errors. URL http://purl.org/net/icall/handouts/calico06-metcalf-meurers.pdf. Pre-conference Workshop on NLP in CALL – Computational and Linguistic Challenges. CALICO 2006. May 17, 2006. University of Hawaii.

Dickinson, M. & W. D. Meurers (2003b). Detecting Inconsistencies in Treebanks. In Proceedings of the Second Workshop on Treebanks and Linguistic Theories (TLT-03). Växjö, Sweden, pp. 45–56. URL http://purl.org/dm/papers/dickinson-meurers-tlt03.html.

Dickinson, M. & W. D. Meurers (2005). Detecting Errors in Discontinuous Structural Annotation. In Proceedings of the 43rd Annual Meeting of the Association for Computational Linguistics (ACL'05). pp. 322–329. URL http://aclweb.org/anthology-new/P05-1040.

Díaz-Negrillo, A. & J. Fernández-Domínguez (2006). Error Tagging Systems for Learner Corpora. Revista Española de Lingüística Aplicada (RESLA) 19, 83–102. URL http://dialnet.unirioja.es/servlet/fichero_articulo?codigo=2198610&orden=72810.

Díaz-Negrillo, A., D. Meurers, S. Valera & H. Wunsch (to appear). Towards interlanguage POS annotation for effective learner corpora in SLA and FLT. Language Forum URL http://purl.org/dm/papers/diaz-negrillo-et-al-09.html.

Elghafari, A., D. Meurers & H. Wunsch (2010). Exploring the Data-Driven Prediction of Prepositions in English. In Proceedings of COLING 2010.

Fitzpatrick, E. & M. S. Seegmiller (2004). The Montclair electronic language database project. In U. Connor & T. Upton (eds.), Applied Corpus Linguistics: A Multidimensional Perspective, Amsterdam: Rodopi. URL http://chss.montclair.edu/linguistics/MELD/rodopipaper.pdf.

Granger, S. (2003). Error-tagged learner corpora and CALL: A promising synergy. CALICO Journal 20(3), 465–480. URL http://purl.org/calico/granger03.pdf.

Hirschmann, H., S. Doolittle & A. Lüdeling (2007). Syntactic annotation of non-canonical linguistic structures. In Proceedings of Corpus Linguistics 2007.

Meunier, F. (1998). Computer Tools for Interlanguage Analysis: A Critical Approach. In G. Sylviane (ed.), Learner English on Computer, London and New York: Addison Wesley Longman, pp. 19–37.

Meurers, D., N. Ott & R. Ziai (2010a). Compiling a Task-Based Corpus for the Analysis of Learner Language in Context. In Pre-Proceedings of Linguistic Evidence. Tübingen, pp. 214–217. URL http://purl.org/dm/papers/meurers-ott-ziai-10.html.

Meurers, D., R. Ziai, L. Amaral, A. Boyd, A. Dimitrov, V. Metcalf & N. Ott (2010b). Enhancing Authentic Web Pages for Language Learners. In Proceedings of the 5th Workshop on Innovative Use of NLP for Building Educational Applications, NAACL-HLT 2010. Los Angeles. URL http://purl.org/dm/papers/meurers-ziai-et-al-10.html.

Meurers, W. D. (2009). On the Automatic Analysis of Learner Language: Introduction to the Special Issue. CALICO Journal 26(3), 469–473. URL http://purl.org/dm/papers/meurers-09.html.

Miura, S. (1998). Hiroshima English Learners' Corpus: English learner No. 2 (April) & English II). URL http://home.hiroshima-u.ac.jp/d052121/eigo2.html. Last Modified 14 May, 1998.

Ott, N. & D. Meurers (submitted). Information Retrieval for Education: Making Search Engines Language Aware URL http://purl.org/dm/papers/ott-meurers-10.html.

Sampson, G. & A. Babarczy (2003). Limits to annotation precision. In Proceedings of the 4th International Workshop on Linguistically Interpreted Corpora (LINC-03). pp. 61–68. URL http://www.sfs.uni-tuebingen.de/~zinsmeis/AnnotCorp05/materials/sampson-barbarczy03.pdf.

Tetreault, J. & M. Chodorow (2008). The Ups and Downs of Preposition Error Detection in ESL Writing. In *Proceedings of COLING-08*. Manchester. URL http://www.ets.org/Media/Research/pdf/r3.pdf.

van Rooy, B. & L. Schäfer (2002). The Effect of Learner Errors on POS Tag Errors during Automatic POS Tagging. *Southern African Linguistics and Applied Language Studies* 20, 325–335.

van Rooy, B. & L. Schäfer (2003). An Evaluation of Three POS Taggers for the Tagging of the Tswana Learner English Corpus. In D. Archer, P. Rayson, A. Wilson & T. McEnery (eds.), *Proceedings of the Corpus Linguistics 2003 conference Lancaster University (UK), 28 – 31 March 2003*. vol. 16 of *University Centre For Computer Corpus Research On Language Technical Papers*, pp. 835–844.

Voutilainen, A. & T. Järvinen (1995). Specifying a shallow grammatical representation for parsing purposes. In *Proceedings of the 7th Conference of the EACL.*. Dublin, Ireland. URL http://portal.acm.org/ft_gateway.cfm?id=977003&type=pdf&coll=GUIDE&dl=GUIDE&CFID=47108142&CFTOKEN=71182750.