Using Coh-Metrix to Assess Cohesion and Difficulty in High-School Textbooks

Philip M. McCarthy, Erin J. Lightman, David F. Dufty, and Danielle S. McNamara
Department of Psychology
Memphis. TN 38152

{pmccarthy, elightman, d.dufty, d.mcnamara} @mail.psyc.memphis.edu)

Recent research in text processing has emphasized the importance of the *cohesion* of a text in comprehension (e.g., McNamara, 2001). Cohesion is the degree to which ideas in the text are explicitly related to each other and facilitate a unified situation model for the reader. Such research has led to the development of a computational tool, *Coh-Metrix*, (Graesser et al., 2004) that delivers over 300 indices of textual cohesion and difficulty. We hypothesized that a *Coh-Metrix* analysis of texts would indicate that *cohesion* indices - more so than traditional, shallow *difficulty* indices such as Flesch-Kincaid Grade Level (FKGL, Klare, 1974-75) - would identify characteristics of texts. Specifically, we hypothesized that within the expository domain, *science* texts would demonstrate greater cohesion than history texts, as the former dealt with less familiar subjects and would be likely to employ greater redundancy. We further hypothesized that as the *parts* of a text (*beginning*, *middle*, and *end*) serve different rhetorical purposes, that the sophisticated indices of *Coh-Metrix* would identify these differences.

To test our hypothesis, we sampled three representative 1000-word sections from the *beginning*, *middle* and *end* of each chapter of seven commonly used high-school text books (three from *science* and four from *history*). Each section was analyzed using *Coh-Metrix* indices of Cohesion (*argument overlap*, *latent semantic analysis* (LSA), and number of connectives) as well as FKGL to assess difficulty.

Results and Discussion

We conducted an Analysis of Variance to assess differences *between* genres and *across* textual units (see Table 1). The results confirmed out hypothesis: *Cohesion* indices were higher for *science* texts than for *history* texts (*LSA*, $F(1, 273) = 437.72$, $p < .01$; *argument overlap*, $F(1, 273) = 742.07$, $p<.01$). The FKGL difficulty index showed no significant difference between genres. Across chapters, our results suggested *science* texts were less cohesive near the end of units, whereas *history* texts tended to be *more* cohesive (see Table 1). Our study suggests that *Coh-Metrix* can facilitate sophisticated analysis of texts, helping to establish benchmarks and typical patterns of textual cohesion and difficulty. With greater understanding of cohesion between genres and across textual units, Coh-Metrix stands to offer a broader assessment of text that may better facilitate assignments of text to readers.

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References

Graesser, A.C., McNamara, D., Louwerse, M., & Cai, Z. (2004). Coh-Metrix: Analysis of text on cohesion and language. *Behavioral Research Methods, Instruments, and Computers*, *36,* 193-202.

Klare, G. R. (1974–1975). Assessing readability. *Reading Research Quarterly, 10,* 62-102.

McNamara, D. S. (2001). Reading both high-coherence and low-coherence texts: Effects of text sequence and prior knowledge. *Canadian Journal of Experimental Psychology*, *55*, 51-62.

Table 1. Results for Measures of Cohesion and Difficulty

	Science				History			
	Beginning	Middle	End	Sig	Beginning	Middle	End	Sig
F-K	10.39 (0.12)	10.63 (0.10)	10.76 (0.12)	**	10.43 (0.07)	10.57 (0.06)	10.82 (0.07)	**
LSA	0.38 (0.01)	0.39 (0.01)	0.34 (0.01)	**	0.24 (0.01)	0.23 (0.01)	0.24 (0.01)	
AO	0.70 (0.01)	0.71 (0.01)	0.67 (0.01)	**	0.43 (0.01)	0.46 (0.01)	0.45 (0.01)	*
Con	68.25 (1.03)	65.45 (1.11)	67.51 (0.91)		68.88 (0.66)	69.40 (0.69)	69.03 (0.60)	

Notes: standard errors are in parentheses; * p<.05; ** p<.01