Considering the **Speed and Comprehension Trade-Off** in Reading Mediated by Typography

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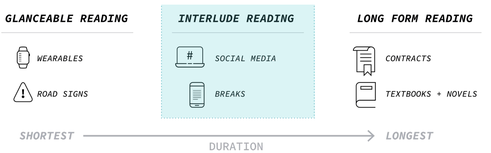
Can we optimize reading speed and comprehension by changing fonts?

In the context of **Interlude Reading**, today's readers are attempting to absorb increasing amounts of information, In this study we are considering the effect of font selection on the speed/comprehension trade-off.



Study procedure

Participants: 440 Mechanical Turk crowdworkers

Ages & Gender: 18-70 (avg = 36), 40% Female

Methods: Surveys Google Forms, HTML5, & 2 reading comprehension questions

Materials: 56 reading passages, 69--93 words per, & 12th grade reading level

Study Time: ~ 30 minutes to complete

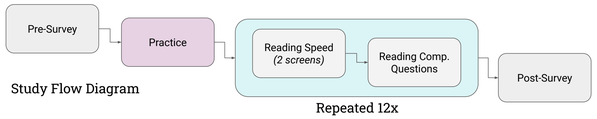
Survey: 5-point Likert Questions & Short Answer Questions

Fonts to Test: 27 possible fonts ranging from new media to print

Fonts per Participant: 6 fonts per participant (Times and 5 random)

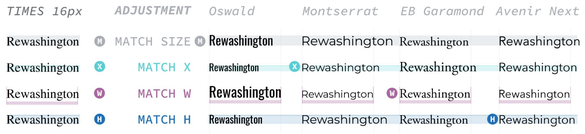
Reading Speed: Participants are timed per screen, 4 screens per font.

Reading Comprehension: Participants answer 4 questions per font.



Study Flow Diagram

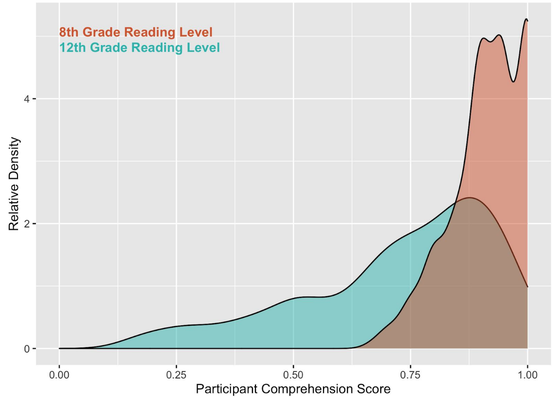
Font size normalized based on human perception



Data inclusion and comparing comprehension

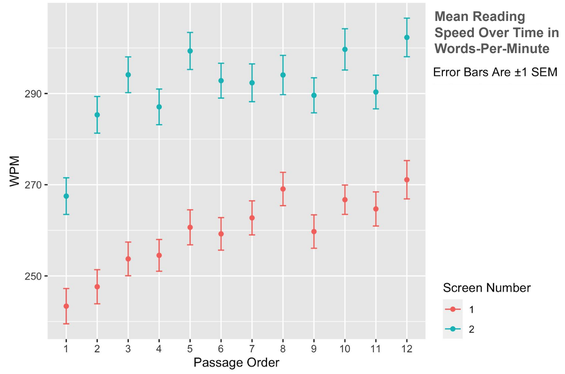
- Participant's first language was English.
- Participant's had no visual impairments or learning disorders.
- A passage was considered valid if estimated reading speeds for **both** screens fell between 100 and 650 WPM.
- A check on per-participant comprehension scores was performed, but because of the wider range of scores, none were excluded.

Distributions of Comprehension Scores at Two Reading Levels



Ensuring passages & fonts were randomized

- Testing shows that passages and fonts were adequately randomized across presentation orders. (p = 0.40 & p = 0.96, respectively)



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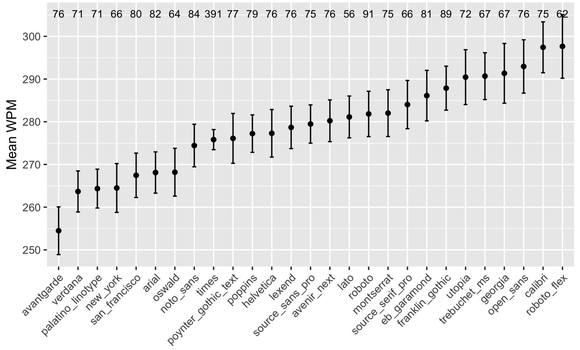
Comparing passages & reading speed / comprehension

- Reading speed was NOT affected by passage (p = 0.14), while passage order, screen number, and font were significant. (p < 0.001, p < 0.001, p = 0.02)
- Comprehension scores were not significantly affected by font.
- Examining the first screen only, the pattern of significance remains.
- Examining second screen only, font fails to reach significance, perhaps suggesting that "skimming" behavior outweighs the typeface. Perhaps an example of behavior being captured in the data.

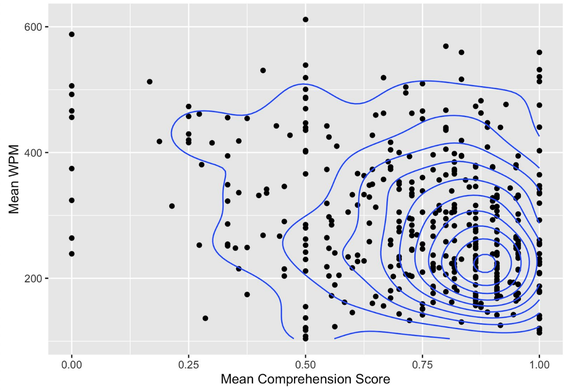
Mean WPM per Font
Across Both Screens



Reading speed & comprehension are inversely correlated

- At the per-user, per-passage level, reading speed is inversely correlated with comprehension. (R = -0.27, p < 0.001)

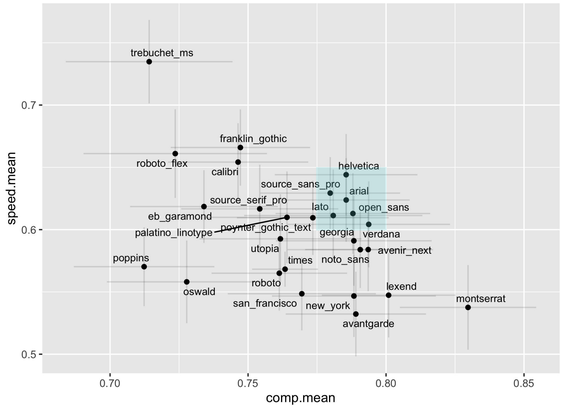
Comprehension Score vs. WPM
Pearsons R = -0.27, p < 0.001



Different fonts help participants optimize their reading speed and comprehension

- Aggregating per-passage, reading speed and comprehension are not strongly correlated. (R = 0.06, p = 0.653)
- **Aggregating per-font, reading speed and comprehension are correlated.** (R = -0.43, p = 0.026)
- Font also significantly affected reading speed. (p = 0.018)
- Confirmatory analyses on each font's relative speed (ranked speeds per participant) demonstrated a strengthened relationship. (R = -0.48, p = 0.011)
- **These results suggest fonts' design characteristics mediated the reading speed and comprehension trade-off within and between participants.**

Mean Relative Per-User Speed/Comprehension Scores



Observations from Typographers *(Sam Berlow & others)*

- The fonts (**Arial, Open Sans, Lato, Georgia, Source Sans Pro, & Source Serif Pro**) that enhance both speed and comprehension have two fundamental similarities:
  - Drawn specifically for reading text on screen.
  - The fonts optimized by delta hinting instructions which incorporate hints that tell the rasterizer how best to render the font at given point sizes.
- Montserrat and Trebuchet MS which performed well in comprehension and speed respectively, are also designed and optimized for screen,
- The influence of font properties, anatomy, and attributes on speed and comprehension are ripe for exploration.

Conclusion

Fonts demonstrated the same trade-off in an intra-participant analysis; our results suggest that leveraging typeface design could minimize individuals' trade-offs. Indeed, finding the right font for the reader could improve individual performance in the context of their reading goal: comprehension or speed.