Does sentence context help us read small print?

Eliza Chong, Kelsey Hanrahan & Steve Mansfield, Department of Psychology, SUNY College at Plattsburgh

Plattsburgh
STATE UNIVERSITY OF NEW YORK

Rationale

It is well established that sentence context helps us read faster. Reading speeds are 1.4 to 2.5 times faster for sentences than for shuffled sentences or unrelated words. However, it is unclear whether sentence context helps us read smaller print.

Does context help us identify words that would otherwise be too small to read?

Methods

Participants

- 20 students enrolled in PSY101 General Psychology, with normal or corrected-to-normal vision.

Normal and shuffled sentences

- Sentences were extracted from novels downloaded from *Project Gutenberg*.
- Each sentence had six words, and contained no extra punctuation or repeated words (see Figure 1).
- The initial capital letter in each sentence was changed to lowercase.
- Shuffled sentences were created by randomizing word order.

Print size

- We tested at five very small print sizes: from -0.3 to +0.1 logMAR (i.e., x-height subtending 0.042° to 0.105°.)
- These sizes span the typical acuity limit of healthy college-aged students with normal vision.
- For comparison: 20/20 text subtends 0.083°; Newsprint, under typical reading conditions, subtends 0.23°.

Procedure

- We measured reading accuracy as a function of print size.
- The sentences were displayed using *rapid serial visual presentation* — words were presented one at a time at the same location on the screen.
- We tested at rates of: 240, 120, and 60 words per minute.
- Participants read the sentences aloud, and the experimenter counted how many words were read accurately.

Demonstration

Does sentence context allow reading at smaller print sizes?

Normal sentences	Shuffled sentences
but they were very decently kept	grieved is sadly mother our poor
we had some accidents with it	all affection own her was his
he made only one thing clear	our watches at both looked we
we all went into the bedroom	fact the girl the understand let
we were all agreed upon that	like late not you will staying
she could not but be thankful	point gained main the was but
the little man smiled and nodded	had promise her kept bravely she
this appears to be your affair	him his this sister brought upon
I would rather not be tempted	gushed into tears eyes the her
but the secret soon came out	of them the round rest crowded
and so the amiable couple parted	never chair but do the would
they both looked at each other	golden not the there were waters
she would do anything for me	manfully I future the turned to
the conference was a long one	was darling it now her object
I remember he was in mourning	negative she the in was answered
then she began to blame herself	hurt they on your account me
we have got our first principle	checked in she just time herself
and now my written story ends	London bring would soon cure its
she turned and left the house	creature a is quite little she
I know the way out perfectly	thinking had hours he for been

Figure 1. We find that the normal sentences support reading at faster speeds, but not at smaller sizes

Results

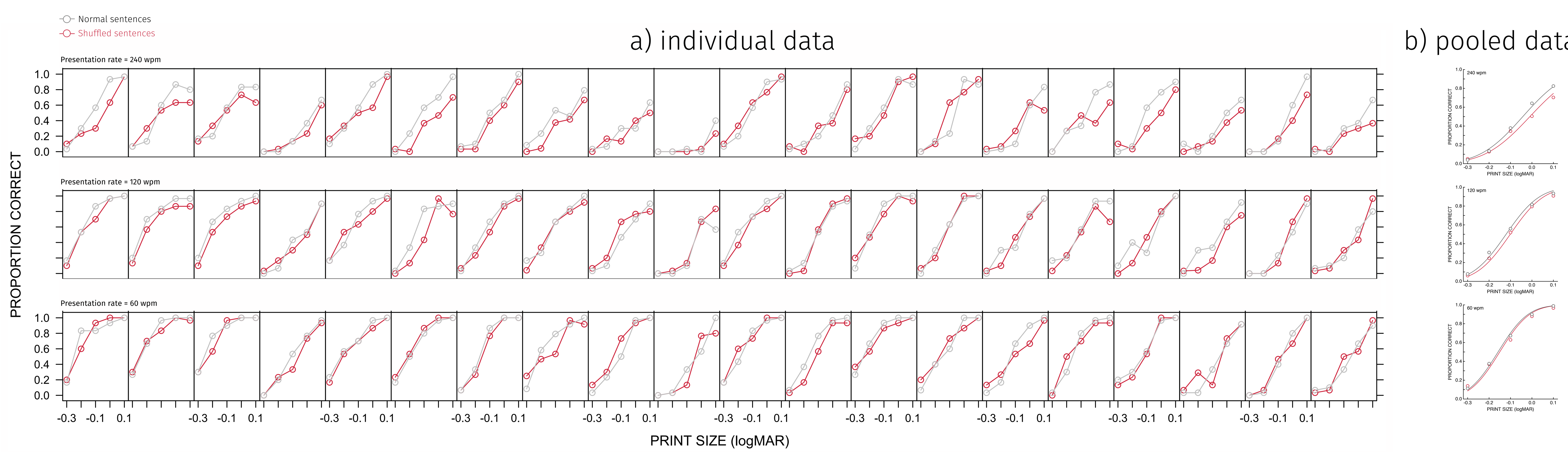

Figure 2. a) Reading-accuracy versus print-size curves from 20 participants. Each column shows data from one participant at three presentation rates (240 wpm top; 120 wpm, middle; and 60 wpm bottom). Gray: normal sentences. Red: shuffled sentences.

b) Pooled data. These curves show the fixed effects from a mixed-effect model used to fit cumulative-Gaussian curves to the accuracy-versus-size data [as outlined by Knoblauch and Maloney (2012).] The model has threshold, slope, and sentence context as fixed effects:; and threshold and participant as random effects.

Discussion

- At 240 wpm, normal sentences could be read at sizes 9% smaller than shuffled sentences ($p < 0.01$).
- Slower presentation rates allow reading at smaller print sizes. Threshold print size at 60wpm is 30% smaller than at 240wpm.
- Context provides no advantage when reading very small print at slow speeds.
  - Perhaps the processing advantage due to context is offset by the slow presentation rate.
  - Or, possibly, it is hard to establish context under these conditions because the text is hard to read.

References

Knoblauch, K. & Maloney, L. T. (2012), *Modeling Psychophysical Data in R*. New York: Springer.

Acknowledgements

Supported by a SUNY Plattsburgh Redcay award for student-faculty collaboration in the behavioral sciences.