Is there a Coverage Threshold for Reading Comprehension? A Demonstration Using Regression Discontinuity (RD) and Bayesian Informative Hypotheses Evaluation (BAIN)

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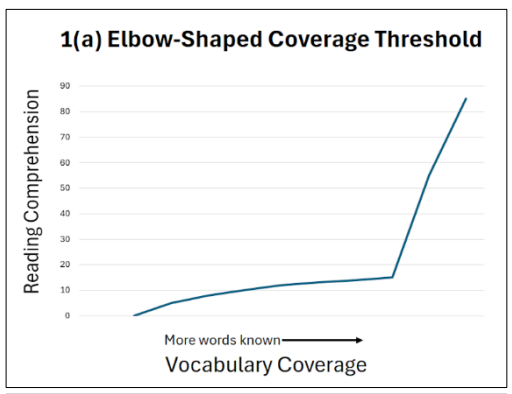
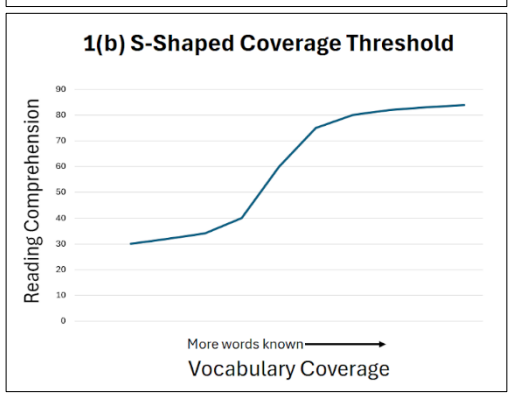
Background

Earlier studies on coverage "threshold"

- *t*-test: Laufer (1989):
  - ⇨ *less than 90% vs at least 90%*
  - ⇨ *90-94% vs 95%**
  - ⇨ *less than 95% vs at least 95%**
- Regression model:
  - Hu & Nation (2000)
  - Laufer & Ravenhorst-Kalovski (2010)
  - Schmitt et al. (2011)
- Line graph: Schmitt et al. (2011)



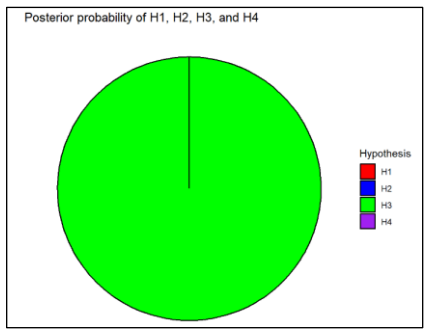


RQ: Is there a threshold in lexical coverage upon which L2 reading comprehension increases rapidly when crossed?

Demonstration using simulated data

BAIN to detect potential threshold

H1: 90-92 = 93-94 = 95-97 = 98-100
H2: 90-92 < 93-94 = 95-97 = 98-100
H3: 90-92 = 93-94 < 95-97 = 98-100
H4: 90-92 = 93-94 = 95-97 < 98-100



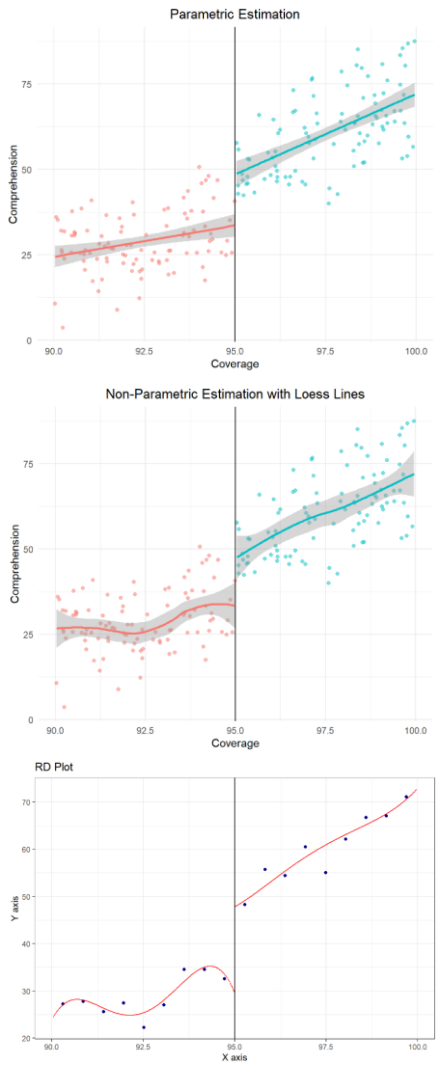
RD Part 2: Testing delta values

	Full data	Bandwidth = 4	Bandwidth = 2.5	Bandwidth = 1
(Intercept)	37.416 ***	37.070 ***	38.488 ***	33.197 ***
	(1.459)	(1.560)	(1.934)	(3.389)
coverage_centered_95	3.311 ***	3.818 ***	5.542 ***	-1.904
	(0.438)	(0.585)	(1.265)	(4.810)
cutoff_95Above_95	14.777 ***	13.251 ***	9.855 **	17.186 **
	(2.628)	(2.796)	(3.465)	(5.472)
N	200	155	90	37
R2	0.776	0.757	0.692	0.467
logLik	-723.667	-553.774	-315.737	-130.262
AIC	1455.334	1115.548	639.474	268.523

*** p < 0.001; ** p < 0.01; * p < 0.05.

`rdrobust()` can be used to test for significance for non-parametric bandwidths

RD Part 1: Visualisation



References

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4. Laufer, B. (1989). What percentage of text lexis is essential for comprehension? In C. Lauren & M. Nordman (Eds.), *Special Language: From Humans Thinking to Thinking Machines* (pp. 316–323). Clevedon: Multilingual Matters.
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6. Ross, S. J., & Mackey, B. (2015). Bayesian Approaches to Imputation, Hypothesis Testing, and Parameter Estimation. *Language Learning*, *65*(S1), 208–227. https://doi.org/10.1111/lang.12118
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Re-analysis of Schmitt et al. (2011)

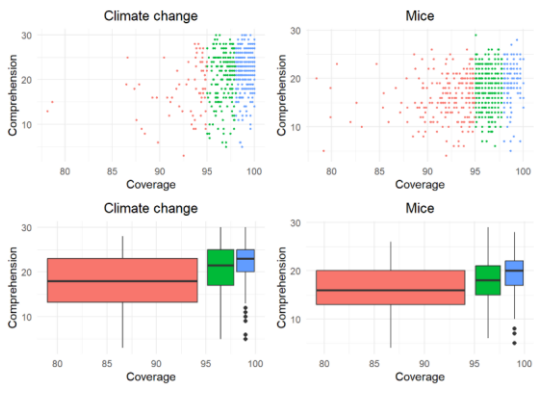
Data from Schmitt et al. (2011):

n = 664

IV : vocab checklist "containing a very high % of the words in the two readings" (p. 31)

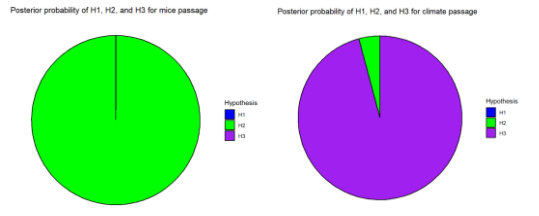
DV : 30-item reading test for each text (p. 32)

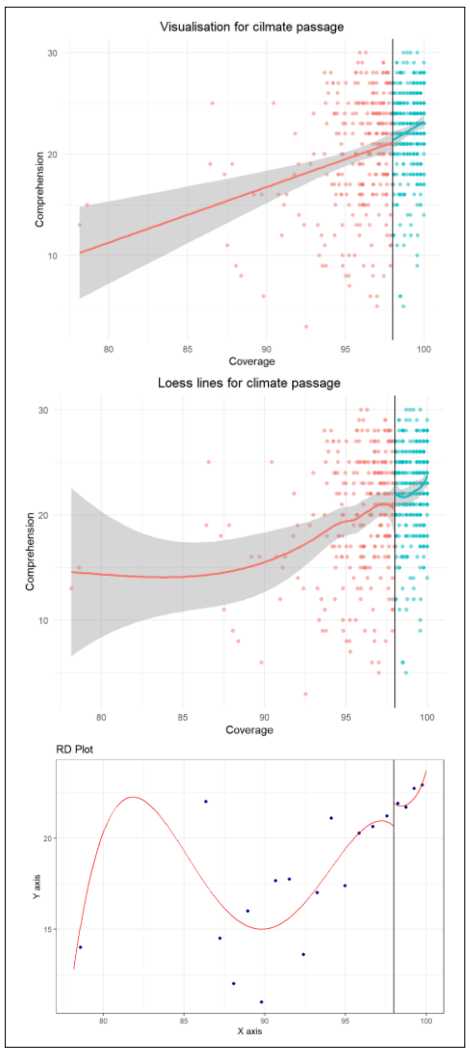
Initial visualisation:

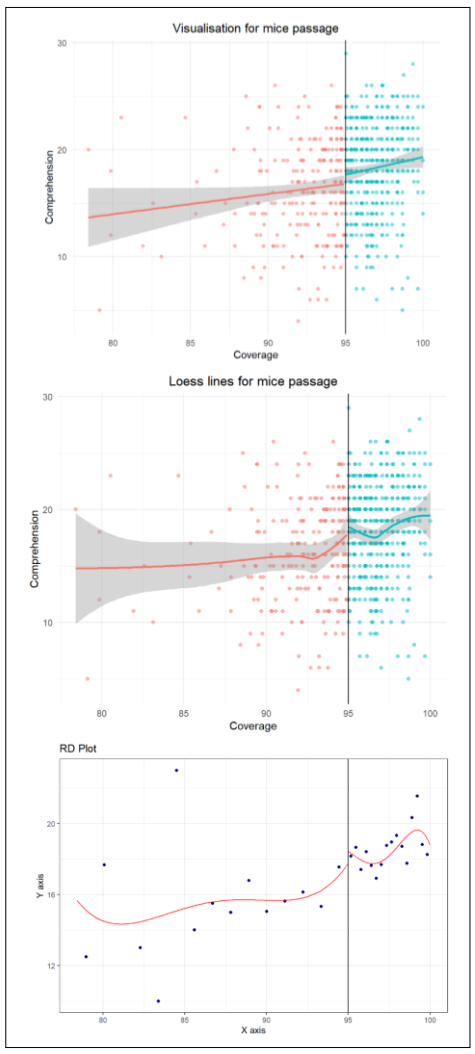


BAIN to detect potential threshold:

H1: below95 = 95-97 = 98-100
H2: below95 < 95-97 = 98-100
H3: below95 = 95-97 < 98-100







Summary of all tested delta values for both passages:

Passage	Method	Bandwidth	Estimate	*p*
Climate	Parametric	Full data	0.58	0.28
(threshold at 98%)		2	0.10	0.90
		1.5	0.22	0.83
		1	0.87	0.49
	Non-parametric	Full data	2.39	0.11
		2	0.12	0.89
		1.5	0.33	0.75
		1	0.74	0.57
Mice	Parametric	Full data	0.95	0.08
(threshold at 95%)		5	0.52	0.40
		2.5	0.97	0.21
		1	1.84	0.13
	Non-parametric	Full data	1.33	0.25
		5	0.54	0.40
		2.5	0.42	0.60
		1	1.90	0.12

Conclusion:

Empirical evidence fails to support the presence of a "coverage threshold", whereupon reading fluency increases rapidly