

## Relationship between Readability of Paper-Based Braille and Character Spacing

**Authors :** T. Nishimura, K. Doi, H. Fujimoto, T. Wada

**Abstract :** The Number of people with acquired visual impairments has increased in recent years. In specialized courses at schools for the blind and in Braille lessons offered by social welfare organizations, many people with acquired visual impairments cannot learn to read adequately Braille. One of the reasons is that the common Braille patterns for people visual impairments who already has mature Braille reading skill being difficult to read for Braille reading beginners. In addition, there is the scanty knowledge of Braille book manufacturing companies regarding what Braille patterns would be easy to read for beginners. Therefore, it is required to investigate a suitable Braille patterns would be easy to read for beginners. In order to obtain knowledge regarding suitable Braille patterns for beginners, this study aimed to elucidate the relationship between readability of paper-based Braille and its patterns. This study focused on character spacing, which readily affects Braille reading ability, to determine a suitable character spacing ratio (ratio of character spacing to dot spacing) for beginners. Specifically, considering beginners with acquired visual impairments who are unfamiliar with reading Braille, we quantitatively evaluated the effect of character spacing ratio on Braille readability through an evaluation experiment using sighted subjects with no experience of reading Braille. In this experiment, ten sighted adults took the blindfold were asked to read test piece (three Braille characters). Braille used as test piece was composed of five dots. They were asked to touch the Braille by sliding their forefinger on the test piece immediately after the test examiner gave a signal to start the experiment. Then, they were required to release their forefinger from the test piece when they perceived the Braille characters. Seven conditions depended on character spacing ratio was held (i.e., 1.2, 1.4, 1.5, 1.6, 1.8, 2.0, 2.2 [mm]), and the other four depended on the dot spacing (i.e., 2.0, 2.5, 3.0, 3.5 [mm]). Ten trials were conducted for each conditions. The test pieces are created using by NISE Graphic could print Braille adjusted arbitrary value of character spacing and dot spacing with high accuracy. We adopted the evaluation indices for correct rate, reading time, and subjective readability to investigate how the character spacing ratio affects Braille readability. The results showed that Braille reading beginners could read Braille accurately and quickly, when character spacing ratio is more than 1.8 and dot spacing is more than 3.0 mm. Furthermore, it is difficult to read Braille accurately and quickly for beginners, when both character spacing and dot spacing are small. For this study, suitable character spacing ratio to make reading easy for Braille beginners is revealed.

**Keywords :** Braille, character spacing, people with visual impairments, readability

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