A, An, and The

Automatically Identifying and Correcting the Most Common Errors in English Article Usage

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Overview of Presentation

- Background
  - The problem with articles (Ø, a/an, the)
  - Research on article errors
  - Research on article error analysis systems
- Research Questions
  - What article errors do learners typically make?
  - How can a system be trained to automatically identify and correct article errors?
- Results
  - Common article errors in university student writing
  - A Fast and Accurate Error Correction System (*AntCorrector*)
- Conclusion / Future Work

Background (1)
The problem with articles (Ø, a/an, the)

- English articles are notoriously difficult for non-native speakers of English
  - Master (1987; 1995); Celce-Murcia & Larsen-Freeman (1999); Cheng & Warren (1999); Wong & Celce-Murcia (2003); Han et al., (2006)
- 27% of all errors in the JLE corpus involve articles
  - Gamon et al. (2009)
- 12% of all errors in the ICLE and CLEC corpora involve articles
  - Rozovskaya, A. & Roth, D. (2010)

Background (1)
The problem with articles (Ø, a/an, the)

- A brief review of article complexities
  - Strength of countability
    - Strong: *I want to read book.
I want to read a book.
    - Medium: I want to eat cake.
I want to eat a cake.
    - Weak/None: I want to get knowledge.
*I want to get a knowledge.
  - Adjectives
    - Good: He has a good knowledge of English.
    - Better: She has a better knowledge of English.
She has the better knowledge of English.
    - Best: She has the best knowledge of English.

Background (1)
The problem with articles (Ø, a/an, the)

- A brief review of article complexities
  - Units of measure
    - The temperature is 60 degrees.
    - He has a temperature.
    - The time is 3 0'clock.
    - I don't have the time.
    - I don't have time.
  - Proper Nouns
    - Have you seen Tokyo Tower?
    - *Have you seen a Tokyo Tower?
    - Have you seen The Eiffel Tower?
    - *Have you seen an Eiffel Tower?
    - Have you seen the Statue of Liberty?
    - Have you seen a Statue of Liberty, in Odaiba, Tokyo?

Background (1)
The problem with articles (Ø, a/an, the)

"As any teacher of English as a Second Language can attest, one of the most complex problems faced by a non-native speaker is when to use a (or an), the, or 0 (zero or no) article…"

(Na-Rae Han et al, 2006: 115)

Background (2)
Research on article errors

- Identification of Error Types
  - Books
    - Claire, E. & Greenwood, R. (1988); Brender, A. S. (1997); Cole, T. (2000)
  - Research papers
    - Wong, J., & Celce-Murcia, M. (2003)
- Research on Teaching about Article Errors
  - Books
    - Any ESL/EFL textbook
  - Research papers
    - Master, P. (1995); Ferris et al., (2000); Bitchener, J., Young, S., & Cameron, D. (2005); Farrow, N. K. (2008); Wei-chen Chuang (2009)

Consciousness raising and indirect feedback can be effective in teaching about article errors

Background (2)
Research on article errors

"One of the most common mistakes that non-native speakers make with articles is using a or an with plural or uncountable nouns."
http://www.rpi.edu/dept/llc/writecenter/web/esl.html

"[This] lesson avoids directly dealing with the related (and relevant) questions of:
- zero article
- countable and uncountable nouns, singular and plural uses
- …
Some of these remaining 'rules' are relatively simple…
(Farrow, N. K., 2008)

Background (3)
Research on article error analysis systems

- Rule-Based Approaches
  - Bond, Ogura, & Ikehara, 1994; Heine, 1998 ; Murata & Nagao, 1993; Gressang (2000)
- Strengths
  - Can be created/understood/interpreted by humans
    - An "expert system"
  - Can be modified (improved) easily
  - Can be tailored to the quirks of a particular domain
- Weaknesses
  - Do not scale-well to very large systems with broad contexts
  - Difficult to design and debug (not always opaque)
  - Time-consuming to develop appropriate sets of rules

Background (3)
Research on article error analysis systems

- Data-Driven Approaches
  - Knight & Chander, 1994; Minnen, Bond, & Copestake, 2000; Turner & Charniak, 2007 ; Izumi, Uchimoto, Saiga, Supnithi, & Isahara, 2003; Han, Chodorow, & Leacock, 2004; Nagata, Wakana, Masui, Kawai, & Isu, 2005; Nagata, Kawai, Morihiro, & Isu, 2006; De Felice & Pulman, 2007; Chodorow, Tetreault, & Han, 2007; Tetreault & Chodorow, 2008; Gamon et al., 2008
- Strengths
  - Scale well to very large systems with broad contexts
  - Fast and efficient
  - Regular (only one or a few approaches are combined)
- Weaknesses
  - Difficult for humans to understand/interpret
  - Difficult to modify (improve)
  - Cannot be tailored (easily) to the quirks of a particular domain

Very few error analysis systems have become mainstream
(except Microsoft Word Grammar checker, ETS Criterion, JIEM CASEC G/GTS/WT)

Research Question 1:
What article errors do learners typically make?

- Literature Findings
  - Omission errors account for 70.37% of all non-speech related article errors in the NICT JLE Corpus (Gamon et al., 2009).
  - Omission errors account for 58% of all article errors in student TOEFL essays (Han et al, 2006: 125).

Table 7. *Proportion of article errors by error type for three language groups*

Error Type	Chinese	Japanese	Russian
1. Extraneous	0.238	0.215	0.222
2. *a-the* confusion	0.064	0.062	0.050
3. Missing *a/an*	0.291	0.334	0.315
4. Missing *the*	0.185	0.223	0.261
5. Missing either	0.025	0.029	0.018
6. Other	0.198	0.136	0.134
Total	1.000	1.000	1.000

Research Question 1:
What article errors do learners typically make?

- Subjects:
  - Location: Faculty of Sci. and Eng., Waseda University
  - Number: 26 students
  - Age: 2nd year undergraduate (CBD Course)
  - Level: TOEIC (Min. 555 pts. Max. 840 pts., Ave. 661 pts.)
- Corpus
  - Genre: 4 homework essays collected over 6 weeks in 2010

Topic	Title	Words
A	Explanation of the Nobel Prize nomination process	4132
B	Description of a figure showing overseas study trends	5949
C	Explanation of the problem-solving task	3598
D	Discussion of the Space Shuttle Challenger disaster	9358
	Total	23,037

Research Question 1:
What article errors do learners typically make?

Concept Building and Discussion 1(2010) – Report 2

xxx YYY

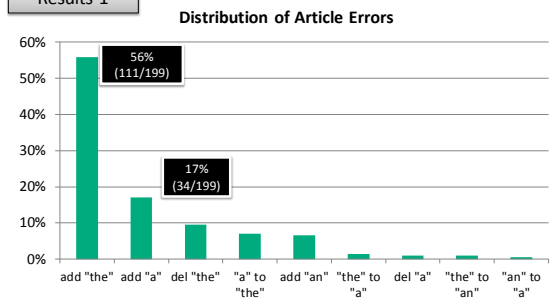
Student Number: ZZZ

Title: Nomination of the Nobel Prize

Nominating the Nobel Prize involves 6 steps. In the first step, the Nobel Assembly appoints a working committee called the Nobel Committee, and it organizes and carries out initial planning. In the second step, it sends about 3000 invitations ~~that solicit~~for proposals for the Nobel Prize candidates to members of the scientific or engineering community, such as universities, famous scientists, and research organizations ~~or so~~ by September. Third, about 250-300 candidates ~~return~~ are ~~proposals~~ proposed to the Nobel Committee by late January the following year. In the next step, by September, ~~The~~ the Nobel Committee asks experts to evaluate each candidate and makes their recommendations. Then, it gives them to the Nobel Assembly. Following this, the Nobel Assembly makes a final decision on who will win the Nobel Prize by October. The last step is awarding the Nobel Prize in December at Stockholm Concert Hall.

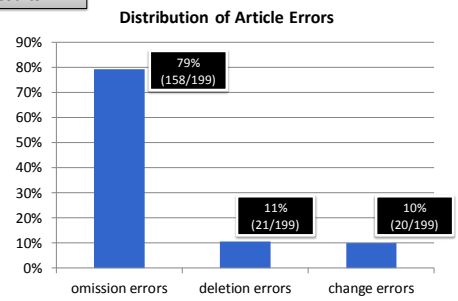
Research Question 1:
What article errors do learners typically make?

Results 1



Research Question 1:
What article errors do learners typically make?

Results 2



Research Question 1:
What article errors do learners typically make?

Results 3

Correction Type	Frequency	Percentage
add "the"	111	56%
add "a"	34	17%
delete "the"	19	10%
change "a" to "the"	14	7%
add "an"	13	7%
change "the" to "a"	3	2%
delete "a"	2	1%
change "the" to "an"	2	1%
change "an" to "a"	1	1%
Total	199	100%

Correction Type	Frequency	Percentage
add errors	158	79%
delete errors	21	11%
change errors	20	10%
Total	199	100%

Research Question 2:
Can a system be created to identify and correct article errors?

- Experimental Design
  - Approach: A rule-based system (a set of "IF-THEN" statements)
  - Examples:
    - IF singular noun appears THEN scan back to find the appearance of an article.
    - IF no article appears THEN add "the"
    - IF "a" is followed by "most" THEN change "a" to "the"
  - Rationale:
    - Can be created/understood/interpreted by humans
    - Can be modified (improved) easily
    - Can be tailored to the quirks of a particular domain (learner writing)
    - Can work at small (classroom) scale levels

Research Question 2:
Can a system be created to identify and correct article errors?

- Experimental Procedure
  - Pre-processing:
    - Tag corpus data with article errors (199 errors) in Microsoft Word
    - Save as (Unicode UTF-8) plain text (no data cleaning necessary)
    - Split sentences with multiple errors into single sentences containing only one *marked* error (to simplify measuring the system performance)
    - Part-Of-Speech (POS) tag all sentences (with CLAWS)
  - Step 1: Divide the corpus data in training and testing sets
    - Training Data: 149 randomly selected sentence errors
    - Testing Data: 50 randomly selected sentence errors
  - Step 2: Build the rule-based system based on the training data
  - Step 3: Measure the system performance on the testing data
    - Performance Measures: Accuracy, Precision, Recall
    - Comparison Measure: *Microsoft Word* Grammar Checker

Research Question 2:
Can a system be created to identify and correct article errors?

- Performance Measures

		System Result			
		omission	deletion	change	Ø
Desired Result	omission	$true_o$	$false_{od}$	$false_{oc}$	$false_{oØ}$
	deletion	$false_{do}$	$true_d$	$false_{dc}$	$false_{dØ}$
	change	$false_{co}$	$false_{cd}$	$true_c$	$false_{cØ}$
	Ø	$false_{Øo}$	$false_{Ød}$	$false_{Øc}$	$true_Ø$

- Accuracy = $\frac{true_o + true_d + true_c + true_Ø}{\text{total true + total false}}$
- $Precision_{omission} = \frac{true_o}{true_o + false_{do} + false_{co} + false_{Øo}}$
- $Recall_{omission} = \frac{true_o}{true_o + false_{oc} + false_{oc} + false_{oØ}}$

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Research Question 2:
Can a system be created to identify and correct article errors?

- Results (149 training samples) with *AntChecker*

		System Result			
		omission	deletion	change	Ø
Desired Result	omission	112	0	0	8
	deletion	0	11	0	2
	change	0	1	10	5
	Ø	0	0	0	0

- Performance Measures

Accuracy = 133/149 = 89%					
$Precision_{omission}$	112/112	100%	$Recall_{omission}$	112/120	93%
$Precision_{deletion}$	11/12	92%	$Recall_{deletion}$	11/13	85%
$Precision_{change}$	10/10	100%	$Recall_{change}$	10/16	62%

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Research Question 2:
Can a system be created to identify and correct article errors?

- Comments
  - Analyzing the training data revealed (possible) human level mistakes
    - Examples:
      - add_"the" NASA should learn a lot from this disaster and must never cause disasters like this .
      - We highly think a pilot of an airplane is add_"a" male .
      - Therefore , some students was not permitted to Entering "a"_to_"the" country .

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Research Question 2:
Can a system be created to identify and correct article errors?

- Results (50 testing samples) with *AntChecker*

		System Result			
		omission	deletion	change	Ø
Correct (Desired) Result	omission	27	0	0	11
	deletion	0	5	0	3
	change	0	0	0	4
	Ø	0	0	0	0

- Performance Measures

Accuracy = 33/50 = 64%					
$Precision_{omission}$	27/27	100%	$Recall_{omission}$	27/38	71%
$Precision_{deletion}$	5/5	100%	$Recall_{deletion}$	5/8	62%
$Precision_{change}$	0/0	-	$Recall_{change}$	0/4	0%

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Research Question 2:
Can a system be created to identify and correct article errors?


14 Firstly , the Nobel Assembly chooses the members of a work committee called the Nobel Committee .
17 First of all , the Nobel Assembly makes an appointment of a working committee which is called the Nobel Committee .
23 First , the Nobel Assembly appoints the working committee called the Nobel Committee .
30 However , United States , United Kingdom , and Germany had a lower percentage in 2003 than in 1998 .
33 While some countries such as the US , the UK , Germany got a lower percentage in 2003 than 1998 , the other countries including France , Australia , Japan , Italy , New Zealand , Finland , Korea got a higher percentage .
37 The possible reasons for decreasing the percentage in some countries are : 1 : because of increasing the percentage of some countries which had a low percentage in 1998 , the countries which had a higher percentage got a lower percentage relatively , 2 : because of the large student 's population , the countries which had a higher percent became less the kind than before .
41 The Second factor is the technology of the country .
84 the Other popular countries , the United Kingdom and Germany , also got a lower percentage in 2003 compare to in 1998.
87 It also shows that the 2003xs81f the percentage of the top three destination countries which are United States , United Kingdom and Germany are decreasing comparing to 1998.
89 These results suggest that modern people began to get interested in the other countries which have the unique culture and language .
77 Australia is also the English speaking country and near Asia .
84 However , he is caught by the police officer and he is given a ticket .
85 That ticket maybe shows the traffic violation .
111 First , the weather was bad at the landing site from January 25 to 28.
113 Therefore , NASA changed the launch day to the next day three times .
128 If the O-rings will not operate properly , the SRB failure will cause the space shuttle destruction .
129 When the Challenger launched , the atmospheric temperature was probably lower than the O-ring81fs minimum operating temperature .
142 Therefore , hot fuel gases escaped from the SRBs and it leaded a critical damage for the space shuttle .
146 The Third fact is weather conditions .
154 One is the relation between the O-ring and the weather condition .
160 It is difficult to prevent the accident whether the task is difficult or not .
162 Therefore the possible way for reduce the probability of the accident is probably NASA managers consider about the condition both of the Space Shuttle and weather more carefully and listen to the opinion of engineers .
166 Managers might not have any margins for the late of the launch .
172 The NASA launched the space shuttle Challenger on January the 28th , 1986.
175 Until that day , the Challenger has succeeded nine missions .
177 When the challenger disintegrated , they were said to still alive in the challenger

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Research Question 2:
Can a system be created to identify and correct article errors?

- Results (50 testing samples) with *Microsoft Grammar Checker*

		System Result			
		omission	deletion	change	Ø
Correct (Desired) Result	omission	0	0	0	38
	deletion	0	0	0	8
	change	0	0	0	4
	Ø	0	0	0	0

- Performance Measures

Accuracy = 0/50 = 0%					
$Precision_{omission}$	0/0	-	$Recall_{omission}$	0/38	0%
$Precision_{deletion}$	0/0	-	$Recall_{deletion}$	0/8	0%
$Precision_{change}$	0/0	-	$Recall_{change}$	0/4	0%

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Research Question 2:
Can a system be created to identify and correct article errors?

- Results (149 training samples) with *Microsoft Grammar Checker*

		System Result			
		omission	deletion	change	Ø
Correct (Desired) Result	omission	0	0	0	120
	deletion	0	1	0	13
	change	0	0	1	16
	Ø	0	0	0	0

- Performance Measures

Accuracy = 2/149 = 1%					
$Precision_{omission}$	0/0	-	$Recall_{omission}$	0/120	0%
$Precision_{deletion}$	1/1	100%	$Recall_{deletion}$	1/13	8%
$Precision_{change}$	1/1	100%	$Recall_{change}$	1/16	6%

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Research Question 2:
Can a system be created to identify and correct article errors?

- Comments
  - Many article 'errors' not corrected by the *AntCorrector* system still lead to grammatical English
    - Examples:
      - Next , the Nobel Committee sends invitations to the members of the scientific or engineering community in September .
      - Therefore he was driving a car in the wrong lane .
      - It is said that there are four major cause of the disaster and death of crews .

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Conclusion and Future Work

- Conclusion
  - Omission errors are the most common article errors.
  - Many elaborate error analysis systems have been proposed.
  - But… poor performing tools are still the predominantly used by learners in the classroom
    - ubiquitous, intuitive, easy to use, built into popular word processors
  - More work is required to bring NLP systems to the real-world
    - *AntCorrector* demonstrates that a simply approach can be effective in restricted domains (e.g. the university writing class)
- Future Work
  - Improve the performance of *AntCorrector*
  - Embed the system in a web-based correction tool
  - Trial the software with a large user groups:
    - Initial trial: 10,000 students: Later trials: 50,000 students

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