Detecting Mindless Reading From Eye Movements

Tomasz D. Loboda
Erik D. Reichle

1. BACKGROUND & MOTIVATION

- Mindless reading (MR) occurs when we read without attending to text **and as a result little or nothing is comprehended** [1]. **Moreover, we may not even be aware of having lapsed into mindless reading** [1][2].
- **Knowing when** mindless reading **occurs is necessary to study it and potentially mitigate its detrimental effect on text comprehension.**
- **The state-of-the-art method** [1] **of detecting MR is impractical and imprecise and this research attempts to ameliorate these deficiencies by developing an unobtrusive method based on eye-movements.**

2. DATA COLLECTION

- 116 subjects read a novel for over an hour.
- Mindless reading was discovered by a combination of randomly distributed probes and instruction to self-report.

- Text comprehension   **0.68** (SD=0.17; chance: 0.25)
- Probe-caught ratio   **0.24** (SD=0.21)
- Self-reports   **14.6** (SD=13.0)

3. UNDERSTANDING MINDLESS READING

- The number of MR episodes increased with fatigue [3][4] and disinterest in text [5][6]. ♠
- The number of MR episodes and text comprehension were negatively correlated [1][2][7]. ♡
- More preoccupied [8] and faster readers were more likely to be high self-reporters of MR. ◇
- Word effects ♣ and other effects were studied as well.

4. DETECTING MINDLESS READING

- We model the probability of the reader being mindless using three classes of independent variables:
  - Word   (e.g., frequency)
  - Eye-movement   (e.g., gaze duration)
  - Context   (e.g., preoccupation, time of day) [9]
- The statistical models we employed were used to make the following separate distinctions:
  - Normal reading vs. probe-caught mindless reading (N-P)
  - Normal reading vs. self-caught mindless reading (N-S)
  - Normal reading vs. mindless reading combined (N-PS)
- The models made their decisions based on small (2-5s), medium (10s), or large (20-30s) amount of reading data.

- To ensure the method generalizes, two separate analyses were made on reading data from the current experiment and the reading data collected by [2] (a total of 337,260 and 20,790 statistical models were fitted, respectively).

5. CONCLUSIONS

- Eye-movement reading data can be used to disentangle normal and mindless reading. ♘
- Discriminating between normal reading and probe-caught mindless reading is the least challenging. ♗
- This method will perform poorly unless samples of reading data from subjects are available before it is used on those subjects. ♖

REFERENCES

1. Schooler, Reichle, & Halpern (2004) Zoning-out during reading: Evidence for dissociations between experience and meta-consciousness.
2. Reichle, Reineberg, & Schooler (2010) Eye movements during mindless reading.
3. Kane, Brown, McVay, Silvia, Myin-Germeys, & Kwapil (2007) For whom the mind wanders, and when: An experience-sampling study of working memory and executive control in daily life.
4. Teasdal,e Dritschell, Taylor, Proctor, Lloyd, & Nimmo-Smith (1995) Stimulus-independent-thought depends upon central executive resources.
5. Grodsky & Giambra (1989) Task unrelated images and thoughts whilst reading.
6. Smallwood, Nind, & O'Connor (2009) When is your head at? An exploration of the factors associated with the temporal focus of the wandering mind.
7. Shad, Nuthman, & Engbert (2012) Your mind wanders weakly, your mind wanders deeply - Objective measures reveal mindless reading at different levels.
8. Schacter (2001) The seven sins of memory: How the mind forgets and remembers.
9. Giambra, Rosenberg, Kasper, Yee, & Sack (1988) A circadian rhythm in the frequency of spontaneous task-unrelated images and thoughts.

Word effect: Gaze duration (em.fp.gd)

Classification performance