Research Report

Reading Speed of Contracted French Braille

Louise Laroche, Jacinthe Boulé, and Walter Wittich

Reading is essential in the context of education. For individuals who do not have easy access to print materials because they are visually impaired (that is, they are blind or have low vision), this process of acquiring knowledge through reading requires additional effort and accommodations. One key adjustment that is made for students for whom braille is the preferred communication method (hereafter referred to as "braille readers") for completing their examinations is the allocation of additional time. Depending on the country, educational system, or institution, the amount of extra time that is allotted may vary; however, in Québec, Canada, the Ministry of Education, Leisure and Sport (MELS) has regulated the additional time allocated for braille readers by limiting the "extension of the duration of the test to a maximum additional time equivalent of one third the time normally allotted" (Gouvernement du Québec, 2007, chap. 5, p. 55).

It has been our experience that this allotment of time is not sufficient to allow students who are visually impaired to operate under the same time constraints as their sighted peers. To propose a concrete change in the allotted amount of time, however, empirical data were necessary. The most easily measured component of an examination that is conducted using braille is reading speed, often recorded in words per minute (wpm). There are considerable individual differences in reading speed for both print and braille readers. Legge, Madison, and Mansfield (1999) used both the print and braille versions of the MNRead test to compare the reading speeds of sighted print readers and braille readers while reading out loud. Whereas print readers ranged in speed from 150 to 310 wpm (median = 251 wpm), braille readers ranged from 24 to 232 wpm (median = 124 wpm), indicating that some of the fast braille readers actually outperformed some of the slower print readers. Still, the median speed was approximately twice as fast for the print readers. These data would indicate that as far as reading is concerned, the time allotment for braille readers should be twice the time allocated for print readers. This logic does not hold, however, because most students do not take examinations orally. Therefore, a comparison of reading speeds for print and braille readers was necessary to investigate the difference in reading speed when reading silently.

An additional aspect that makes a comparison of reading speeds difficult is the level of braille in which the text is written (contracted versus uncontracted) and in which language the text is transcribed. Specifically, the language is of importance in contracted braille because the demands on the reader differ across languages. A reader of English braille has to learn uncontracted braille as well as 189 contractions and short-form words to decode text in contracted braille (Braille Authority of North America, 2008). In comparison, because of differences in the French alphabet and language structure, a reader of French braille has to learn 1,168 contractions, divided into four levels in Québec, to be able to decode a text in contracted braille (*braille abrégé*) (Gouvernement du Québec, 1997). This considerable difference in the complexity of contracted braille indicates that the cognitive load for readers of French braille is substantially higher that that of readers of English braille; however, these differences are not

The authors thank Louise Comtois and Olga Overbury for their kind contributions to the completion of the study as well as to this manuscript. Postdoctoral fellowship funding for Walter Wittich was provided by the Canadian Institutes of Health Research.

reflected in accommodations for students who use French braille during examinations.

Furthermore, a student's reading speed in braille can be influenced by the reading technique that the student uses. It is now generally accepted that the majority of efficient and fast braille readers adopt a two-handed scissors pattern, whereby the left reading finger reads to the center of a line, at which point the right takes over and the left is free to find the beginning of the next line (Wright, Wormsley, & Kamei-Hannan, 2009). This technique has been shown to facilitate reading speed in French braille as well (Mousty & Bertelson, 1985) and should be considered as a variable when conducting research on braille reading speeds. In addition, previous work indicated that the age at which braille is learned may affect the speed at which braille is processed (Mousty & Bertelson, 1985); that is, children who were taught braille before age 10 generally became faster readers.

The study presented here was designed to address three hypotheses:

1. The reading speed of both readers of French braille and readers of French print will be faster in the silent condition; however, this gain in speed will be larger for print readers.
2. Individuals who acquired braille before age 10 will display faster reading speeds at lower error rates than will those who acquired braille after age 10.
3. As with the results of previous studies, braille readers who use a two-handed scissors pattern will demonstrate faster reading rates than those who do not, specifically under the silent reading condition.

Method

Participants

The study was approved by the board of directors of the École Jacques-Ouellett, from which the participants were recruited, in addition to other educational institutions in the Province of Québec, and through advertisements in news services that serve the braille-reading community. To be eligible to participate, the students had to be older than age 15, French speaking, have used braille as the primary method of reading for at least three years without access to print materials, and have completed or were attending a postsecondary educational institution or a high school. A total of 30 braille readers were recruited, as well as 10 sighted readers for the control group, stratified to match on age, gender, and level of education.

Materials and procedure

The participants completed a questionnaire on their demographic characteristics and were presented with a practice text to familiarize themselves with the testing environment. During the test phase, they were given two types of reading materials: a continuous text from a newspaper article and a narrative text from a novel, both at the Grade 4 reading level. The participants were allowed to explore the text briefly before reading and were then asked to read aloud for three minutes, followed by reading silently for three minutes. Afterward, they were asked to comment on the text they read to ensure a reasonable level of comprehension. For the period of silent reading, the researcher marked the length of the text that was read within the time limit. Reading speed was calculated on the basis of the number of words read during the first three minutes of reading.

Results

The braille readers (15 men and 15 women) ranged in age from 18 to 67 (M = 40.9, SD = 3.1), whereas the sighted print readers (5 men and 5 women) ranged in age from 22 to 57 (M = 40.9, SD = 13.9). The participants' educational levels were high school (6 braille readers and 2 sighted readers), college (8 braille readers and 3 sighted print readers), or university (16 braille readers and 5 sighted

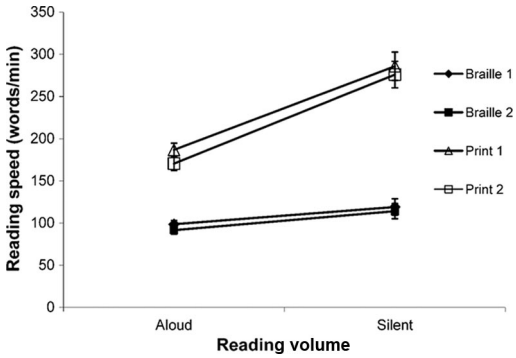

Figure 1. Reading speed as a function of volume for both braille and print readers on Grade 4–level text from a newspaper (1) or a novel (2). The mean gain in the reading speed of the print readers under the silent condition was 4.95 times larger than that of the braille readers. Error bars represent one standard error.

print readers). Their employment status was student (6 braille readers and 2 sighted print readers), employed (14 braille readers and 8 sighted print readers), retired (6 braille readers and no sighted print readers), or other (4 braille readers and no sighted print readers). Analyses of variance (ANOVAs) were calculated using SPSS 17.0 for Windows. There were no statistically significant differences among the dependent variables as a function of the type of text (newsprint or novel); therefore, the analyses presented here represent the pooled results for both types of text.

A mixed 2 × 2 ANOVA (reading volume × vision status) of reading speed revealed an interaction effect, $F(1, 38) = 29.4$, $p < .001$, $\eta^2 = .44$, indicating that both braille- and print readers read faster silently than out loud; however, this effect was larger for the print readers (see Figure 1). The mean reading speed for the braille readers increased from 99 wpm to 119 wpm, whereas the mean reading speed for the print readers increased from 187 wpm to 286 wpm. This gain in speed for the print readers was 4.95 times larger than that for the braille readers. Under the silent reading condition, the print readers read, on average, 2.4 times faster than did the braille readers.

When the braille readers were divided by the age at which they started learning braille (before age 10, $n = 21$; age 10 and later, $n = 9$), a mixed 2 × 2 ANOVA (reading volume by age group) revealed an interaction effect, $F(1, 28) = 8.07$, $p = .008$, $\eta^2 = .40$, indicating that the improvement in reading speed between reading out loud and silent reading was higher for the participants who learned braille before age 10 (see Figure 2). For the group who learned braille before age 10, the mean reading speed increased from 101 wpm to 130 wpm, whereas the group who acquired braille later increased only from 81 wpm to 87 wpm. However, an independent-samples *t*-test indicated that, under the reading-out-loud condition, the group who learned braille before age 10 made significantly more errors, $t(20) = 2.08$, $p = .05$, $\eta^2 = .18$.

A mixed 2 × 2 ANOVA of reading speed as a function of technique (one- versus two-handed) and volume (silent or out loud) dem-

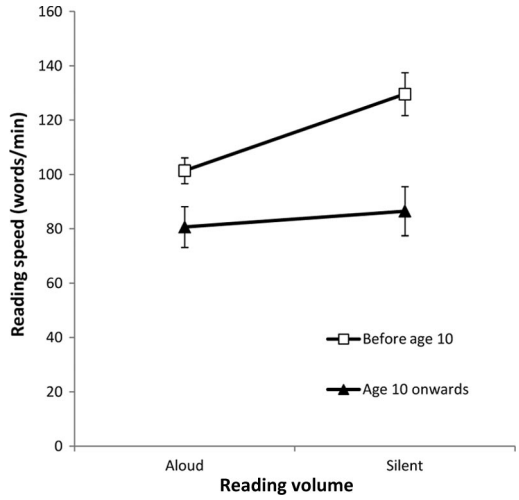

Figure 2. Reading speed as a function of volume across the two braille-acquisition age groups. The reading speed increased significantly for the silent condition, but more so among the individuals who learned braille before age 10. Error bars represent one standard error.

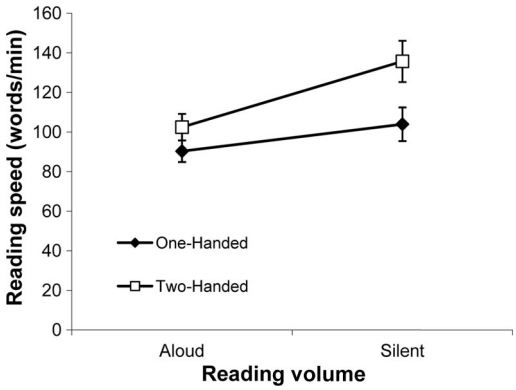

Figure 3. Reading speed as a function of volume for braille readers who used either one or both hands. The increase in reading speed when reading silently was more apparent for those who used both hands. Error bars represent one standard error.

onstrated an interaction effect, $F(1, 28) = 6.86$, $p = .014$, $\eta^2 = .20$, indicating that the improvement in the silent reading speed was larger for the two-handed readers ($n = 12$) than for those who used only one hand ($n = 18$), as is shown in Figure 3. The one-handed readers improved from 90 wpm to 104 wpm when reading silently, whereas the two-handed readers improved from 102 wpm to 117 wpm. With regard to the reading speeds of the two-handed readers, the ANOVA indicated that those who used a scissor pattern had a greater benefit when reading silently than those who did not, $F(1, 10) = 12.91$, $p = .005$ (see Figure 4).

Discussion

The purpose of the study was to gain a better understanding of the factors related to reading speed in contracted French braille. A not-surprising finding was that all the participants read faster silently than out loud; however, the gain in speed in reading silently was almost 5 times as large for the print readers as for the braille readers. With regard to the average silent reading speeds, the data suggest that for students who use contracted French braille during examinations, their allotted examination time should be 2.5 times longer than that of print readers. For obvious logistic reasons, such accommodations may be neither practical for the school nor sustainable for the students. The Québec MELS addressed this issue officially while this study was being conducted, changing the policy on access to examinations for students who are visually impaired, as well as for all other students with special needs, by allowing voice-generating technology during examinations.

In a previous study on French braille reading, Mousty and Bertelson (1985) noted that 21 of their 24 participants had acquired braille before age 10, and more recent studies have focused specifically on students who acquire braille early (Wall Emerson, Holbrook, & D'Andrea, 2009; Wright et al., 2009). In the study presented here, the participants whose age of acquisition of braille was younger than 10 years demonstrated a significant improvement in reading speed as adults when reading silently, compared to those who learned braille later. This finding supports the intuitive conclusion that early instruction in and acquisition of braille will make braille readers

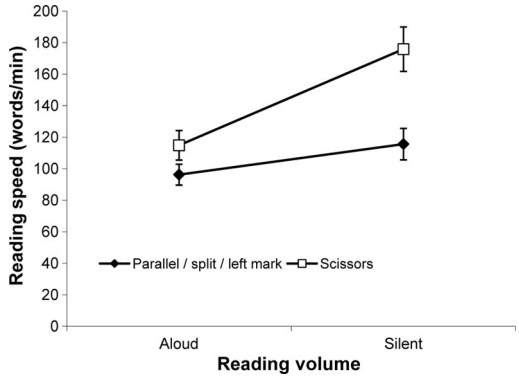

Figure 4. Reading speed as a function of volume for two-handed braille readers who used the scissors pattern versus those who did not. The increase in speed while reading silently was more pronounced only for those who used the scissors pattern. Error bars represent one standard error.

more efficient, owing to cognitive flexibility in infancy. However, it should be noted that this increase in speed in our study was accompanied by an increase in the number of errors made while decoding, without affecting the participants' level of comprehension. Faster braille readers may choose to balance the risk of errors in decoding with the benefit of speed while reading. This speed may also allow them to correct errors in the context of the content of their reading materials. As to the effect of reading technique, we were able to replicate previous reports of the benefit of using the scissors pattern (Mommers, 1980; Mousty & Bertelson, 1985; Wormsley, 1981; Wright et al., 2009). Even though this benefit was apparent for both silent reading and reading out loud, it was remarkable how much larger the effect was for silent reading. This finding demonstrates that the production of speech is a limiting factor in reading speed.

Unfortunately, it was not possible to account for numerous variables that also influence reading speed and general literacy in braille, such as the frequency, duration, and intensity of braille instruction, at whatever age. In addition, the quality of teachers and the teachers' relationship with their students could greatly influence progress in literacy. Furthermore, variables such as the availability of braille materials in a child's environment, the desire to read simply for pleasure, or the role of parents in the literacy training of their children, may differ greatly.

In summary, among the French braille-reading participants in the study we observed that the acquisition of braille before age 10 facilitated faster reading speeds. In addition, readers who used the scissors pattern to read braille were generally able to read faster. The instruction of braille, whether in French or in any other language, may best be served by focusing on teaching young readers (and writers) the most efficient techniques while inspiring a desire for reading. Braille should continuously be seen as a written form of communication that needs to be cultivated, even though it takes time and effort. Its importance for linguistic development should not be underestimated; it remains an essential learning tool.

References

Braille Authority of North America. (2008). BANA braille codes update 2007. Retrieved from http://www.brailleauthority.org/update07/codesupdate2007-rev1.pdf

Gouvernement du Québec. (1997). Le Braille: Éducation préscolaire Enseignement primaire et secondaire Programme d'études. *Version mise à l'essai, Ministère de l'éducation* [Braille: Preschool, primary and secondary education curriculum. Tried version, Ministry of Education]. Québec: Author.

Gouvernement du Québec. (2007). Règlement de la sanction des études *Ministère de l'éducation, loisir et sport* [Regulation of educational sanctions, Ministry of Education, Leisure and Sport] (chap. 5). Québec: Author.

Legge, G. E., Madison, C., & Mansfield, J. S. (1999). Measuring braille reading speed with the MNRead Test. *Visual Impairment Research, 1*, 131–145.

Mommers, M. J. C. (1980). Braille reading: Effects of different hand and finger usage. *Journal of Visual Impairment & Blindness, 74*, 338–342.

Mousty, P., & Bertelson, P. (1985). A study of braille reading: 1. Reading speed as a function of hand usage and context. *Quarterly Journal of Experimental Psychology, Section A. Human Experimental Psychology, 37*, 217–233.

Wall Emerson, R., Holbrook, A., & D'Andrea, F. M. (2009). Acquisition of literacy skills by young children who are blind: Results from the ABC Braille Study. *Journal of Visual Impairment & Blindness, 103*, 610–624.

Wormsley, D. P. (1981). Hand movement training in braille reading. *Journal of Visual Impairment & Blindness, 75*, 327–331.

Wright, T., Wormsley, D. P., & Kamei-

Hannan, C. (2009). Hand movements and braille reading efficiency: Data from the Alphabetic Braille and Contracted Braille Study. *Journal of Visual Impairment & Blindness, 103*, 649–661.

Louise Laroche, B.Sc.Ed., *educational consultant for the visually impaired, École Jacques-Ouellette, Cross-regional Center for Vision Impairment, Cross-regional Support Service and Expertise for Laval and the Laurentians, 1240, Boulevard Nobert, Longueuil, Québec, Canada, J4K 2P4; e-mail: <louise_laroche@csmv.qc.ca>.* ***Jacinthe Boulé, SRDV,*** *low vision rehabilitation specialist, École Jacques-Ouellette, Cross-regional Center for Vision Impairment, Cross-regional Support Service and Expertise for Laval and the Laurentians, Québec, Canada; e-mail: <jacinthe_boule@csmv.qc.ca>.* ***Walter Wittich, Ph.D., F.A.A.O.,*** *postdoctoral fellow, Centre de recherché institute universitaire de gériatrie de Montréal, University of Montreal, Research Coordinator, MAB-Mackay Rehabilitation Centre, 7000 Sherbrooke Street West, Montréal, Québec, Canada H4B 1R3; e-mail: <wwittich@ssss.gouv.qc.ca>.*

