# How might test-taker gender affect testscore meaning in a test of writing? Using corpus tools to extend a DIF study

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# **Gender and Language Use**

**Succinct Personal Direct** Instrumental Refs to Elliptical • "I" Reference Directives Quantity Refs to Judgmental Sentences Male Locatives Adjectives Quantity Dependent Negations Refs to Clauses Uncertainty **Emotion** Female Intensive Adverbs Verbs Mean Length Questions Sentence Hedges Contextual **Indirect Elaborate** Affective

from Mulac et al., (2006)



# **Study Context**

- The Canadian English Language Proficiency Index Program (CELPIP) – General Test
  - Purposes and test structure
  - The writing tasks
    - 1. Writing an email (27 minutes)
    - 2. Responding to survey questions (26 minutes)





# **Study Context**

- 1. In a test, do male and female test takers write differently?
- 2. If male and female test takers write differently, does this difference result in a bias in the scores achieved?



# Differential Item Functioning (DIF)

An item is labeled with "DIF" when:

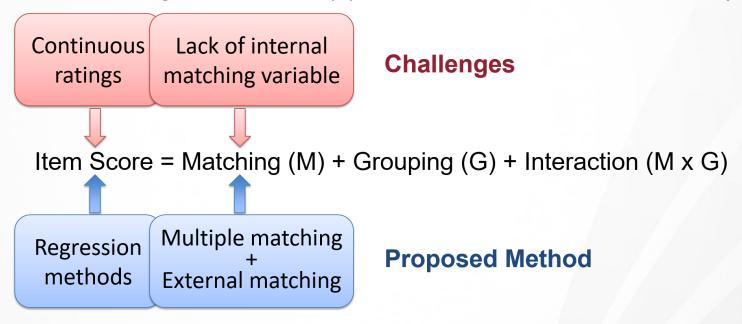
Test takers with equal ability, but from different groups have an unequal probability of item success.



# Differential Item Functioning (DIF)

A DIF analysis strategy needs to address two major issues:

(a) define matching variable; and (b) accommodate the continuous responses.



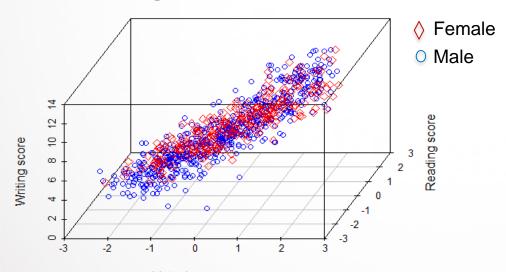
Adopted from Chen, Lam & Zumbo (2016); See also, Breland & Lee (2007)



# Differential Item Functioning (DIF)

Recap of a DIF study on writing prompts

- 81 writing prompts were tested
- 29 (35.8%) of the prompts were flagged
- Small magnitude of the Gender DIF effect: change of the R<sup>2</sup> < 0.02.</li>



Listening score

Results from Chen et al., 2016



# Interpretation of DIF Findings

DIF vs. Bias

Experts review items/prompts

Test takers report cognitive process

Analyzing test takers' writing samples?



# **Research Questions**

- To what extent do the gender groups differ in the linguistic features as elicited by a DIF writing task?
- How do the differences, if they exist, relate to test takers' scores on the writing task?



# The CELPIP Writing Construct

- Analytic scoring on four dimensions by multiple raters
  - Coherence/Meaning: organization/clarity/depth of meaning
  - Lexical Range: word choice/natural use of vocabulary/precision and accuracy
  - Readability/Comprehensibility: word form/spelling, grammar, punctuation/format and paragraphing/transitions
  - Task Fulfillment: relevance/completeness/tone/length
- Final reporting levels: 11 levels (M, 3-12)

from CELPIP Study Guide: Reading and Writing



# **The Writing Prompt**

- Selected CELPIP writing prompt
  - Write a letter to a restaurant manager to 1) describe your food restrictions;
  - 2) complain about the unavailability of food options for you; and
    - 3) make suggestions to the restaurant.



# The Corpus

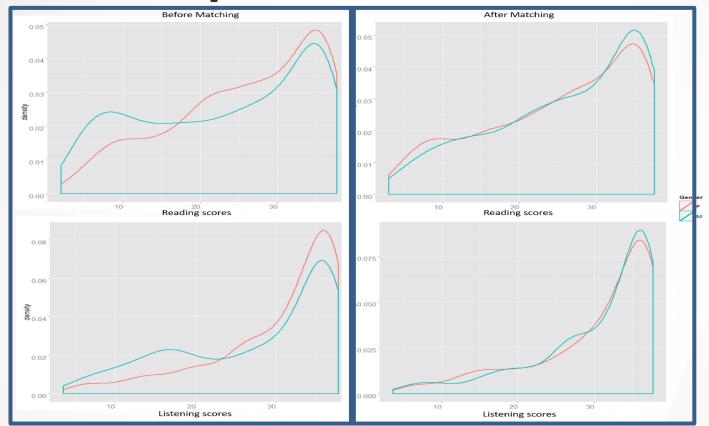


Table 1. Summary of the CELPIP corpus of written samples

Gender	Level 4	Level 5-8	Level 9-12	# of samples	# of words
Male	49	281	83	413	76855
Female	20	306	87	413	79619



# **Analytical Tools**

Tool (category)	Feature groups used	# of features used	Relevance to the scoring dimensions
SEANCE 1.05	The General Inquirer (GI)-based indices	85	Task Fulfilment
(sentiment/ social cognition)	The NRC Word-Association Emotion Lexicon (EmoLex)-based indices	10	-
TAACO (cohesion features)	Adjacent lexical/semantic overlaps at sentence levels	28	Coherence & Meaning;
	Rhetorical connectives	23	Readability &
	Type-token ratios and repeated words	10	Comprehensibility
TAASSC 1.4	Clause-based complexity indices	21	_ Readability &
(syntactic features)	Noun phrase-based complexity indices	33	Comprehensibility
	Usage-based syntactic sophistication indices	23	
	Indices from the L2 Syntactic Complexity Analyzer (L2SCA)	4	
TAALES 1.0	Frequency of words and n-grams (BNC)	11	Lexical Range
(lexical features)	Range of words and n-grams (BNC)	10	-
	MRC psychological properties of words	4	_

# **Data Preparation & Analysis**

- Feature selection
  - Construct-relevance criterion
  - Distribution-based screening
  - Pearson correlations
- Mann-Whitney U test (male vs. female)
- Multiple regressions





# **Results**Sentiment/Social Cognition

Table 3. Distinctive sentiment and social cognition features

Sentiment/social cognition Features (dictionary or source)	Mann-Whitney <i>U</i> Test (M vs. F)		Correlation with writing proficiency level	
	ES	р	r	р
Positive (EmoLex)	-0.079	.022	-0.084	.016
Negative (EmoLex)	-0.070	.045	0.133	< .001
Know (GI)	-0.069	.048	0.141	< .001
Causal (GI)	-0.071	.040	-0.167	< .001
Self (GI)	-0.080	.022	-0.330	< .001
Strong (GI)	-0.071	.042	0.110	.002

Legal (GI) 013 -0.088 .011



# Results

### **Cohesion Features**

Table 4. Distinctive cohesion features

Features	Mann-Whitney <i>U</i> Test (M vs. F)		Correlation with writing proficiency level	
	ES	p	r	p
Overlap of noun lemmas (binary, 1				
sentences)	-0.097	.005	-0.086	.013
Overlap of content word lemmas (binary, 2				
sentences)	-0.093	.007	0.340	< .001
Overlap of preposition lemmas (binary, 2				
sentences)	-0.095	.007	0.209	< .001
Number of logical connectives	-0.079	.022	-0.242	< .001
Number of coordinating conjunctions	-0.110	.002	-0.129	< .001
Number of connectives for reason and				
purpose	-0.078	.025	-0.153	< .001
Number of causal connectives	-0.082	.018	-0.255	< .001
Number of repeated content lemmas and				
pronouns	-0.100	.004	-0.278	< .001
Ratio of pronouns to nouns	-0.140	< .001	-0.307	< .001
Number of subject personal pronouns	-0.092	.008	-0.371	< .001

# **Results**Syntactic Features

Table 5. Distinctive syntactic features

Features	Mann-Whitney <i>U</i> Test (M vs. F)		Correlation with writing proficiency level	
	ES	р	r	р
Possessives per direct object	-0.129	< .001	0.143	< .001
Possessives per object of preposition	-0.096	.006	-0.080	.022
Possessives per nominal	-0.163	< .001	0.070	.045
Dependents per nominal subject	-0.094	.007	0.199	< .001
Prepositions per object of preposition	-0.086	.014	0.287	< .001
Complex nominals per clause	-0.129	< .001	0.118	.001
Existential 'there' per clause	-0.092	.008	0.117	.001
Undefined dependents per clause	-0.152	< .001	-0.324	< .001
Subordinating conjunctions per clause	-0.145	< .001	0.097	.005
Faith scores (verb-construction, SD)	-0.110	.002	0.132	< .001
Faith scores (construction-verb, type)	-0.099	.005	-0.126	< .001
Delta P scores (verb-construction, SD)	-0.115	.001	0.112	.001



# Results Lexical Features

Table 6. Distinctive lexical features

Features	Mann-Whitney <i>U</i> Test (M vs. F)		Correlation with writing proficiency level	
	ES	р	r	р
Word frequency in BNC Written				
(content words)	-0.070	.044	-0.073	.037
Trigram proportion in BNC Written				
(all words)	-0.070	.045	0.216	< .001



# **Results**Summary

Table 7. Summary of the linguistic features studied for the gender groups

Category (software)	# of features studied	# of distinctive features	# of features w/ positive correlation
Sentiment and social order features (SEANCE)	95	6	3
Cohesion features (TAACO)	61	10	2
Syntactic features (TAASSC)	81	12	9
Lexical features (TAALES)	25	2	1
Total	262	30	15

Adjusted R<sup>2</sup> = .698 ( $k_{all}$  = 262); Adjusted R<sup>2</sup> = .460 ( $k_{disinctive}$  = 30); Adjusted R<sup>2</sup> = .273 ( $k_{positive}$  = 15)



### **Discussions**

- Gender differences in the (timed) writing task
  - Sentiment/social cognition; Cohesion features/Syntactic features/Lexical features
  - Mulac et al., 2006; Leaper & Ayres, 2007
- Implications
  - Impact of gender differences on the equivalence of meanings of scores



### Conclusions

- Overall, only a small number of linguistic features in the four aspects were found different between the gender groups with very small effect sizes.
- As a whole, these differences may have negligible impact on the comparability of writing scores.



How might test-taker gender affect test-score meaning in a test of writing?
Using corpus tools to extend a DIF study

# **Questions & Comments?**

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# **Example texts** – Level 4 (Sentiment/ Social Cognition)

**Female** 

I am start diet current with my sister.

Few days ago, my best friend birthday invited, so we went special restaurant near by my house.

There are very clan and nice place and very favourite sea food restaurant.

So we attend new special menu sea food kind ordered but there were no menu option that were suitable for me.

So I made complain for restaurant manager, what kind of diet food do you have? he said just making fried seafood with salad.

I am really disappointed kind of food, so I required seafood made grilled but he can not accepted.

Really, feel bad with my friend and we just take diet drink.

We just few minutes stay away, and I was told to manager as for the service at the restaurant.

In your restaurant place very clan and very nice, but I think your if got more food kind then more came in customers and favourite restaurant.

Male

Dear, manager.

Last week i visit your restaurant and i disappointed because i cannot eat same food i like because your restaurant serve a sea foods and also nuts i cannot eat it. Your restaurant is clean and good but i suggest you serve all different kinds of food example like vegetable fruit and most specially chicken for the children. Next time when i visit again in your restaurant i bring my friends and relatives and also i help you to improve your restaurant to going up soon. I invite also my all coworkers too visit your restaurant because food is very good test.



# **Example texts** – Level 7 (Sentiment/ Social Cognition)

**Female** 

Dear Manager:

I went to your restaurant last week. I have some food allergies, specifically I cannot eat seafood or nuts. If I eat this kind of food I have a severe allergic reaction, and I must go directly to the hospital. I was told by my doctor that if I don't get medical help soon after the event, I could die.

Usually when I go out for dinner, I ask to the waitress if they have some alternative dishes that are nut free. Also I ask for beef or chicken. But when I looked at your menu I didn't find any option. Everything contain seafood or nuts.

You might have your guests happy if you include more variety of ingredients. Also it is important to have a small kitchen separated to avoid food contamination.

I am looking forward to visit your restaurant in the future, and have an option to enjoy your excellent kitchen.

Thank you

XXX

Male

To whom it may concern,

I recently visited your restaurant, on 3/11/16, to celebrate my birthday with a group of friends. I had been excited to try it out as I had heard great things about the quality of food. Unfortunately, looking upon the menu I found that there were no options for someone with allergies to nuts and also seafood.

Usually I would never have this problem in restaurants as there is always at least one dish that caters to my dietary restrictions. I was bitterly disappointed, and resigned to drinking from a bowl of water, like a dog. What a way to spend your 5th birthday.

I would suggest that your company take the necessary measures to include multiple options on a new, redesigned menu. One that doesn't discriminate against people with weak immune systems. Maybe a nice variety of salads.

Yours sincerely,

XXX



# Example texts – Level 10 (Sentiment/ Social

Cognition)

**Female** 

To whom it may concern,

I am writing to express my disappointment with a recent dining experience at Villa Italiano. As a long time customer of your restaurant, I feel the need to communicate my displeasure.

As you may recall, I visited your restaurant on the evening of March 15th accompanied by my husband and two close friends. Earlier that day, I had called to enquire about the evening menu. I took pains to call ahead of time because I have recently learned that I am allergic to seafood and nuts, and I wanted to ensure that it would be possible for your staff to accommodate these restrictions. I was assured by your hostess that it would not be a problem and that there would be lots of options available for me.

When we arrived for our 7:30 reservation, one glance at the menu was sufficient to show me that there was nothing I would be able to eat. We were forced to leave the restaurant. This problem could have been avoided if your hostess had been properly informed about the evening menu. I sincerely hope that you will improve your customer service in the future.

Male

Good day Mr. Smith (New Manager of the Northern Peninsula Restaurant),

I am writing to express my disappointment in the limited menu options at your restaurant and the apparent unwillingness to change. I have severe allergic reactions to seafood (mainly shellfish) and nuts (such as almonds). I was shocked when I went to restaurant last week with my wife, only to realize that there were no food options on the menu which were safe for me to eat. All items either had a seafood or nut ingredient. I informed the waiter and he noted that the chef could do nothing at the time to prepare a meal suitable for me. I left rather disheartened. This week was a repeat of the same issue.

I think you could solve this problem rather easily. For your menu options you could introduce meals with other meats, such as chicken, moose or venison. Another solution, might be to have variations of meals, excluding nuts for example. Lastly, I think that having a chef and staff that are flexible and can adjust meals to suit customers with dietary restrictions would prove useful. I hope you accept this advice.

A disappointed customer,

XXX

## Example texts – Level 4 (Cohesion)

#### **Female**

I am start diet current with my sister.

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Really, feel bad with **my** friend and **we** just take diet drink.

**We** just few minutes stay away, and I was told to manager as for the service at the restaurant.

<u>In your restaurant</u> place very clan and very nice, *but* I think your if got more food kind then more came <u>in</u> customers and favourite restaurant.

#### Male

Dear, manager.

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Usually when I go out for dinner, I <u>ask</u> to the waitress *if* they have some alternative dishes that are nut free. Also I <u>ask</u> for beef or chicken. *But* when I looked at **your** menu I didn't find any option. Everything contain seafood or nuts.

**You** might have your guests happy *if* **you** include more variety of ingredients. Also **it** is important to have a small <u>kitchen</u> separated to avoid food contamination.

I am looking forward to visit **your** restaurant in the future, *and* have an option to enjoy **your** excellent <u>kitchen</u>.

Thank you

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Male

To whom it may concern,

I recently visited your restaurant, on 3/11/16, to celebrate **my** birthday <u>with</u> a group <u>of</u> friends. I had been excited to try it out *as* I had heard great things about the quality <u>of</u> food. Unfortunately, looking upon the menu I found that there were no options for someone <u>with</u> allergies to nuts and also seafood.

Usually I would never have this problem in restaurants as there is always at least one dish that caters to my dietary restrictions. I was bitterly disappointed, and resigned to drinking from a bowl of water, like a dog. What a way to spend your 5th birthday.

I would suggest that **your** company take the necessary measures to include multiple options on a new, redesigned menu. One that doesn't discriminate against people with weak immune systems. Maybe a nice variety of salads.

Yours sincerely,

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## Example texts – Level 10 (Cohesion)

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I am writing to express **my** disappointment with a recent dining experience at Villa Italiano. As a long time customer of **your** restaurant, I feel the need to communicate **my** displeasure.

As **you** may recall, **I** visited your <u>restaurant</u> on the <u>evening</u> of March 15th accompanied by **my** husband <u>and</u> two close friends. Earlier that day, **I** had <u>called</u> to enquire about the <u>evening</u> menu. **I** took pains to <u>call</u> ahead <u>of</u> time <u>because</u> **I** have recently learned that **I** am allergic to seafood <u>and</u> nuts, and **I** wanted to ensure that **it** would be possible for **your** staff to accommodate these restrictions. **I** was assured by **your** hostess that **it** would not be a problem and that there would be lots of options available for **me**.

When **we** arrived for our 7:30 reservation, one glance at the <u>menu</u> was sufficient to show **me** that there was nothing I would be able to eat. We were forced to leave the restaurant. This problem could have been avoided *if* **your** hostess had been properly informed about the evening <u>menu</u>. I sincerely hope that **you** will improve your customer service in the future.

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I think **you** could solve this problem rather easily. For **your** menu options you could introduce <u>meals</u> with other meats, such as chicken, moose or venison. Another solution, might be to have variations of <u>meals</u>, excluding nuts <u>for</u> example. Lastly, I think that having a chef and staff that are flexible and can adjust meals to suit customers with dietary restrictions would prove useful. I hope **you** accept this advice.

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# **Example texts** – Level 4 (Syntactic features)

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# Example texts – Level 7 (Syntactic features)

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Yours sincerely,



# **Example texts** – Level 10 (Syntactic features)

**Female** 

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I think you could solve this problem rather easily. For **your** menu options you could introduce meals with other meats, such as chicken, moose or venison. Another solution, might be to have variations of meals, excluding nuts for example. Lastly, I think that <a href="https://having.achef-and-staff-that-are-flexible-and-can-adjust-meals">having a chef-and-staff-that-are-flexible-and-can-adjust-meals</a> to suit <a href="mailto:customers-with-dietary-restrictions">customers-with-dietary-restrictions</a> would prove useful. I hope you accept this advice.

A disappointed customer,

XXX