Does font size affect children’s memory and reading comprehension?

Vered Halamish
Institute of Information Processing and Decision Making, University of Haifa

Tami Katzir, Shirley Hershko, Hila Nachman
Edmond J. Safra Brain Research Center for the Study of Learning Disabilities
Department of Learning Disabilities
University of Haifa

Typography: Does it matter?

- **Common view in education**: reducing load is beneficial for learning (Sweller & Chandler, 1994)

- Indeed, more fluent typography (large font size) increases reading rate and accuracy among young children and dyslexic children
  - E.g., Hugh & Wilkins, 2000, 2002; O’Brien, Mansfield, & Legge, 2005; Zorzi et al., 2012

- More convenient typography improved adults reading comprehension
  - Lonsdale, Dyson & Reynolds, 2006

- **However**, research in cognitive psychology suggests that difficulties are desirable for learning (Bjork, 1994)

- Indeed, less fluent typography (difficult to read font, presenting words upside down) enhances memory and comprehension among high school students and adults
  - Diemand-Yauman, Oppenheimer, & Vaughan, 2011; French et al., in press; Sunghasettee, Friedman, & Castel, 2011

- But, font size does not affect adults memory
  - Rhodes & Castel, 2008; Kornell, Castel, Rhodes, & Tauber, 2011

Current research

- Does typography (font size) affect memory and comprehension among children?

  - Any developmental trends?
    - Young readers are glued to the print, older children focus on details and ideas (Chall, 1991).

  - What about metacognition?

Memory and Metamemory

- Does font-size affect children’s memory for the material?
- Does it affect meta-memory?
- Any developmental trend?

  - Subjects:
    - 50 1st graders (22 male, mean age: 6.9 years)
    - 44 5th and 6th graders (18 male, mean age: 11.1 years)
Halamish, Nachman, & Katzir (in preparation)

Recall

Memory and Metamemory

Estimated recall

Actual recall

0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

1st grade
5th-6th grade

18 pt
48 pt

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words

Estimated recall

Actual recall

1st grade
5th-6th grade

22 words
Reading comprehension

• Does font-size, line spacing and line length affect children’s reading comprehension?
• Any developmental trend?

• Subjects:
  – 45 2nd graders (25 male, mean age: 7.5 years)
  – 45 5th graders (21 male, mean age: 10.5 years)

Text 1: standard
– 2nd grade: 20 pt font size, 4.2 inch line length, double line spacing
– 5th grade: 13 pt font size, 4.6 inch line length, 1.5 line spacing

Text 2: decreasing font size by 20%

Text 3: increasing line length by 20%

Text 4: decreasing line spacing by 20%
Standard 2nd grade

Small font size

- 4 age-appropriate texts
  - 2nd grade: 44-47 words long
  - 5th grade: 110-120 words long

- Text 1: standard
  - 2nd grade: 20 pt font size, 4.2 inch line length, double line spacing
  - 5th grade: 13 pt font size, 4.6 inch line length, 1.5 line spacing

- Text 2: decreasing font size by 20%
- Text 3: decreasing line spacing by 20%

Reading comprehension

Standard 2nd grade

Small spacing

- 4 age-appropriate texts
  - 2nd grade: 44-47 words long, with diacritical marks
  - 5th grade: 110-120 words long, without diacritical marks

- Text 1: standard
  - 2nd grade: 20 pt font size, 4.2 inch line length, double line spacing
  - 5th grade: 13 pt font size, 4.6 inch line length, 1.5 line spacing

- Text 2: decreasing font size by 20%
- Text 3: decreasing line spacing by 20%
- Text 4: increasing line length by 20%

Reading comprehension

Standard 2nd grade

Large line length

- 4 age-appropriate texts
  - 2nd grade: 44-47 words long, with diacritical marks
  - 5th grade: 110-120 words long, without diacritical marks

- Text 1: standard
  - 2nd grade: 20 pt font size, 4.2 inch line length, double line spacing
  - 5th grade: 13 pt font size, 4.6 inch line length, 1.5 line spacing

- Text 2: decreasing font size by 20%
- Text 3: decreasing line spacing by 20%
- Text 4: increasing line length by 20%
Reading comprehension

• 4 multiple-choice reading comprehension questions for each text:
  - Locating details
  - Semantic knowledge
  - Syntactic knowledge
  - Inference

• High reliability as assessed in a pilot study:
  - 2nd grade: N = 51, Cronbach’s α = .756
  - 5th grade: N = 50, Cronbach’s α = .797

Summary

• Typographical features affect children’s performance
  - 2nd graders remembered better with larger font size
  - 2nd graders comprehended better with standard (vs. smaller) font size, and with standard (vs. longer) lines
  - 5th graders comprehend better with fonts smaller than the standard!

Conclusions

• Merely manipulating the typographical aspects of text presentation can affect performance with texts (reading comprehension and memory) among children

Conclusions

• Children at different stages of reading development respond differently to these typographical manipulations.
## Conclusions

- Subjective feelings do not always capture the effect of typographical features on performance
  - Children feel that large font size is easier to remember
  - For 5th graders, this is an illusion!
- Encountering difficulties when reading can be desirable! (Bjork, 1994)
- The optimal level of difficulty changes with development.

## Future directions

- Is the effect of font size and line length on children’s comprehension mediated by reading time?
- How does font size affect adult’s comprehension?
- How does font size affect meta-comprehension?

## Implications

- In the modern area of on-screen reading, typography (e.g. font size) can be easily manipulated by the readers
- It is therefore important to understand:
  - How typography influences performance with texts
  - Whether readers accurately grasp this influence and can effectively regulate on-screen reading.

## Thank you!