Writing in tables and lists: exploring multimodal undergraduate writing through keyword searches

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Writing in tables and lists:
Exploring multimodal undergraduate writing through keyword searches

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ICAME 2011
Outline

1. Research questions and the corpora

2. Findings
   2.1 Overall findings from keyword analysis
   2.2 Visuals and lists
   2.2 Comparison of text pairs in Biology and Economics

3. Conclusions
Why study UK undergraduate writing?

• UG assessed writing is a ‘high-stakes’ genre which has been under-researched

• UG writing is challenging due to the recent increase in multi-disciplinary degrees…
  **But… academic writing varies between disciplines** (e.g. Hewings, 1999; Hyland, 2008)

• Increase in new genres in UK assignments e.g. reflective blogs, website evaluations or press releases (Leedham, 2009; Nesi & Gardner, 2006).

• A major strategic aim of assignment-writing is to display disciplinary knowledge in an appropriate form
Why study Chinese students’ writing?

• The ‘largest single overseas student group in the UK’ (British Council, 2010)
  Over 85,000 Chinese students in UK in 2009

• BUT… most studies of Chinese students’ writing have been carried out on learner corpora (e.g. Chuang and Nesi, 2006; Mayor et al., 2007) or postgraduate theses (e.g. Hyland, 2008)

• This study uses authentic undergraduate assignments

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Research Questions

1. What are some of the differences between Chinese and British undergraduate students' assessed UG writing?

2. How do these vary across the years of undergraduate study?

3. How significant is the discipline of study?
The Corpora

British Academic Written English (BAWE)

- 6,506,995 words
- 2,896 texts
- 2,761 assignments
- 1,039 contributors
- 30+ disciplines
- 13 genre families
- 4 levels of study
- Variety of L1s
- All proficient writing

The corpora for this study

- Extracted L1 English and L1 Chinese texts from BAWE
- Reduced to UG texts only
- Selected 5 disciplines
- Added extra L1 Chinese texts from other sources
- Resulting in: 104 texts from Chinese students
- 295 texts from British students
- Insights from lecturer interviews

ESRC project number
RES-000-23-0800
# The corpora

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<th></th>
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<th>L1 English corpus</th>
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</table>
Outline

1. Research questions and the corpora

2. Findings
   2.1 Overall findings from keyword analysis
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Keyness

- ‘A word which is *positively* key occurs *more* often than would be expected by chance in comparison with the reference corpus.’
  Scott, WordSmith Help files, 2010

- WordSmith Tools v.5 (Scott, 2010)

- Used log likelihood statistic, \( p = .000001 \)

- Extracted key words and key n-grams (2-5 words)

- Compared keywords in Chi-Engineering with Eng-Engineering, and in each corpus with all-UG-BAWE, etc

- Checked to ensure each keyword or key n-gram occurs in writing from at least 5 texts and 3 students
### Keywords

<table>
<thead>
<tr>
<th>Key in Chi-Economics</th>
<th>Key in Eng-Economics</th>
<th>Key in both</th>
</tr>
</thead>
<tbody>
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<td>rate, model, output, formula, level, growth, curve, income, government, supply, students, population, dividends, per, reserves, consumption, T, aggregate, tax, Dutch, quantity, stock, portfolio, assets, inefficiency, competitive, capm, generation, repurchases, qtmark, asset, refer, cash, disposable, progress, deficit, income</td>
<td>in, that, as market, however, if, policy, economy, firm, therefore, firms, had, competition, costs, hence, under, since, U.S., significant, period, shown, war, international, lower, world, did, Britain, markets, impact, profits, transport, Bertrand, railways, crises, states, you, cournot, wages, question, extent, stabilisation, British, vertical, shirking, credibility, IMF, governments</td>
<td>price, demand, monopoly, well, than, capital, increase, higher, exchange, inflation, labour, economic, unemployment, prices, countries, money, production, cost, investment, interest, firm, foreign, crisis, trade, wage, long, marginal, F, country, Y, run, elasticity, domestic, variables, goods, exam, equilibrium, expectations, rates, short, consumers, monetary, surplus, policies, consumer, efficiency, spending, scale, fiscal, productivity, Phillips, slope, bank, central, monopolist, saving, relative</td>
</tr>
</tbody>
</table>

- first person pronouns (we, I)
- connectors
- references to tables and figures
- use of numbers in lists (denoted in WS by # in some disciplines)
## First person pronouns

<table>
<thead>
<tr>
<th>per 10,000 words</th>
<th>Chi Biol</th>
<th>Eng Biol</th>
<th>Chi Engin</th>
<th>Eng Engin</th>
<th>Chi Econ</th>
<th>Eng Econ</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>10****</td>
<td>9</td>
<td>14*</td>
</tr>
<tr>
<td>we</td>
<td>6</td>
<td>7</td>
<td>17</td>
<td>15</td>
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<td>8</td>
<td>20</td>
<td>25</td>
<td>38</td>
<td>37</td>
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</tbody>
</table>

* p<.05; ** p<.01
*** p<.001; **** p<.0001

### Use of I in reflective writing in Engineering

(1) … I don't think this is what a professional engineer is, although I do think that a professional engineer must work in this ‘professional manner’ … (0354f).

(2) With hindsight I would have called everybody an hour before the meeting to make sure they were coming as I eventually had to later on in the project (0342c).
<table>
<thead>
<tr>
<th>Connectors</th>
<th>Chi-Economics (raw)</th>
<th>Eng-Economics (raw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>however</td>
<td>14 (55)</td>
<td>34**** (178)</td>
</tr>
<tr>
<td>therefore</td>
<td>17 (65)</td>
<td>23* (122)</td>
</tr>
<tr>
<td>hence</td>
<td>8 (32)</td>
<td>16*** (86)</td>
</tr>
<tr>
<td>thus</td>
<td>12**** (44)</td>
<td>4 (20)</td>
</tr>
<tr>
<td>in contrast</td>
<td>2** (7)</td>
<td>0 (1)</td>
</tr>
</tbody>
</table>

* p<.05; ** p<.01; *** p<.001; **** p<.0001

Preferred connectors… and difference in position

(3) …about the prices of other firms. However, monopolies can charge what they like. (6008q, L1 chinese)

(4) The implication of this however, is that price discrimination, which is possible through monopoly… (0399a L1 English)
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3. Conclusions
### Keywords

| Key in Chi-
|Economics | \*rate, model, output, formula, level, growth, curve, income, government, supply, students, population, dividends, per, reserves, consumption, T, aggregate, tax, Dutch, quantity, stock, portfolio, assets, inefficiency, competitive, capm, generation, repurchases, qtmark, asset, refer, cash, disposable, progress, deficit, income |
| Key in Eng-
|Economics | \*in, that, as market, however, if, policy, economy, firm, therefore, firms, had, competition, costs, hence, under, since, U.S., significant, period, shown, war, international, lower, world, did, Britain, markets, impact, profits, transport, Bertrand, railways, crises, states, you, cournot, wages, question, extent, stabilisation, British, vertical, shirking, credibility, IMF, governments |
| Key in both | \*price, demand, monopoly, we, than, capital, increase, higher, exchange, inflation, labour, economic, unemployment, prices, countries, money, production, cost, investment, interest, firm, foreign, crisis, trade, wage, long, marginal, F, country, Y, run, elasticity, domestic, variables, goods, exam, equilibrium, expectations, rates, short, consumers, monetary, surplus, policies, consumer, efficiency, spending, scale, fiscal, productivity, Phillips, slope, bank, central, monopolist, saving, relative |

- first person pronouns (we, I)
- connectors
- references to tables and figures
- use of numbers in lists (denoted in WS by # in some disciplines)
**Visuals**

- tables, figures, diagrams, images, photos…

**Lists**

- A ‘genuine’ or prototypical list contains ‘list items’, each consisting of a word or NP/VP.
- List items are separated by bullet points/hyphens/letters/numbers, or are indented.

**Listlikes**

- ‘paragraphs of running text carrying list-like formatting’
- ‘false lists’ or ‘list-likes’ contain larger units of text per list item (Heuboeck et al., 2005: 29).
Visuals and lists

Lists
A ‘genuine’ or prototypical list contains ‘list items’, each consisting of a word or NP/VP. List items are separated by bullet points/hyphens/letters/numbers, or are indented.

Listlikes
- ‘paragraphs of running text carrying list-like formatting’
- ‘false lists’ or ‘list-likes’ contain larger units of text per list item (Heuboeck et al., 2005: 29).

Conclusions
The experiment yielded the following conclusions:
- The efficiency of a single stage centrifugal pump at high pump speed (3000 RPM) is better than it at low pump speed (2000 RPM).
- The input power with high pump speed increases faster than the one with low pump speed as discharge increases.
- The relationship between total head and discharge is not affected by pump speed, but higher pump speed provides higher total head.
### Keywords relating to visuals and lists

<table>
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<tr>
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<th>Chi-Bus</th>
<th>Chi-Econ</th>
<th>Chi-Engin</th>
<th>Chi-Food</th>
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<td>output</td>
<td>numbers</td>
<td></td>
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</table>
References to visuals and lists

Biology
• All "Phases" are labeled on the graph. The curve of the Exponential Phase was straight, though some point lay outside this best straight line of fit (0041a).

Economics
• Actually the total loss resulting from the lower monopoly output (Q M) is the grey triangle. The part of the grey triangle above P C is the loss of consumer surplus (6008q).

Engineering
• According to the program and refer to the figure 4.1.1, it is easy to find… (6107d).

Food Science
• According to the 3 sets of data calculated above… (6150d).
References to visuals and lists

Biology
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## Visuals and lists

<table>
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* \( p < 0.05 \)
** \( p < 0.01 \)
**** \( p < 0.0001 \)
Listlikes by yeargroup
Outline

1. Research questions and the corpora

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Visuals and extended captions in Biology

• Dinolfo et al. (2007) students ‘see’ or ‘read’ cells under a microscope and subsequently describe them.

• “all-at-once’ processing of complex and often competing visual data’ compared with the ‘linear ‘one-at-a-time’ processing that occurs when we read written text line by line’ (Dinolfo et al., 2007: 401)

<table>
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The role of maternal effect genes in the development of the nematode Caenorhabditis elegans

ABSTRACT

Caenorhabditis elegans (C. elegans) has been used as one of the favourite model organisms for developmental studies. Embryogenesis of C. elegans extensively relies on maternal effect genes for intrinsically asymmetric cell division and cell-cell interactions. In this review, the early embryogenesis of C. elegans, from the establishment of Anterior-Posterior polarity initiated by sperm entry to the asymmetrical cell divisions and different cell lineages induced by a variety of cell fate determinant is summarized, some of the molecular mechanisms carried out by the crucial maternally expressed cell fate determinants underlying these processes are described.

INTRODUCTION

The C. elegans and its life cycle

Caenorhabditis elegans (C. elegans) is a small (~1 mm long) free living soil nematode that has a predominantly hermaphroditic adult life. (Figure 1)

![Figure 1 Adult C. elegans. Upper diagram: differential interference contrast image of an adult C. elegans. Lower diagram: anatomical structures of adult C. elegans (schematic drawing). Middle Left scale bar: 0.1 mm.](image)

The life cycle of C. elegans contains an embryonic stage, four larval stages (L1-L4) and an adult stage. (Figure 2) Molt (apopysis, new cuticle formation, and ecdysis) takes place at the end of each larval stage. Under certain external conditions such as starvation, a non-growing stage, dauer larva, may form through a facultative, reversible arrest at the lethargus in the second of four cuticle molts. The life cycle is about 2 to 3 weeks. Each

The role of maternal effect genes in the development of the nematode Caenorhabditis elegans

Maternally expressed genes are essential for the correct patterning and cell-fate determination in the early Caenorhabditis elegans embryo. The PAR proteins and MEK-5/6 are responsible for initial polarisation of the zygote. opl-1 is required to specify the EMS fate, the bifunctional protein PIE-1 is required to maintain the totipotent germ cell lineage and specification of the AB lineage involves a system homologous to Notch in Drosophila. This review describes the current understanding of these molecular mechanisms in the specification of cell fates in the pregastrulation embryo.

Introduction

The potential of Caenorhabditis elegans as a model organism for the study of embryology emerged in the 1970s (Brenner, 1974). This free-living soil nematode is ideal for studying in the laboratory as it has a rapid period of embryogenesis (15 hours) and each worm has an invariant cell lineage, with exactly 959 somatic cells in the adult, which can be easily traced during development through the transparent cuticle (Sulston & Horvitz, 1977).

C. elegans is a small round worm, approximately 1 mm long, that lives for 2-3 weeks and can be fed on Escherichia coli, which allows large numbers to be conveniently raised in a Petri dish. The predominant adult form is hermaphroditic, containing both sperm and eggs and therefore reproduction is rapid, either by self-fertilization or by cross-fertilization with the rare males.

Reproduction

In hermaphroditic worms, fertilization occurs in the spermatheca – an organ where the sperm is stored – when mature oocytes pass from the ovary towards the vulva (Figure 1a). The point of sperm entry determines the posterior end of the embryo. After fertilization, a rigid, ovoid-shaped chitin eggshell called the chorion is made (Kemphues & Strome, 1997) and the long axis of this ovoid is termed the anteroposterior (a/p) axis of the embryo.

Text 0434a, Chinese writer

Text 0067b, English writer
Diagrams and extended caption in 0434a (Chinese writer)

- 186 word extended caption
- different font to main text
- text wrapping of image and caption
- full sentences and in same, neutral stance as the rest of the text (e.g. use of passives, no first person pronouns, formal language)
- caption describes the process illustrated by diagram on the left
- diagram and main text are not integrated (in this case) – the extended caption functions as a freestanding text

(Cf work on multimodal texts by Kress & Van Leeuwen)
Bulleted lists vs. connected prose in Economics

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</table>
Question 2b
Interpretation of results (equations 4 and 5 appendix 2)
The coefficient on class attendance is 0.15, which implies that holding all other variables constant, if you increase class attendance by 1 unit (1% increase in class attendance in a year), then the exam mark will increase by 0.15 units (0.15% increase in your mark). The coefficient on lecture attendance is 0.06, meaning holding all other variables constant, attending 1 more lecture will increase your mark by 0.06%. The coefficient on revision lecture attendance is slightly surprising, at -0.04, implying that attending 1 more revision lecture, your mark will decrease by 0.04%. The intercept can be interpreted to mean that if you attended no classes, revisions or standard lectures, you would score 49.33%

Tests (shown in appendix 2)
The coefficient on class attendance was significant at the 0.01% level implying that in the multiple regression model, class attendance has a significant impact on test mark. The coefficient on lecture attendance was not significant, even at the 10% level, implying perhaps that lecture attendance does not have a significant impact in a multivariate framework. However, lecture attendance does appear to have a reasonably high correlation with class attendance, so the regression may be suffering from multicollinearity, which has made the result not significant. However, multicollinearity must be occurring with another factor being ‘unhelpful’ for it to have a negative impact on the regression. The coefficient on revision lecture attendance was significant up to the 1% level, thus implying that while we can be fairly sure that revision lectures have a significantly negative impact, there is scope for the fact that the null hypothesis is indeed correct (type I error) and that the result is not significant.

The F-test for the joint explanatory power of the independent variables yielded an F-statistic of 13.07. This is significant at the 0.01% level as it exceeds the critical value of 3.78. Hence we can reject the null hypothesis given in the appendix. This means that the explanatory variables have made a significant joint contribution to exam performance.

Question 3
To investigate whether there are differences in performance between the sub-sample of 2002 students and previous year’s students I have created a set of dummy variables and added them to the original equation, as shown by equation 1 and 2 in appendix 3. The first equation is the restricted model, as opposed to the unrestricted model in equation 2, because it imposes the F-test null hypothesis (see hypothesis 4, appendix 3) on equation 2. Hence in equation 2, the intercept is allowed to vary whereas it is not allowed to vary in equation 1 and is assumed to be constant in all years.

Interpretation of coefficients
The intercept in equation 3 can be interpreted as before, meaning that if you attended no lectures and had no A’s at A level, you would score 56.97. This is slightly nonsensical in the sense that you would not have got onto the course if you did not score any A’s at A level. The coefficient of 0.14 on lecture attendance means that if you attended 1% more lectures you would get 0.14 more out of 100 more in the exam. The coefficient of 0.04 on A’s scored at A level means that if you get an extra A at A level you would get 0.04% more in the exam. The dummy variables in this case have a slightly different interpretation. Basically they say how much the intercept will move up or down compared to the omitted category, the year 2000 students.

The dummy variable coefficient on 1998 was -0.19, meaning that if you were a 1998 student, you would score a proportion of 1.19% less than if you were a 2002 student. Finally the coefficient of -0.85 on the 2001 dummy variable means that you would score a proportion of 0.85% less than if you were a 2002 student. These are shown in equations 3 to 6.

Ref: [1] Refer to “Correlation matrices for these quantitative variables” in the Appendix.

Ref: [2] Refer to the Appendix for the bivariate regression results tables.

**Text 0155a, Chinese writer**

**Text 0202j, English writer**
Comparisons of data across various groups

**Pure Economics degree vs. non pure Economics degree**: Students doing pure Economics degree scored 66.23 on average, while students doing a mixed-Economics degree scored 61.68 (very significant).

**Female vs. Male**: The average female students got 63.8, compared to 65.4 for male students.

**UK students vs. non-UK students**: On average, UK students gained 64.63 while non-UK students gained 66.38.

**Number of parents who attended university**: Those students whose parents never attended university achieved 64.12 on average, those with one parent attended university achieved 64.99 averagely, and those with both parents attended university achieved 65.59 on average.

To make some comments about these results, we need to break this up into sub-samples. Firstly, we can break it up according to sex, as Siegfied and strand did. For males, table 2 shows that the mean score is 65.4%, which is higher than the corresponding score for females of 63.75%. This agrees with Siegried and Strand’s paper which claims males do better than females. However, the standard deviation for males is lower than for females, 12.64% compared to 14.02%.

Use of lists by the Chinese student entails:
- Lower connector usage
- Fewer words needed to say the same thing
- Higher mean word length and lower mean sentence length
Interviews with lecturers

Importance of visuals

- Diagrams and formulae are ‘the spine of the essay’ (Economics)
- Including visuals helps students gain better marks as it avoids having to describe and introducing errors (Biology)
- The ‘challenge’ is ‘to marry the diagrams with the text’ (Economics)
- ‘there is no existing document out there which explains how to interpret their data’ (Biology)
- ‘the key writing skill for an economist is the ability to demonstrate in writing about a diagram an understanding of the analysis’ it represents (Economics)

Being concise

- Lecturers value writing which is ‘clear and concise’, and ‘succinct’ and dislike ‘verbosity’ (Engineering)
- ‘there’s never been a penalty for an essay that’s too short (Biology)
Conclusions

• Chinese students make greater use of visuals and lists than British students
• As all the assignments have achieved high scores, these differences are acceptable
• NB… EAP teachers do not always teach or encourage the use of visuals and lists – more training in disciplinary differences needed
• Need to read texts from the corpus to see what’s going on and what is missing/altered from the original texts
• Need disciplinary insights from lecturers (assignment-readers) and from students (assignment-writers)

Next steps…

• Establish ways of analyzing visual elements in assignments
• Talk to lecturers and students as to the range of acceptability in assignment layout/use of visuals/writing in lists
References

• Leedham, M. (2009) ‘From traditional essay to ‘Ready Steady Cook’ presentation: reasons for innovative changes in assignments’ In Active Learning in HE.