

BAR-ILAN UNIVERSITY

**The Effect of Font Size on Reading Time, Reading
Comprehension and Meta-Comprehension
in Younger and Older Children**

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Abstract

Numerous studies in cognitive psychology suggest that difficulties are often desirable for learning (Bjork, 1994; Bjork & Bjork, 2011). However, recently there is a difference of opinion on whether presenting textual materials in difficult-to-read fonts is also desirable. Some studies suggested, quite counterintuitively, that presenting textual materials in fonts that are difficult to read in terms of size or type, enhance adults' cognitive performance (e.g., Diemand-Yauman, Oppenheimer, & Vaughan, 2011). Yet, other studies failed to replicate these findings, finding either no effect of font difficulty or the reversed effect by which difficult-to-read fonts impair adults' performance (e.g., Rummer, Schweppe, & Schwede, 2016). Overall, this pattern of results is consistent with the more complex suggestion that not all difficulties are desirable (McDaniel & Butler, 2011). Clearly, additional research is needed to understand the limiting conditions and moderating variables of the effect of difficult-to-read fonts on studying texts (Dunlosky & Mueller, 2016).

The goal of the current study was to examine the effect of difficult-to-read fonts on children's reading comprehension, and whether children's age moderates this effect. Despite the recent growing interest in the effect of difficult-to-read fonts on learning with adults, little research has been conducted on this matter with children. This is unfortunate given the potential practical implications of such research for education. Thus, we focused on font difficulty in terms of font size, comparing standard fonts with smaller-than standard fonts that are more difficult to read. In a recent study, we (Katzir, Hershko, & Halamish, 2013) observed that presentation of texts in smaller-than-standard font improved fifth graders' comprehension, but impaired second graders' comprehension. In the current study we aimed at replicating these findings, and further extending them by examining whether font size affects children's reading time and meta-comprehension assessments. Reading time might be a mediator for the effect of font size on reading comprehension (e.g., older children might invest more time when reading in smaller-than-standard font, which would yield better comprehension). As to meta-comprehension, previous studies with adults suggested that they are often insensitive to the effect of font difficulty on their performance, and we wanted to examine whether the same applied for children.

Participants were 48 second graders and 48 fifth graders chosen from a regular elementary school in the south of Israel. Participants in each grade read four short age-appropriate texts. Two of the texts were presented in a standard font size for that grade, and the other two texts were presented in smaller-than-standard font (with font size order counterbalanced across participants). Reading of each text was self-paced, and reading time was recorded. For each text, participants assessed their comprehension and completed a comprehension test.

Based on Katzir and colleagues' (Katzir et al., 2013) findings, our first hypothesis was that a smaller-than-standard font size, with second graders will impair reading comprehension, and in contrast, with fifth graders, smaller-than-standard font size, will improve reading comprehension. The study's second hypothesis was that font size will affect reading time, so the smaller size font text will be longer than reading time of the standard font size text, both with second and fifth graders. The study's third hypothesis was that font size will affect meta-comprehension assessments, so that meta-comprehension assessments will be higher (meaning, the subjects will assess their reading comprehension better) following reading in standard font size, than reading smaller-than-standard font, both with second and fifth graders.

Following the first hypothesis, results revealed that the effect of font size on comprehension depended on the grade. Second graders comprehended the texts better when reading in standard font than when reading in smaller-than-standard font. In contrast, fifth graders comprehended the texts better when reading in smaller-than-standard font than when reading in standard font. The effect of font size on reading time also depended on grade. Second graders read the texts longer when reading in standard font than when reading in smaller-than-standard font. However, fifth graders' reading time was not affected by font size. Comprehension assessments were higher when reading in standard font than when reading in smaller-than-standard font. In addition, assessment-of-comprehension accuracy was examined in terms of over- or under-confidence. Overall, participants were overconfident in their comprehension assessment. However, they were more overconfident when reading in standard font size. In other words, comprehension assessments were more accurate when reading in smaller-than-standard font than when reading in standard font size.

Additionally, in regards to reading time, in another test the readers were divided to fast readers and slow readers, according to their reading pace in words' reading task

(relatively to the class). It was found that fast readers showed better reading comprehension, in comparison to slow readers. It was also found that the effect of font size on reading comprehension depended on reading pace. With slow second grade readers it was found that reading comprehension scores were higher in standard font than in small font texts. In contrast, with fast readers there was no effect of font size on reading comprehension, in both age groups. Thus, the finding in common to all participants, saying that second- grade reading comprehension is better with standard font than smaller font, and vice versa for fifth grade, is actually true only for slow readers and not with fast readers.

The current results suggest that smaller-than-standard font is a desirable difficulty for fifth graders' comprehension, but an undesirable difficulty for second graders' comprehension. The results further suggest that the effect of font size on reading time depends on age, but also that reading time cannot fully account for the effect of font size on children's comprehension. In addition, the results suggest that fifth graders do not value the small fonts' benefits. Finally, the results point at another potential benefit of small fonts, improving meta-comprehension accuracy.

On a theoretical level, these findings highlight the need in considering font size, and potentially other characteristics of font difficulty, in reading comprehension models. On a more practical level, the current findings should be considered when designing text properties for children. More generally, the current results further suggest that much like adults, children's subjective comprehension feelings do not necessarily reflect their performance. This evidence accentuate the need for carrying out an objective assessment that would serve as a basis for evidence-based educational practices.