

# Disciplinary differences in university lecture slides

- A corpus-based and multimodal analysis

Zhi Li & Shayna Lodge  
Paragon Testing Enterprises, Inc.  
Vancouver, Canada

# About Paragon



# Study Context

- Lecture slides or PPTs as a multimodal semiotic system
- They can function
  - as part of classroom discourse
  - as standalone study materials
- Why study lecture slides?

# Literature Review

- Previous studies on PPT slides
  - Effectiveness and design of lecture slides (Apperson et al., 2008)
  - Visuals in conference slides (Rowley-Jolivet, 2004)

# Literature Review

- Studies on multimodality
  - Multimodal analysis of lecture slides (Zhao & Van Leeuwen, 2014)
  - Systemic-Functional Linguistics (SFL)-based analysis (Unsworth, 2006)
- Limited studies on lecture slides for their
  - linguistic features
  - visual-text relations
  - Possible differences in different disciplines

# Research Questions

- What are the major linguistic and multimodal characteristics of the university lecture slides?
- Do these characteristics of the slides differ between two broad disciplines (Social Sciences vs. Engineering)?

# The Corpus of PPT slides

| Discipline             | N  | Average word count | Example subjects  |
|------------------------|----|--------------------|---|
| <b>Social Sciences</b> | 35 | 1152. (759.1)      | Sociology, History, Economics, Linguistics, Psychology ...              |
| <b>Engineering</b>     | 35 | 1446.7 (757.4)     | Mechanical Engineering, Electric Engineering, Computer Engineering, ... |

## Sources of lecture PPT

- Online search on university course websites
- Requests from students and faculty members

## Inclusion criteria

- undergraduate courses in North American universities
- non-orientation content
- Inclusion of visuals

# Linguistic Features

- Phrase-level complexity
  - Verb phrases (VP)
  - Complex nominals (CN)
  - Coordinate phrases (CP)

L2 Syntactic Complexity Analyzer (L2SCA) Lu & Ai, 2015,

<http://aihaiyang.com/software/l2sca/>

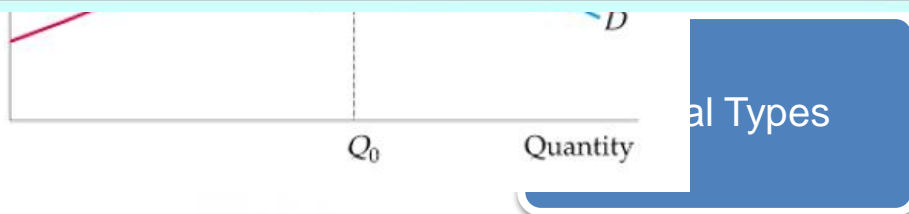


# Linguistic Features

- Lexical complexity
  - Lexical Density
  - Lexical Sophistication: lexical sophistication, verb sophistication
  - Lexical Variation: Number of different words (NDW) per 50-word sequences, Corrected type-token ratio (TTR), variation in specific word class (e.g., verb variation)

Lexical Complexity Analyzer (LCA) Lu, 2012,  
<http://aihaiyang.com/software/lca/>

```
TrigraphFrequency
Enter name of text file: OneFish.txt
BLU = 1
FIS = 4
ISH = 4
LUE = 1
ONE = 1
RED = 1
TWO = 1
```



Figurative (e.g.,  
photos, cartoon)

Graphical  
(e.g., tables, graphs)

Numeric  
(e.g., equations)

Scriptural  
(e.g., screenshot or  
photocopy of texts)

Videos

Adapted from Rowley & Jolivet (2004)

UAM Image Tool (O'Donnell, 2008)

<http://www.wagsoft.com/ImageTool/>

...Keeps Changing With Time...



Concurrence

Complementarity

Weak or No  
Relation

Adapted from Unsworth (2006)

# Data Preparation

- Lecture slides (PPT) → txt files for corpus-based analysis
  - Automatic calculation of complexity indices
- Lecture slides (PPT) → Image files for multimodal analysis
  - Manual annotation for visual type and visual-text relations using UAM Image Tool

# Data Analysis

- Descriptive statistics
- Normality check
- Mann-Whitney  $U$  test (Social Sciences vs. Engineering)

# Results – Linguistic Features

Table 2. *Phrase-level complexity*

| Features                   | SS<br>Mean (SD) | ENG<br>Mean (SD) | Mann-Whitney <i>U</i> Test<br>(SS vs. ENG) |          |
|----------------------------|-----------------|------------------|--|----------|
|                            |                 |                  | <i>W</i>                                   | <i>p</i> |
| # of verb phrases          | 150.06 (88.64)  | 116.97 (859.09)  | 438  | .041 *   |
| # of coordinate<br>phrases | 46.14 (33.15)   | 20.09 (13.89)    | 219.5                                      | <.001*** |
| # of complex<br>nominals   | 196.37 (107.7)  | 126.29 (98.97)   | 343.5                                      | .002**   |

# Results – Linguistic Features

Table 2. *Lexical complexity*

| Features                        | SS          | ENG         | Mann-Whitney <i>U</i> Test<br>(SS vs. ENG) |           |
|---------------------------------|-------------|-------------|--|-----------|
|                                 | Mean (SD)   | Mean (SD)   | <i>W</i>                                   | <i>p</i>  |
| Lexical density                 | 0.60 (0.05) | 0.61 (0.07) | 699  | .311      |
| Lexical sophistication<br>(LS1) | 0.37 (0.06) | 0.46 (0.10) | 923  | <.001 *** |
| Verb sophistication (VS2)       | 3.58 (2.59) | 2.06 (1.48) | 410.5                                      | .012 *    |

# Results – Linguistic Features

## *Lexical variation*

| Features                         | SS<br>Mean (SD) | ENG<br>Mean (SD) | Mann-Whitney <i>U</i> Test<br>(SS vs. ENG) |           |
|----------------------------------|-----------------|------------------|--|-----------|
|                                  |                 |                  | <i>W</i>                                   | <i>p</i>  |
| # of different words<br>(NDWESZ) | 36.74 (2.98)    | 34.27 (3.17)     | 347.5                                      | .002 **   |
| Corrected type-token<br>ratio    | 8.81 (1.60)     | 7.07 (1.63)      | 269.5                                      | <.001 *** |
| Lexical word variation           | 0.60 (0.11)     | 0.54 (0.13)      | 413.5                                      | .012 *    |
| Verb variation (VV2)             | 0.09 (0.02)     | 0.07 (0.02)      | 303  | <.001 *** |
| Noun variation                   | 0.42 (0.11)     | 0.38 (0.10)      | 442  | .046 *    |
| Adjective variation              | 0.1 (0.02)      | 0.08 (0.03)      | 299.5                                      | <.001 *** |
| Adverb variation                 | 0.03 (0.01)     | 0.02 (0.01)      | 477.5                                      | .097      |
| Modifier variation               | 0.13 (0.03)     | 0.1 (0.03)       | 278  | <.001 *** |





# Results – Slide Composition

| Features                              | SS<br>Mean (SD) | ENG<br>Mean (SD) | Mann-Whitney <i>U</i> Test<br>(SS vs. ENG) |          |
|---------------------------------------|-----------------|------------------|--|----------|
|                                       |                 |                  | <i>W</i>                                   | <i>p</i> |
| # of slides                           | 34.20 (14.31)   | 37.54(12.67)     | 519  | .274     |
| # of text-only slides                 | 14.40 (13.28)   | 12.49 (11.94)    | 339.5                                      | .001 *** |
| # of visual-only slides               | 1.71 (4.07)     | 1.49 (2.05)      | 526.5                                      | .265     |
| # of mixture slides                   | 18.09 (10.43)   | 12.57 (12.87)    | 853.5                                      | .005 **  |
| Avg. # of words/text-containing slide | 46.92 (38.08)   | 33.56 (15.88)    | 567  | .140     |

# Results – Visual Features

*Visual types : Averages*

| Features   | SS<br>Mean (SD) | ENG<br>Mean (SD) | Mann-Whitney <i>U</i> Test<br>(SS vs. ENG) |           |
|--|-----------------|------------------|--|-----------|
|  |                 |                  | <i>W</i>                                   | <i>p</i>  |
| Avg. # of Figurative <sup>a</sup>                                  | 0.42 (0.45)     | 0.38 (0.41)      | 588  | .776      |
| Avg. # of Graphical  | 0.58 (0.33)     | 0.69 (0.37)      | 502.5                                      | .197      |
| Avg. # of Numerical  | 0.06 (0.19)     | 0.32 (0.45)      | 354.5                                      | <.001 *** |
| Avg. # of Scriptural   | 0.04 (0.17)     | 0.05 (0.17)      | 550.5                                      | .326      |
| Percent of visual-<br>containing slides                            | 0.36 (0.27)     | 0.61 (0.25)      | 273  | <.001 *** |
| Avg. # of visuals/<br>visual-containing slide                      | 1.04 (0.38)     | 1.44 (0.44)      | 273.5                                      | <.001 *** |
| Avg. # of non-<br>numerical<br>visuals/visual-<br>containing slide | 1.01 (0.37)     | 1.13 (0.33)      | 494.5                                      | .155      |

a: per visual-containing slide

# Results – Visual Features

## *Visual-text Relations: Averages*

| Features                           | SS<br>Mean (SD) | ENG<br>Mean (SD) | Mann-Whitney <i>U</i> Test<br>(SS vs. ENG) |          |
|------------------------------------|-----------------|------------------|--|----------|
|                                    |                 |                  | <i>W</i>                                   | <i>p</i> |
| Avg. # of Concurrence <sup>a</sup> | 0.64 (0.30)     | 0.77 (0.30)      | 710  | .169     |
| Avg. # of Redundancy               | 0.11 (0.21)     | 0.13 (0.18)      | 687.5                                      | .230     |
| Avg. # of Exposition               | 0.31 (0.34)     | 0.34 (0.23)      | 699  | .212     |
| Avg. # of Instantiation            | 0.22 (0.25)     | 0.29 (0.24)      | 730  | .103     |
| Avg. # of<br>Complementarity       | 0.35 (0.28)     | 0.51 (0.27)      | 777.5                                      | .029*    |
| Avg. # of Augmentation             | 0.35 (0.28)     | 0.51 (0.27)      | 778.5                                      | .028 *   |
| Avg. # of Divergence               | <0.01 (<0.01)   | 0 (0)            | 577.5                                      | .324     |
| Avg. # of Weak                     | 0.12 (0.19)     | 0.08 (0.23)      | 528  | .374     |
| Avg. # of Decorative               | 0.07 (0.16)     | 0.02 (0.04)      | 531  | .324     |
| Avg. # of Emotive                  | 0.02 (0.09)     | 0.01 (0.06)      | 560  | .307     |
| Avg. # of Detached                 | 0.02 (0.07)     | 0.06 (0.22)      | 610  | .799     |

# Results – Visual Features

## *Visual-text Relations : Percentages*

| Features                | SS          | ENG         | Mann-Whitney <i>U</i> Test<br>(SS vs. ENG) |          |
|-------------------------|-------------|-------------|--|----------|
|                         |             |             | <i>W</i>                                   | <i>p</i> |
| Percentage <sup>a</sup> |             |             |  |          |
| Concurrence             | 0.61 (0.31) | 0.57 (0.19) | 646.5                                      | .540     |
| % Redundancy            | 0.17 (0.27) | 0.17 (0.23) | 523.5                                      | .477     |
| % Exposition            | 0.47 (0.40) | 0.45 (0.30) | 570  | .931     |
| % Instantiation         | 0.37 (0.35) | 0.37 (0.30) | 550  | .738     |
| Percentage              |             |             |  |          |
| Complementarity         | 0.29 (0.24) | 0.38 (0.17) | 468.5                                      | .130     |
| % Augmentation          | 100         | 100         | 408  | .258     |
| % Divergence            | 0           | 0           | 442  | .258     |
| Percentage Weak         | 0.10 (0.16) | 0.05 (0.11) | 666  | .346     |
| % Decorative            | 0.56 (0.48) | 0.45 (0.50) | 114.5                                      | .671     |
| % Emotive               | 0.16 (0.36) | 0.07 (0.27) | 118  | .362     |
| % Detached              | 0.28 (0.42) | 0.47 (0.50) | 87.5                                       | .410     |

# Results – Summary

*Summary of the significant differences between the two broad disciplines*

| Feature categories        | # of features investigated | # of distinctive features | Areas of distinction  |
|---------------------------|----------------------------|---------------------------|---|
| Syntactic                 | 3                          | 3                         | VP, CP, CN  |
| Lexical                   | 25                         | 19                        | Lexical sophistication, lexical variation   |
| General Slide Composition | 10                         | 7                         | # of text-only and mixture slides, percentage of visual-containing slides, # of visuals and words, avg. visuals/slide |
| Visual type               | 10                         | 4                         | # of graphical and numerical  |
| Visual-text relation      | 33                         | 8                         | # & Avg. of concurrence and complementarity   |

# Conclusions

- Differences observed in the linguistic features such as phrase structures and lexical features
- Differences in slide compositions; however, there are no differences in the average number of words and non-numerical visuals
- Similarities in their preference of graphical visuals, followed by figurative visuals; as well as concurrence relations, followed by complementarity relations

# Implications

- For EAP pedagogy
- For EAP assessment

# Disciplinary differences in university lecture slides as a part of classroom discourse

- findings from corpus-based analysis and multimodal analysis

## Questions & Comments?

[research@paragontesting.ca](mailto:research@paragontesting.ca)

Special thanks to Johnathan Jones

---



# Selected References

- Apperson, J. M., Laws, E. L., & Scepansky, J. A. (2008). An assessment of student preferences for PowerPoint presentation structure in undergraduate courses. *Computers & Education*, 50(1), 148–153.
- Kress, G., & Van Leeuwen, T. (1996). *Reading images: The grammar of visual design*. Psychology Press.
- Lim, F. V., & O'Halloran, K. L. (2012). The ideal teacher: An analysis of a teacher-recruitment advertisement. *Semiotica*, 189/142, 229–253.
- Lu, X. (2012). The relationship of lexical richness to the quality of ESL Learners' oral narratives. *The Modern Language Journal*, 96(2), 190–208.
- Lu, X., & Ai, H. (2015). Syntactic complexity in college-level English writing: Differences among writers with diverse L1 backgrounds. *Journal of Second Language Writing*, 29, 16–27.
- O'Donnell, M. (2008). Demonstration of the UAM CorpusTool for text and image annotation. In *Proceedings of the 46th annual meeting of the Association for computational linguistics on human language technologies: Demo session* (pp. 13–16). Association for Computational Linguistics.
- Royce, T. (2002). Multimodality in the TESOL classroom: Exploring visual-verbal synergy. *TESOL Quarterly*, 36(2), 191.
- Rowley-Jolivet, E. (2004). Different Visions, Different Visuals: a Social Semiotic Analysis of Field-Specific Visual Composition in Scientific Conference Presentations. *Visual Communication*, 3(2), 145–175.
- Thompson, P. (2006). A corpus perspective on the lexis of lectures, with a focus on economics lectures. In K. Hyland & M. Bondi (Eds.), *Academic Discourse Across Disciplines* (pp. 253–270). Bern, Switzerland: Peter Lang.
- Unsworth, L. (2006). Towards a metalanguage for multiliteracies education: Describing the meaning-making resources of language-image interaction. *English Teaching: Practice and Critique*, 5(1), 55–76.
- Zhao, S., & van Leeuwen, T. (2014). Understanding semiotic technology in university classrooms: A social semiotic approach to PowerPoint-assisted cultural studies lectures. *Classroom Discourse*, 5(1), 71–90.