Spelling in Computer-Assisted Language Learning - Background

Spell Checking in CALL
- The use of word processors has become an integral part of the language learning classroom
- spell checkers have turned into a highly desirable tool for non-native writers
- however, the success of generic spell checkers in correcting misspellings by non-native writers has not been studied extensively

Generic spell checkers
- are designed for native speakers
  - yet in CALL, we are dealing with non-native writers
- assume that most misspellings are performance-based (typos)
  - yet non-native writers also make competence-related errors because they do not know the foreign language that well (e.g. <goed> for <went>)
- correction rate for native speakers’ misspellings is above 90%
  - no comparable studies for non-native speakers’ misspellings

The algorithms of generic spell checkers are based on empirical findings
- most (80 – 95%) misspellings contain only a single error of omission, addition, substitution or transposition (e.g. <lenguage>, <lannguage>, <languafe>, <langauge>)
- the first letter of a misspelled word is usually correct

Rimrott & Heift 2005
Shortcomings of Generic Spell Checkers Concerning L2 Misspellings

Allerton et al. (forthcoming)

- as foreign language learners' errors “often do not correspond to typical typing mistakes, the algorithms used by spell che[ck]ers are of relatively little help in this situation. What is needed to detect this type of variation and generate appropriate feedback is an algorithm (coupled with a database) designed to deal specifically with learner language.”

Kese et al. (1992:126)

- “many more errors could be detected by a spelling corrector if it possessed at least some rudimentary linguistic knowledge”. When confronted with a regular though false form of a word (e.g. with “mouses”), a spelling corrector normally fails to propose the corresponding irregular form (“mice”) as a correction alternative.

Holmes & de Moras (1997:104)

- test the French Grammar Analyzer Le Correcteur 101 on essays by English learners of French and conclude that “[t]he software’s usefulness would be extended if it were taught to anticipate some typical Anglophone errors”

Burston (1998:209)

- analyzes French grammar and spell checker Antidote 98 and concludes that while the program handles most misspellings effectively, it misidentifies “some fairly obvious spelling errors” and fails to recognize sentence initial misspellings

Rimrott & Heift 2005
Spell Checking Aids for Non-Native Writers 1/2

For Learners of English

- SPELLER (De Haan & Oppenhuizen, 1994)
  - intelligent tutoring system that supports Dutch students in the learning of English spelling by engaging them in dialog-like interactions to solve spelling problems
  - targets mainly phonologically-motivated misspellings
  - the system is able to diagnose spelling errors caused by misrepresentations of English phonemes (e.g. writing *<payn> for <pain>)

- The Penguin (Fallman, 2002)
  - a descriptive spelling (and grammar) checker
  - retrieves from the Internet the number of hits of a given string
  - the number of hits for alternative spellings can be compared to determine the correct spelling (i.e. the alternative with the most hits is likely to be the correct spelling)
Spell Checking Aids for Non-Native Writers 2/2

For Learners of Dutch

- Het Speelraam (Bos 1994)
  - a tutoring system for the conjugation and spelling of Dutch verbs
  - the system presupposes that errors are systematic in that they are due to the correct application of incorrect knowledge (“mal-rules”)
    - the correct spelling of Dutch verbs can be obtained by answering various questions concerning the morphosyntactic features of the intended verb form in a decision tree
  - if a verb is misspelled, the system tries to determine at what point in the decision tree the writer made the wrong choice and then guides the student to the correct answer

For Learners of French

- FipsCor (Ndiaye & Vandeventer, 2003)
  - geared towards the correction of both typographical and phonologically-motivated spelling errors
  - uses phonological reinterpretation to retrieve corrections for words that are written phonetically
- Sans-Faute
  - targets beginners and intermediate learners
- Antidote
  - incorporates non-native error lists
- Le Correcteur Didactique

Rimrott & Heift 2005
Need to Consider Authentic Learner Errors/Purpose of the Paper

Problem

• many of the spell checking aids for non-native learners described above are not based on an extensive analysis of non-native misspellings
• yet many researchers recognize the need to consider authentic learner errors in the design of useful language learning programs

Purpose of the Paper

• to provide a classification of non-native German spelling errors along with the distribution of the errors across the proposed categories
• to evaluate a commonly used, generic spell checker based on these non-native German spelling mistakes

Research Design

• 34 Participants (24 English and 10 Chinese learners of German)
• Data Collection
  • E-Tutor - an online CALL program for German
  • for an entire semester, the misspellings that occurred in English-to-German translation exercises were tracked
• Corpus of Misspellings: 374 spelling errors that occurred in 341 uniquely misspelled words

Rimrott & Heift 2005
**Classification of Spelling Errors: Main Categories**

<table>
<thead>
<tr>
<th>Performance Errors</th>
<th>Competence Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• accidental mistypings, “typos”</td>
<td>• systematic misspellings</td>
</tr>
<tr>
<td>• made by L1 and L2 writers alike</td>
<td>• made mainly by L2 writers due to lack of command of language</td>
</tr>
<tr>
<td></td>
<td>• usually greater target deviation</td>
</tr>
<tr>
<td>• usually single letter violations (one-letter additions, omissions, substitutions or transpositions)</td>
<td>• not typical input for spell checkers</td>
</tr>
<tr>
<td>• typical input for spell checkers</td>
<td>• e.g. *&lt;Metz&gt; for &lt;Fleisch&gt; meat</td>
</tr>
<tr>
<td>• e.g. *&lt;Brpt&gt; for &lt;Brot&gt; bread</td>
<td>• 298 of the 374 misspellings in the corpus = 80%</td>
</tr>
<tr>
<td>• 76 of the 374 misspellings in the corpus = 20%</td>
<td></td>
</tr>
</tbody>
</table>

**Pie Chart**

- Performance: 20%
- Competence: 80%

Rimrott & Heift 2005
Competence Errors (80%): Subcategories

Word-level errors / Vocabulary problems
- *<teacher> for <Lehrer> teacher
- *<Metz> for <Fleisch> meat (Metzger butcher)

Problems with inflecting or deriving words
- *<gekaufen> for <gekauft> bought
- *<gießen> for <gegossen> watered

Problems with Phoneme-Grapheme-Correspondences
- *<Meite> for <Miete> rent
- *<gesund> for <gesund> healthy

Surface-level errors: e.g. case, word boundary
- *<Peter's> for <Peters> Peter's
- *<Professor> for <Professor> professor
Performance Errors (20%): Subcategories

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Letter Violations</td>
<td>79%</td>
<td>Single addition, omission, substitution, or transposition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*&lt;Brpt&gt; for &lt;Brot&gt; bread</td>
</tr>
<tr>
<td>Multiple Letter Violations</td>
<td>7%</td>
<td>Multiple modifications needed to obtain target word</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*&lt;unch&gt; for &lt;und&gt; and</td>
</tr>
<tr>
<td>Word Boundary Violations</td>
<td>14%</td>
<td>Run-ons and split words</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*&lt;anunser&gt; for &lt;an unser&gt; on our</td>
</tr>
</tbody>
</table>

* Primarily targeted by generic spell checkers

Rimrott & Heift 2005
Spell Checker Evaluation

Research Question:
How many misspellings are detected and corrected by the spell checker?

Possible Spell Checking Outcomes:
- **misspelling corrected**: detected, and target word is on the list
- **misspelling uncorrected**: detected, but target word is not on the list
- **misspelling undetected**: not detected, i.e. misspelling not flagged

Microsoft Word 2003 spell checker, default settings

Rimrott & Heift 2005
Overall Spell Checking Results

<table>
<thead>
<tr>
<th>Category</th>
<th>Corrected</th>
<th>Uncorrected</th>
<th>Undetected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Performance Words (_70)</td>
<td>17%</td>
<td>14%</td>
<td>69%</td>
</tr>
<tr>
<td>Single Competence Words (_240)</td>
<td>18%</td>
<td>30%</td>
<td>52%</td>
</tr>
<tr>
<td>All Single Words (_310)</td>
<td>18%</td>
<td>26%</td>
<td>56%</td>
</tr>
<tr>
<td>All Words (_341)</td>
<td>17%</td>
<td>31%</td>
<td>52%</td>
</tr>
</tbody>
</table>

Corrected: words detected and corrected.
Uncorrected: words detected but left uncorrected.
Undetected: words not detected.

Rimrott & Heift 2005
Spell Checking Results: Competence Misspellings (single-error only)

Lexical (98)
- Corrected: 57%
- Uncorrected: 22%
- Undetected: 21%

Morphological (43)
- Corrected: 63%
- Uncorrected: 12%
- Undetected: 12%

Phonological (95)
- Corrected: 78%
- Uncorrected: 3%
- Undetected: 19%

Orthographic (4)
- Corrected: 50%
- Uncorrected: 50%
- Undetected: 0%

Rimrott & Heift 2005
Conclusions and Suggestions

Conclusions

• Generic spell checkers such as the MS Word 2003 spell checker are much less effective in treating non-native misspellings than in treating native speaker mistakes
  • 52% of L2 misspellings corrected vs. > 90% of L1 misspellings
• The spell checker was much more successful in treating performance errors (~ 69% corrected) than competence misspellings (~ 52% corrected)
  • But: 80% of misspellings were competence-related
• The greater the target deviation the less successful the correction process
  • phonological > morphological > lexical
• Further Research: How do learners interact with generic spell checkers? What is the influence of factors such as native language, exercise type or proficiency level on L2 misspellings?

Suggestions for Improving Spell Checking in CALL

1. Increase spell checkers’ effectiveness
   • use subset of native speakers’ lexicon
   • flag English and other foreign language words
   • include typical misspellings
   • tackle morphological and phonological errors
2. Decrease learners’ dependence on spell checker
   • teach effective use of spell checker
   • discuss typical competence errors
   • encourage dictionary use, e.g. to reduce lexical errors

Rimrott & Heift 2005