# Using a grammar implementation to teach writing skills

## Dan Flickinger

CSLI, Stanford University

Workshop on Technology Enhanced Learning

GWC 2018, Singapore

12 January 2018

# Goals

- Automated error detection in student writing

- Error-specific recommendations for repair

- High precision and high recall

# Current applications

- Language Arts & Writing course for McGraw-Hill Education

  In U.S. classrooms for past ten years

  50,000 students, primary school, mostly native English

  10 million sentences composed, 1 million short paragraphs

  Two-year efficacy study (Suppes et al 2013)

- On-line test preparation for English as second language

  In pilot with Beijing education company

  Several hundred students, high school, native Mandarin

  Data collection and error analysis underway

# Language Arts course design

- Five "strands" woven into each lesson

  Part of Speech

  Sentence Structure

  Paragraphs

  Reading

  Sentence Composition

- Short lecture for each concept, plus 10-20 exercises

- Over 1,000 exercise sets

- Exercise density determined by individual student performance

# Exercise design for sentence composition

- Present a few sentences of context

- Ask a question

- Provide a set of (fully inflected) words, listed by part-of-speech

- Ask the student to compose an answer as a complete sentence

- Evaluate the answer, and if incorrect, identify error where possible

- Invite the student to try again once

# An example from an early grade

*Colin and Miguel enjoy eating spaghetti with meat sauce.*
*What do Colin and Miguel like to eat?*

# Sentence Composition

Write a complete sentence that answers the question by clicking on words from the lists.
To remove a word from your answer, click and drag it out of the box. Use RESET to remove all your words.

Colin and Miguel enjoy eating spaghetti with meat sauce.

What do Colin and Miguel like to eat?

| Noun | Preposition | Pronoun | Verb |
|---|---|---|---|
| fork | to | he | eat |
| sandwich | | them | like |
| spaghetti | | they | sings |

reset                                                          ok

# An example from an early grade

*Colin and Miguel enjoy eating spaghetti with meat sauce.*
*What do Colin and Miguel like to eat?*

Student answer: **They like eat spaghetti.**

System response: *You are missing the word "to" before "eat".*

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*

*Why didn't Abigail want to go hiking?*

# Sentence Composition

Write a complete sentence that answers the question by clicking on words from the lists.
To remove a word from your answer, click and drag it out of the box. Use RESET to remove all your words.

Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.

Why didn't Abigail want to go hiking?

| Verb | Preposition | Noun | Adjective | Pronoun | Conjunction | Contraction | Adverb |
|------|-------------|------|-----------|---------|-------------|-------------|--------|
| want | to | Abigail | tired | she | because | didn't | too |
| was | | hike | hungry | | | | |
| were | | | sick | | | | |
| go | | | | | | | |
| hiking | | | | | | | |
| hike | | | | | | | |

No answer

OK

Please select words from the word lists to write your answer.

RESET

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she*
*felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she
felt too tired and wanted to rest instead.
Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she*
*felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.
She was too tired to go hike.
She was too tired to go hiking.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.
She was too tired to go hike.
She was too tired to go hiking.
She didn't because she was too tired.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.
She was too tired to go hike.
She was too tired to go hiking.
She didn't because she was too tired.
She didn't want to because she was too tired.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.
She was too tired to go hike.
She was too tired to go hiking.
She didn't because she was too tired.
She didn't want to because she was too tired.
She didn't want to go because she was too tired.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she*
*felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.
She was too tired to go hike.
She was too tired to go hiking.
She didn't because she was too tired.
She didn't want to because she was too tired.
She didn't want to go because she was too tired.
She didn't want to hike because she was too tired.

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.
She was too tired to go hike.
She was too tired to go hiking.
She didn't because she was too tired.
She didn't want to because she was too tired.
She didn't want to go because she was too tired.
She didn't want to hike because she was too tired.
She didn't want to go hike because she was too tired..

# An example from a later grade

*Abigail didn't want to go hiking with her parents because she felt too tired and wanted to rest instead.*
*Why didn't Abigail want to go hiking?*

She was tired.
She was too tired.
She was too tired to.
She was too tired to go.
She was too tired to hike.
She was too tired to go hike.
She was too tired to go hiking.
She didn't because she was too tired.
She didn't want to because she was too tired.
She didn't want to go because she was too tired.
She didn't want to hike because she was too tired.
She didn't want to go hike because she was too tired..
She didn't want to go hiking because she was too tired.

# More variants

She **didn't** because she was tired.
She didn't because she was too tired to.
She didn't because she was too tired to go.
She didn't because she was too tired to go hike.
She didn't because she was too tired to go hiking.
She didn't because she was too tired to hike.
She didn't **want to** because she was tired.
She didn't want to because she was too tired to.
She didn't want to because she was too tired to go.
She didn't want to because she was too tired to go hike.
She didn't want to because she was too tired to go hiking.
She didn't want to because she was too tired to hike.
She didn't **want to go** because she was tired.
She didn't want to go because she was too tired to.
She didn't want to go because she was too tired to hike.
She didn't want to go because she was too tired to go hike.
She didn't want to go because she was too tired to go hiking.
She didn't want to go because she was too tired to hike.
She didn't want **to go hike** because she was tired.
She didn't want to go hike because she was too tired to.
She didn't want to go hike because she was too tired to go.
She didn't want to go hike because she was too tired to go hike.
She didn't want to go hike because she was too tired to go hiking.
She didn't want to go hike because she was too tired to hike.
She didn't want **to go hiking** because she was tired.
She didn't want to go hiking because she was too tired to.
She didn't want to go hiking because she was too tired to go.
She didn't want to go hiking because she was too tired to go hike.
She didn't want to go hiking because she was too tired to go hiking.
She didn't want to go hiking because she was too tired to hike.
She didn't want **to hike** because she was tired.
She didn't want to hike because she was too tired to.
She didn't want to hike because she was too tired to go.
She didn't want to hike because she was too tired to go hike.
She didn't want to hike because she was too tired to go hiking.
She didn't want to hike because she was too tired to hike.

# And more variants

She didn't because she was tired.
She didn't because she was too tired to.
She didn't because she was too tired to go.
She didn't because she was too tired to go hike.
She didn't because she was too tired to go hiking.
She didn't because she was too tired to hike.
She didn't want to because she was tired.
She didn't want to because she was too tired to.
She didn't want to because she was too tired to go.
She didn't want to because she was too tired to go hike.
She didn't want to because she was too tired to go hiking.
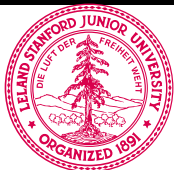She didn't want to because she was too tired to hike.
She didn't want to go because she was tired.
She didn't want to go because she was too tired to.
She didn't want to go because she was too tired to hike.
She didn't want to go because she was too tired to go hike.
She didn't want to go because she was too tired to go hiking.
She didn't want to go because she was too tired to hike.
She didn't want to go hike because she was tired.
She didn't want to go hike because she was too tired to.
She didn't want to go hike because she was too tired to go.
She didn't want to go hike because she was too tired to go hike.
She didn't want to go hike because she was too tired to go hiking.
She didn't want to go hike because she was too tired to hike.
She didn't want to go hiking because she was tired.
She didn't want to go hiking because she was too tired to.
She didn't want to go hiking because she was too tired to go.
She didn't want to go hiking because she was too tired to go hike.
She didn't want to go hiking because she was too tired to go hiking.
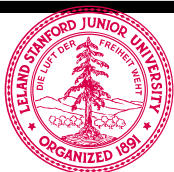She didn't want to go hiking because she was too tired to hike.
She didn't want to hike because she was tired.
She didn't want to hike because she was too tired to.
She didn't want to hike because she was too tired to go.
She didn't want to hike because she was too tired to go hike.
She didn't want to hike because she was too tired to go hiking.
She didn't want to hike because she was too tired to hike.

**Abigail** didn't because she was tired.
Abigail didn't because she was too tired to.
Abigail didn't because she was too tired to go.
Abigail didn't because she was too tired to go hike.
Abigail didn't because she was too tired to go hiking.
Abigail didn't because she was too tired to hike.
Abigail didn't want to because she was tired.
Abigail didn't want to because she was too tired to.
Abigail didn't want to because she was too tired to go.
Abigail didn't want to because she was too tired to go hike.
Abigail didn't want to because she was too tired to go hiking.
Abigail didn't want to because she was too tired to hike.
Abigail didn't want to go because she was tired.
Abigail didn't want to go because she was too tired to.
Abigail didn't want to go because she was too tired to hike.
Abigail didn't want to go because she was too tired to go hike.
Abigail didn't want to go because she was too tired to go hiking.
Abigail didn't want to go because she was too tired to hike.
Abigail didn't want to go hike because she was tired.
Abigail didn't want to go hike because she was too tired to.
Abigail didn't want to go hike because she was too tired to go.
Abigail didn't want to go hike because she was too tired to go hike.
Abigail didn't want to go hike because she was too tired to go hiking.
Abigail didn't want to go hike because she was too tired to hike.
Abigail didn't want to go hiking because she was tired.
Abigail didn't want to go hiking because she was too tired to.
Abigail didn't want to go hiking because she was too tired to go.
Abigail didn't want to go hiking because she was too tired to go hike.
Abigail didn't want to go hiking because she was too tired to go hiking.
Abigail didn't want to go hiking because she was too tired to hike.
Abigail didn't want to hike because she was tired.
Abigail didn't want to hike because she was too tired to.
Abigail didn't want to hike because she was too tired to go.
Abigail didn't want to hike because she was too tired to go hike.
Abigail didn't want to hike because she was too tired to go hiking.
Abigail didn't want to hike because she was too tired to hike.

# And still more variants

**Because she was tired**, she didn't.
Because she was too tired to, she didn't.
Because she was too tired to go, she didn't.
Because she was too tired to go hike, she didn't.
Because she was too tired to go hiking, she didn't.
Because she was too tired to hike, she didn't.
Because she was tired, she didn't want to.
Because she was too tired to, she didn't want to.
Because she was too tired to go, she didn't want to.
Because she was too tired to go hike, she didn't want to.
Because she was too tired to go hiking, she didn't want to.
Because she was too tired to hike, she didn't want to.
Because she was tired, she didn't want to go.
Because she was too tired to, she didn't want to go.
Because she was too tired to hike, she didn't want to go.
Because she was too tired to go hike, she didn't want to go.
Because she was too tired to go hiking, she didn't want to go.
Because she was too tired to hike, she didn't want to go.
Because she was tired, she didn't want to go hike.
Because she was too tired to, she didn't want to go hike.
Because she was too tired to go, she didn't want to go hike.
Because she was too tired to go hike, she didn't want to go hike.
Because she was too tired to go hiking, she didn't want to go hike.
Because she was too tired to hike, she didn't want to go hike.
Because she was tired, she didn't want to go hiking.
Because she was too tired to, she didn't want to go hiking.
Because she was too tired to go, she didn't want to go hiking.
Because she was too tired to go hike, she didn't want to go hiking.
Because she was too tired to go hiking, she didn't want to go hiking.
Because she was too tired to hike, she didn't want to go hiking.
Because she was tired, she didn't want to hike.
Because she was too tired to, she didn't want to hike.
Because she was too tired to go, she didn't want to hike.
Because she was too tired to go hike, she didn't want to hike.
Because she was too tired to go hiking, she didn't want to hike.
Because she was too tired to hike, she didn't want to hike.

Because Abigail was tired, she didn't.
Because Abigail was too tired to, she didn't.
Because Abigail was too tired to go, she didn't.
Because Abigail was too tired to go hike, she didn't.
Because Abigail was too tired to go hiking, she didn't.
Because Abigail was too tired to hike, she didn't.
Because Abigail was tired, she didn't want to.
Because Abigail was too tired to, she didn't want to.
Because Abigail was too tired to go, she didn't want to.
Because Abigail was too tired to go hike, she didn't want to.
Because Abigail was too tired to go hiking, she didn't want to.
Because Abigail was too tired to hike, she didn't want to.
Because Abigail was tired, she didn't want to go.
Because Abigail was too tired to, she didn't want to go.
Because Abigail was too tired to hike, she didn't want to go.
Because Abigail was too tired to go hike, she didn't want to go.
Because Abigail was too tired to go hiking, she didn't want to go.
Because Abigail was too tired to hike, she didn't want to go.
Because Abigail was tired, she didn't want to go hike.
Because Abigail was too tired to, she didn't want to go hike.
Because Abigail was too tired to go, she didn't want to go hike.
Because Abigail was too tired to go hike, she didn't want to go hike.
Because Abigail was too tired to go hiking, she didn't want to go hike.
Because Abigail was too tired to hike, she didn't want to go hike.
Because Abigail was tired, she didn't want to go hiking.
Because Abigail was too tired to, she didn't want to go hiking.
Because Abigail was too tired to go, she didn't want to go hiking.
Because Abigail was too tired to go hike, she didn't want to go hiking.
Because Abigail was too tired to go hiking, she didn't want to go hiking.
Because Abigail was too tired to hike, she didn't want to go hiking.
Because Abigail was tired, she didn't want to hike.
Because Abigail was too tired to, she didn't want to hike.
Because Abigail was too tired to go, she didn't want to hike.
Because Abigail was too tired to go hike, she didn't want to hike.
Because Abigail was too tired to go hiking, she didn't want to hike.
Because Abigail was too tired to hike, she didn't want to hike.

# And even more variants

Because she was tired, **Abigail** didn't.
Because she was too tired to, Abigail didn't.
Because she was too tired to go, Abigail didn't.
Because she was too tired to go hike, Abigail didn't.
Because she was too tired to go hiking, Abigail didn't.
Because she was too tired to hike, Abigail didn't.
Because she was tired, Abigail didn't want to.
Because she was too tired to, Abigail didn't want to.
Because she was too tired to go, Abigail didn't want to.
Because she was too tired to go hike, Abigail didn't want to.
Because she was too tired to go hiking, Abigail didn't want to.
Because she was too tired to hike, Abigail didn't want to.
Because she was tired, Abigail didn't want to go.
Because she was too tired to, Abigail didn't want to go.
Because she was too tired to hike, Abigail didn't want to go.
Because she was too tired to go hike, Abigail didn't want to go.
Because she was too tired to go hiking, Abigail didn't want to go.
Because she was too tired to hike, Abigail didn't want to go.
Because she was tired, Abigail didn't want to go hike.
Because she was too tired to, Abigail didn't want to go hike.
Because she was too tired to go, Abigail didn't want to go hike.
Because she was too tired to go hike, Abigail didn't want to go hike.
Because she was too tired to go hiking, Abigail didn't want to go hike.
Because she was too tired to hike, Abigail didn't want to go hike.
Because she was tired, Abigail didn't want to go hiking.
Because she was too tired to, Abigail didn't want to go hiking.
Because she was too tired to go, Abigail didn't want to go hiking.
Because she was too tired to go hike, Abigail didn't want to go hiking.
Because she was too tired to go hiking, Abigail didn't want to go hiking.
Because she was too tired to hike, Abigail didn't want to go hiking.
Because she was tired, Abigail didn't want to hike.
Because she was too tired to, Abigail didn't want to hike.
Because she was too tired to go, Abigail didn't want to hike.
Because she was too tired to go hike, Abigail didn't want to hike.
Because she was too tired to go hiking, Abigail didn't want to hike.
Because she was too tired to hike, Abigail didn't want to hike.

Because Abigail was tired, Abigail didn't.
Because Abigail was too tired to, Abigail didn't.
Because Abigail was too tired to go, Abigail didn't.
Because Abigail was too tired to go hike, Abigail didn't.
Because Abigail was too tired to go hiking, Abigail didn't.
Because Abigail was too tired to hike, Abigail didn't.
Because Abigail was tired, Abigail didn't want to.
Because Abigail was too tired to, Abigail didn't want to.
Because Abigail was too tired to go, Abigail didn't want to.
Because Abigail was too tired to go hike, Abigail didn't want to.
Because Abigail was too tired to go hiking, Abigail didn't want to.
Because Abigail was too tired to hike, Abigail didn't want to.
Because Abigail was tired, Abigail didn't want to go.
Because Abigail was too tired to, Abigail didn't want to go.
Because Abigail was too tired to hike, Abigail didn't want to go.
Because Abigail was too tired to go hike, Abigail didn't want to go.
Because Abigail was too tired to go hiking, Abigail didn't want to go.
Because Abigail was too tired to hike, Abigail didn't want to go.
Because Abigail was tired, Abigail didn't want to go hike.
Because Abigail was too tired to, Abigail didn't want to go hike.
Because Abigail was too tired to go, Abigail didn't want to go hike.
Because Abigail was too tired to go hike, Abigail didn't want to go hike.
Because Abigail was too tired to go hiking, Abigail didn't want to go hike.
Because Abigail was too tired to hike, Abigail didn't want to go hike.
Because Abigail was tired, Abigail didn't want to go hiking.
Because Abigail was too tired to, Abigail didn't want to go hiking.
Because Abigail was too tired to go, Abigail didn't want to go hiking.
Because Abigail was too tired to go hike, Abigail didn't want to go hiking.
Because Abigail was too tired to go hiking, Abigail didn't want to go hiking.
Because Abigail was too tired to hike, Abigail didn't want to go hiking.
Because Abigail was tired, Abigail didn't want to hike.
Because Abigail was too tired to, Abigail didn't want to hike.
Because Abigail was too tired to go, Abigail didn't want to hike.
Because Abigail was too tired to go hike, Abigail didn't want to hike.
Because Abigail was too tired to go hiking, Abigail didn't want to hike.
Because Abigail was too tired to hike, Abigail didn't want to hike.

# Approach

- Use existing DELPH-IN resources (`www.delph-in.net`)

    English Resource Grammar (ERG: Flickinger 2000, 2011)

    Efficient ACE parser (`moin.delph-in.net/AceTop`)

- Adapt 'mal-rule' approach to accept mild ungrammaticality

    Schneider & McCoy (1998), Bender et al. (2004)

- Parse each novel input and return derivation tree

- Check for `root_robust`, and if so, find `..._rbst` node

- Look up robustness symbol in error code table (grade-specific)

- Present appropriate message to student

# An ungrammatical example

*Ricky's toys are in closet*
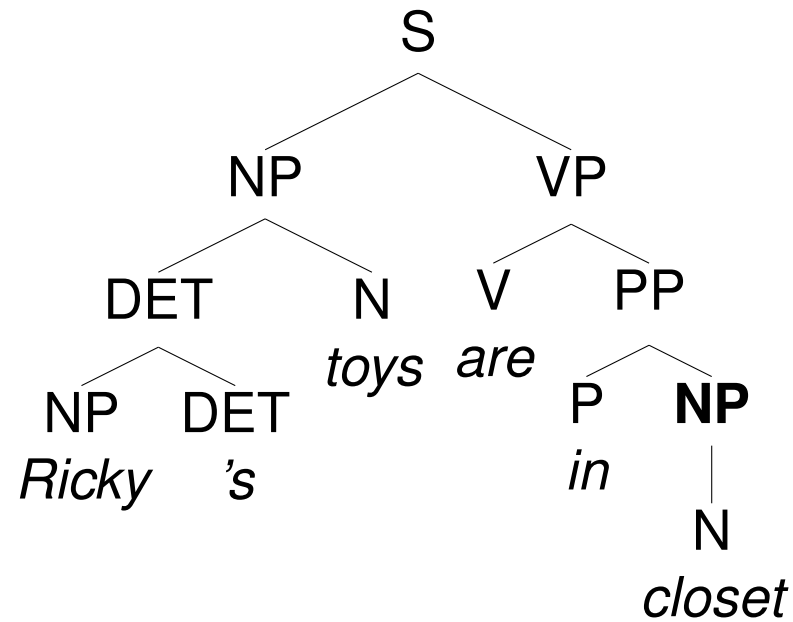
# Theoretical linguistic framework: HPSG

**Head-driven Phrase Structure Grammar**

- Sign-based view of words and phrases as feature structures

- Rich lexicon, small number of schematic rules

- Principles for propagation of feature values within phrases

- Growing emphasis on constructions

- Analyses valid for both parsing and generation

**Typed feature structures**

- Hierarchy of types with appropriate features

- Cross-classification via multiple inheritance

- Merging of constraints via unification

# English Resource Grammar (ERG)

- 7000 types in multiple-inheritance monotonic hierarchy

- 1000 leaf lexical types

- 40,000 manually constructed lexemes

- 200 syntactic rules

- 100 morphological rules (inflection and derivation)


- Online demo: `lingo.stanford.edu/erg`

# Changes to the general-purpose grammar

## Extensions to permit common errors

- **Mal-rules** for inflection, syntax

  e.g. bare singular NP, or bare 3sg-present verb

- **Mal-types** for lexicon

  e.g. subj-equi with base VP: *Ricky likes go to the park*

## Reductions to avoid some ambiguity

- Rules

  For example, block noun-noun compound rules

  *Ricky's **closet toys** are in the closet*

- Lexicon

  For example, block the verb *flower*

  *Art and science **flowered** during the 17th century.*

# Example derivation

```
(sb-hd_mc_c [root_robust_s]
  (sp-hd_n_c
    (sp-hd_hc_c
      (hdn_bnp-pn_c
        (n_sg_ilr (ricky_n1/n_-_pn_le ("ricky" <0:1>))))
      (apostrophe_s_2_lex/n_-_cl-poss_le ("'s" <1:2>)))
    (n_pl_olr (toy_n1/n_-_c_le ("toys" <2:3>))))
  (hd-cmp_u_c
    (be_c_are/v_prd_are_le ("are" <3:4>))
    (hd-cmp_u_c
      (in/p_np_i-reg_le ("in" <4:5>))
    ( bare_np_sg_rbst
        (n_sg_ilr (closet_n1/n_-_c_le ("closet" <5:6>)))))))))
```

# Mal-rule example: bare_np_sg_rbst

$$
\begin{bmatrix}
\text{HEAD} & noun \\
\text{SPR} & \langle\,\rangle \\
\text{DTR} & \begin{bmatrix}
\text{SPR} & \langle\,[\text{OPT} - ]\,\rangle \\
\text{AGR} & \begin{bmatrix} \text{PN} & \text{3sing} \\ \text{DIV} & - \end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$

# Error messages

| | |
|---|---|
| Your answer is not grammatical. | *He are be was dog* |
| Your answer is not a complete sentence. | *In the park* |
| Your answer is grammatical but awkward. | *They saw in the lake a duck* |
| Your answer cannot be a question. | *Did she go to the beach* |
| You are missing an article before the word $X. | *She went to house* |
| Remember to use "an" only before a vowel. | *He ate an sandwich* |
| Don't use "a" before a vowel. | *She saw a owl* |
| Don't put "the" before a name. | *The Katherine eats breakfast* |
| You are missing a preposition before $X. | *They watched movies the afternoon* |
| You are missing the word "to" before $X. | *She told her brother borrow her book* |
| Don't put "to" before $X. | *She let her brother to borrow her book* |
| The verb $X needs an object. | *She let borrow her book* |
| You are missing a noun. | *Our chased the cat* |
| Use an adverb like "well" or "poorly" instead of "bad". | *He did bad on his test* |
| Use "its" instead of "it's" to show ownership. | *The dog is in it's house* |
| Remember to use "this" only before a singular noun. | *He said he like this mittens* |
| Don't use "did/does/do" in your answer. | *The dog did go for a walk* |
| You have the wrong form of the verb. | *The boy be late for school* |
| Your subject doesn't agree with the verb $X. | *Alex write a letter* |

# Efficacy study

- 5,000 students over two years (2009-2011)

- Memphis public schools (grades 2-6)

- Compared annual state exam results

- Correlated with amount of positive LA&W coursework

# Efficacy study



Case Study: Shelby County School District*

# Evaluation of student writing in LA&W

Sentences composed by 29,000 Memphis students in 2010-2012:

| | Correct (stored) | Incorrect (stored) | New | All |
|---|---|---|---|---|
| **Total** | 3,390.850 | 691,021 | 1,977,932 | 6,059,803 |
| | 56.0% | 11.4% | 32.6% | |
| **Analyzed** | | | Correct: 574,312<br>Incorrect: 1,158,411 | |

# Evaluation of student writing in LA&W

Sentences composed by 29,000 Memphis students in 2010-2012:

| | Correct (stored) | Incorrect (stored) | New | All |
|---|---|---|---|---|
| **Total** | 3,390.850 | 691,021 | 1,977,932 | 6,059,803 |
| | 56.0% | 11.4% | 32.6% | |
| **Analyzed** | | | Correct:    574,312<br>Incorrect:   1,158,411 | |

Paragraphs composed by students (grades 3 and 6) in first year

45,000 in Grade 3
4,000 in Grade 6

# Recent one-month usage snapshot

- 120,000 sentences

- 21,000 distinct correct answers

- 5,000 distinct incorrect answers

- 170 error types

# Snapshot error frequencies

| Freq | Error type |
|------|-----------|
| 605 | Missing article |
| 151 | Subj-V number mismatch |
| 147 | Det-N number mismatch |
| 109 | Run-on sentence |
| 86 | Misplaced adjective |
| 56 | Pronoun case |
| 55 | Sentence-initial conjunction |
| 43 | Past-tense verb form |
| 33 | *good* as adverb |
| 29 | Space before comma |
| 27 | Missing apostrophe in contraction |
| 26 | Misspelled *too* as *to* |
| 26 | Missing prep for directional *go* |
| ... | ... |
| 2019 | Total |

# Composing Your Narrative Paragraph

You have two tries to write your sentence. Click "Period" to end the sentence. When you are finished writing, click "Next Exercise".

**Imagine that you went to the park last Saturday. Write a narrative paragraph to describe how you spent your day and whether you had a good time.**

| Reset | | Period | | Next Exercise |
|---|---|---|---|---|

| Basic Words | | | Modifiers | | Nouns | | Verb | |
|---|---|---|---|---|---|---|---|---|
| , | I | we | boring | warm | book | rain | eat | were |
| a | it | when | cold | | brother | Saturday | enjoyed | |
| all | my | with | fun | | day | slides | felt | |
| an | next | | good | | friends | snacks | had | |
| and | of | | great | | game | time | played | |
| at | on | | last | | grass | | raced | |
| down | other | | rainy | | hide-and-seek | | read | |
| each | the | | really | | mom | | sat | |
| finally | there | | sunny | | monkey bars | | slid | |
| first | to | | tired | | park | | was | |

# Sample student paragraph

| 20120312211040 | I went to beach with my family yesterday. |
| 20120312211101 | I went to the beach with my family yesterday. |
| 20120312211224 | At the beach we made sandcastles. |
| 20120312211339 | We went swimming in the ocean. |
| 20120312211429 | We read books at the beach. |
| 20120312211546 | I had a fun time at the beach. |

# Another student paragraph

20120322082558   Dinosaurs dinosaurs dinosaurs.
20120322082628   Pictures pictures pictures books bus.
20120322082644   Books books books.

# Semantic evaluation

- For single sentence tasks, identify errors in meaning

- Include reference answers provided by exercise authors

- Do graph-based comparison of semantics of student's sentence

- Classify mismatches into small number of error types

    Wrong subject or object

    Wrong main verb

    Missing argument

    Wrong or missing modifier

# Semantic comparison: match
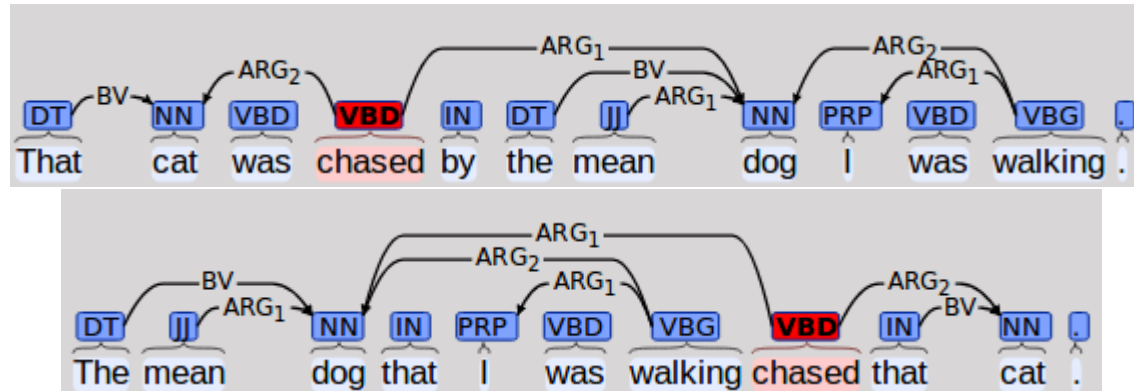
# Semantic comparison: match
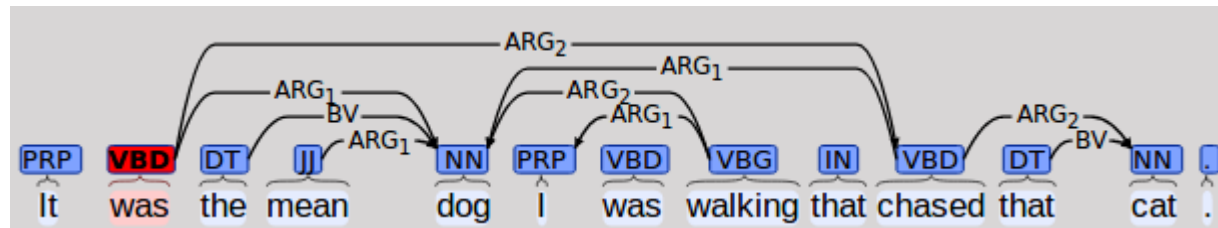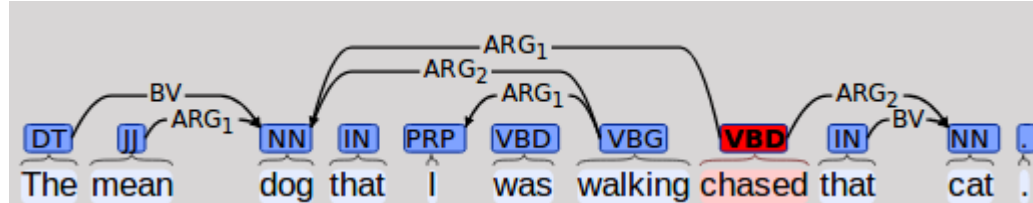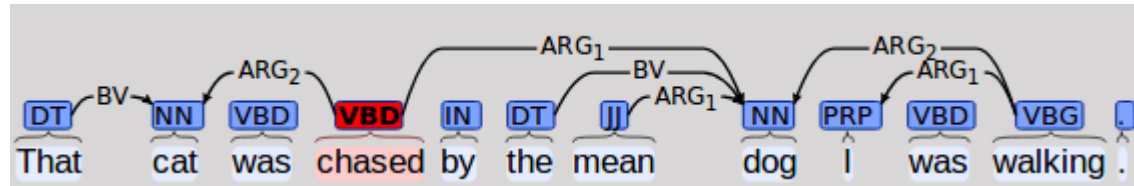
# Semantic comparison: mismatch
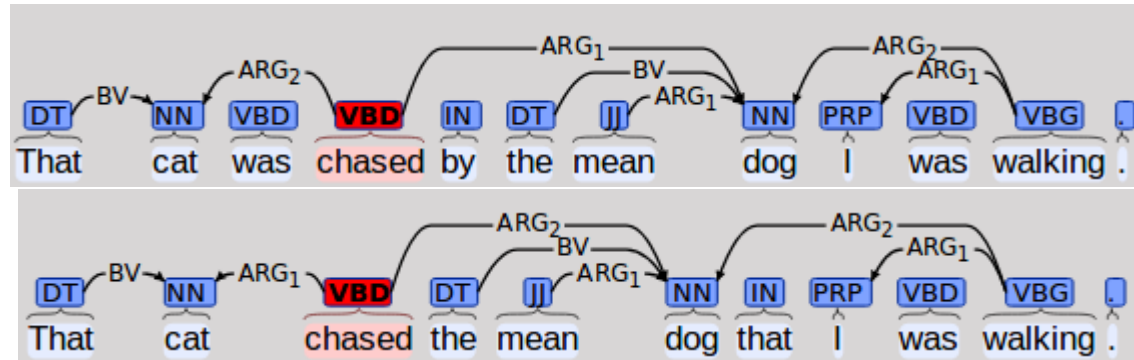
# In development

- Automated paraphrase generation to improve semantic error detection

- Short essays: Error-checking of open-vocabulary compositions
    Grammatical errors and style recommendations

- First-language influence on English error types and frequencies
    Collaboration with Hong Kong Polytechnic for Mandarin speakers

- Generation of corrected student sentences
    Using semantics from incorrect sentence, disabling mal-rules