

# Sense-Specific Lexical Information for Reading Assistance

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The 7th Workshop on Innovative Use of NLP  
for Building Educational Applications  
Montreal, Quebec  
June 7, 2012

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  - Readers need information about a word as it is used in context
  - Kulkarni et al. (2008): sense-specific information led to better vocabulary acquisition than general meaning

# Our system

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- The examples we present are from the COBUILD dictionary (Sinclair, 2006), which is designed for language learners
  - We map automatic word sense disambiguation (WSD) output, using WordNet senses (Fellbaum, 1998), to COBUILD

# Our research questions

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  - lexical information on all senses of each chosen word?
- 2 Does sense-specific lexical information facilitate learners' reading comprehension?

# The web system

Learners can upload texts & click on any content word to obtain sense-specific lexical information while reading

**Let's start!**

[Main Menu](#) | [Reading Text](#) | [Vocab Text](#)

<p>You are on your way home and you make a quick visit to the mall to see if there is anything novel or interesting in any of your favorite stores. There's a chance that there will be new items if you shop at any of the retail chains that use the "fast fashion" model of business. There's no longer any need to wait for a change a season (for example, from autumn to winter) to see a new collection of outfits, because fashion retailers are unveiling new lines of clothing monthly or even weekly.</p> <p>Fast fashion retailers offer reasonably priced clothes that follow the latest trends. This allows shoppers who are conscious of fashion to stay current without going bankrupt. Over the past ten years, falling prices have stimulated exceptional growth in expenditures on clothing. In Britain, shoppers spend over \$37 billion per year on clothes, and the fast fashion sector comprises one-fifth of this market.</p> <p>In fact, people in developed countries shop so much that they are now discarding clothes at higher rates than ever before. They don't think of mending a hole or sewing on a new button when a new shirt can be bought for six or seven dollars. When a dress gets stained, why pay to dry clean it when they can buy a new one instead? According to the Environment Protection Agency, the average American</p>	<p style="text-align: center;"><b>unveil</b></p> <hr/> <p>[definition]</p> <p>2.[VERB] If you unveil a plan, new product, or some other thing that has been kept secret, you introduce it to the public.</p> <p>[example]</p> <p>Companies from across Europe are here to unveil their latest models.</p>
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- Tokenize, lemmatize, POS tag, & identify collocations
- Our WSD system provides all of these features
  - SenseRelate::AllWords(SR::AW) (Pedersen and Kolhatkar, 2009) provides broad coverage of content words

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- **Issue:** Different sense inventories
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  - COBUILD for providing lexical information tuned for learners
- **Solution:**
  - We need to redirect WSD output sense (WordNet) to the appropriate corresponding COBUILD sense ...

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Pilot evaluation, using alignment judgments from linguistics faculty & students on a small set of 9 words (Eom et al., 2012):

- Precision of 42.7%–60.7%; Recall of 36.5%–44.5%, depending on confidence in user judgments

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  - 4 No Senses (NS): reading without any support of lexical information

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- NS: (No chance to click on a word)

# Materials

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**Reading comprehension tests:** one test per text

- Each test has 4 multiple-choice and 6 T/F questions

# Materials & Procedure

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## **Procedure**

- Pretest → 2 weeks → Task & Posttests
  - Gap of 2 weeks prevents learners from focusing on words appearing in the pretest

# Data Analysis

## ■ Vocabulary acquisition

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## ■ Reading comprehension

- One-way ANOVA: reading comprehension scores (dependent variable) & 4 groups (independent variable)

## ■ Quality of sense information (effect of system errors)

- Examine accuracy on target words where the system gave incorrect information

# Vocabulary acquisition

Before presenting the vocabulary acquisition results, we run Levene's test of homogeneity of variances

- Pretest:  $F(3, 55) = 0.49$ ,  $p = 0.69$
- Posttest:  $F(3, 56) = 0.13$ ,  $p = 0.94$

Suggests that the four groups have similar variances

# Overall vocabulary scores

	Pretest		Posttest		Gain
	Mean	SD	Mean	SD	
GS	10.73 (54%)	3.43	15.93 (80%)	3.96	<b>5.20 (26%)</b>
SS	10.93 (55%)	2.82	15.47 (77%)	3.80	<b>4.54 (22%)</b>
AS	10.87 (54%)	3.34	13.47 (67%)	3.83	<b>2.60 (13%)</b>
NS	10.87 (54%)	3.25	11.27 (56%)	3.39	<b>0.40 (2%)</b>

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- The sense-specific groups (GS, SS) show the clearest gains

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- Time\*Group interaction effect:  $F(3, 56) = 7.20$ ,  $p < .001$ 
  - Evidence that groups differ in vocabulary acquisition over time
- Post-hoc comparisons:
  - Significant difference between the GS & AS groups in their vocabulary learning over time ( $p = 0.02$ )
  - SS group's apparent advantage over AS fell slightly short of statistical significance ( $p = 0.09$ )

# Vocabulary acquisition on words learners clicked

- 1 Average number of words each learner clicked:
  - gold senses (GS): 28.27 words (7 target words)
  - system senses (SS): 21.80 words (5.93 target words)
  - all senses (AS): 20.87 words (5.60 target words)

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- 2 Vocabulary acquisition for clicked target words:

	Pretest		Posttest		Gain
	Mean	SD	Mean	SD	
GS	40%	32%	<b>85%</b>	22%	<b>45%</b>
SS	25%	18%	<b>81%</b>	25%	<b>56%</b>
AS	23%	25%	<b>68%</b>	32%	<b>45%</b>

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Future work: why did GS learners click the most, and why does the SS condition show the best improvement?

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  - Sense-specific information has a greater increase
- 2 Learning gains appear to be greater for the subset of *clicked* target words than for all words
- 3 Learners may be checking the meaning more when the words are disambiguated correctly (though this needs verification)

# Reading comprehension

Turning to reading comprehension scores & whether sense-specific lexical information facilitates reading comprehension:

	Mean	SD
GS	35.80 (85%)	3.98
SS	37.07 (88%)	2.46
AS	34.93 (83%)	3.08
NS	33.27 (79%)	3.69

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- GS & SS groups have highest values, but only small differences

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To some extent, this supports the idea that sense-specific lexical information facilitates learners' reading comprehension

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Correct	+	88% (14/16)
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- 1 When learners were wrong in pretest:
  - they generally learn the sense with correct information (76%), but not as much with incorrect (50%)
- 2 When learners were correct in pretest:
  - they generally did not un-learn that information (88% vs. 83%)

# Summary & Outlook

## Summary:

- We have developed a web system for displaying sense-specific information to language learners
- We showed that:
  - Automatic presentation of sense-specific information helps learners in vocabulary learning & reading comprehension
  - Learners might learn more of the words whose definitions they check than words they simply encounter while reading

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## Outlook:

- Examine target words with more sense entries (average number of senses = 2.95 in this study)
  - The AS group demonstrated relatively high performance in vocabulary acquisition and reading comprehension
- Improve the system to consistently provide more accurate sense information

# Acknowledgments

Thanks to:

- Stephanie Dickinson & Chelsea Heaven from the Indiana Statistical Consulting Center (ISCC)
- Graham Katz
- the three anonymous reviewers

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